

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Industrial Micro Systems 5000SX	Infomark DMS-II	Infomark DMS-III	Inforex 9000	Infotecs Control Center II
MAIN STORAGE Min./Max. capacity, words or bytes	512K	256K	512K	256K	1M
NO. WORKSTATIONS CONNECTABLE	16	16	24	24	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	24 Optional Std.; 9600-19.2K bps Async Turbodos (opt.) No	16 Opt.; 19.2K bps Std.; 19.2K bps 2780/3780 — 2780/3780 —	24 Opt.; 19.2K bps Std.; 19.2K bps 2780/3780 — 2780/3780 —	— Std.; 9600 bps Optional 2780/3780, HASP, ULTRANET, ARCNET See Comments Yes	16 Std.; 300-19,200 bps Std.; 300-19,200 bps — — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	3,000-12,000 — — Dealer, OEM	67,000 — — —	113,300 — — —	44,630 — 800 —	6,995 — — —
Date of first U.S. delivery Number installed to date	May 1979 500	1976 110	1976 40	July 1981 Contact vendor	April 1980 Over 1000
COMMENTS	New table-top package; 5.5M-byte Winchester drive available	Basic system price includes hardware, application software installation, and training; *600- and 900-lpm printers are optional	Basic system price includes hardware, application software, installation, and training	RJE terminals emulated include 2770, 2780, 3770, 3780, RES; System 9000 is a distributed information processing system, specifically addressing distributed data entry and file management solutions for business	Programs compatible with DEC PDP-8; complete systems and software sold & serviced nationwide by Infotecs' dealers

MANUFACTURER & MODEL	MAI/Basic Four System 210	MAI/Basic Four System 310	MAI/Basic Four System 510	MAI/Basic Four System 610	MAI/Basic Four System 710
MAIN STORAGE Min./Max. capacity, words or bytes	64K	256K	256K	192K	256K
NO. WORKSTATIONS CONNECTABLE	16	16	16	16	32
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	16 Opt.; 9600 bps Std.; 9600 bps Bisync BFBIN 2780/3780 Yes	16 Opt.; 9600 bps Std.; 9600 bps Bisync BFBIN 2780/3780 Yes	16 Opt.; 9600 bps Std.; 9600 bps Bisync BFBIN 2780/3780 Yes	16 Opt.; 9600 bps Std.; 9600 bps Bisync BFBIN 2780/3780 Yes	32 Opt.; 9600 bps Std.; 9600 bps Bisync BFBIN 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	25,740 (64K bytes) 2,375 (32K bytes) 270 —	55,885 (96K bytes) 2,375 (32K bytes) 504 —	50,360 (64K bytes) 2,375 (32K bytes) 437 —	51,400 (64K bytes) 2,240 (32K bytes) 424 —	69,100 (96K bytes) 2,375 (32K bytes) 593.50 —
Date of first U.S. delivery Number installed to date	1981 14,500 (all models)	1982 14,500 (all models)	1980 14,500 (all models)	1978 14,500 (all models)	1982 14,500 (all models)
COMMENTS	Price includes 64KB memory, 10MB fixed disk, 80-cps printer, 9.2MB magnetic tape cartridge drive, and one VDT	Price includes 96KB memory, 40MB fixed disk, 150-lpm printer, reel-to-reel tape drive, and 2 VDTs	Price includes 64KB memory, 20MB disk drive & pack, operating system, 120-cps printer, 1 VDT, & 9.2MB magnetic tape unit	Price includes 64KB memory, 35MB disk drive & pack, w/op. sys., 160 cps printer, and one VDT	Price includes 96KB memory, two 35MB disk drives & packs w/op. sys., 300-lpm printer, and one VDT

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	MAI/Basic Four System 730	MCM Computers MCM/POWER	Mercator Business Systems System 5000	Microdata Reality Series 2000	Microdata Reality Series 4000
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	256K 32 32 Opt.: 9600 bps Std.: 9600 bps Bisync BFBIN 2780/3780 Yes 95,000 (96K bytes) 2,240 (32K bytes) 766 — 1978 14,500 (all models) Price includes 96KB memory, two 75MB disk drives & packs w/op. sys., 300 lpm printer, and four VDTs	64K 8 199 Opt.: 19.2K bps Opt.: to 19.2K bps Various None Various No Contact vendor Contact vendor Contact vendor Contact vendor September 1980 — MCM/POWER is a multi-user, hard-disk, upgradeable and upward compatible version of the MCM/900	1M 16 16 Optional Optional Bisync — 2780/3780 Optional 35,000 — — — January 1982 — —	64K 8 8 Opt.: to 9600 bps No Async, bisync — See Comments No 34,500-36,200 2,100 (16K bytes) 350-340 — December 1977 4000 (all mod.) Packaged system includes 32KB MOS memory, magnetic tape, 10MB disk drive, 165 cps printer, and 1 CRT; RJE terminals emulated include HASP, 2780/3780, 2770, 3741; *SCREENPRO	128K 32 32 Opt.: to 9600 bps No Async, bisync — See Comments No 42,700 2,950 (32K bytes) 350 — November 1973 4000 (all mod.) Packaged system includes 64KB MOS memory, magnetic tape, 30MB disk drive, 165 cps printer, and 1 CRT; RJE terminals emulated include HASP, 2780/3780, 2770, 3741; *SCREENPRO

MANUFACTURER & MODEL	Microdata Reality Series 6000	Microdata Reality Series 8000	Microtech Business Systems 300 Series	Microtech Business Systems 400 Series	Mitsubishi Electronics America, Inc. 8028
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	256K 32 32 Opt.: to 9600 bps No Async, bisync — See Comments No 52,800-67,600 2,950 (32K bytes) 395-515 — November 1973 4000 (all mod.) Packaged system includes 64KB MOS memory, magnetic tape, 48MB disk drive, 165 cps printer, and 1 CRT; RJE terminals emulated include HASP, 2780/3780, 2770, 3741; *SCREENPRO	512K 48 48 Opt.: to 9600 bps No Async, bisync — See Comments No 84,975-99,975 4,900 (128K bytes) 595-715 — October 1979 4000 (all mod.) Packaged system includes 256KB MOS memory, magnetic tape, 128MB disk drive, 300 lpm printer, and 2 CRTs; RJE terminals emulated include HASP, 2780/3780, 2770, 3741; PEP (Performance Enhanced Processor) provides improved CPU time; *SCREENPRO	1M 8 to 56 56 — Std.; 30-9600 bps Async None None No 11,000 (64K) 3,000 (64K), 6,300 Contact vendor Contact vendor October 1979 100 System 300 W34S, for \$23,650, includes 34MB Winchester, 1/4-in. tape drive in 29-in. enclosure with operating system; up to four 34MB or 68MB drives can be attached to system; \$26,650 for Sys. 300 W68S	1M 16 56 — Std.; 30-9600 bps Async None None No 11,000 (64K) 3,000 (64K), 6,300 Contact vendor Contact vendor May 1979 NA System 400 W158S includes 158MB Winchester, 1/4-in. tape drive in 29-in. enclosure with operating system	256K 4 32 Opt.: 1200-9600 bps Opt.: 300-9600 bps BSC, BC-1 — No 38,000 3,800 (128K bytes) 268 — August 1980 NA

Communications Processors: Technology Overview

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Synopsis

Editor's Note

This report examines the technology of communications processors. For information on the market, see "Communications Processors: Market Overview"; for comparison columns detailing the features of key products, see "Communications Processors: Comparison Columns."

Report Highlights

The term "communications processor" describes not only a specific category of equipment but also systems that perform communications processing functions and other services. Datapro's definition of communications processors covers multifunctional, intelligent systems dedicated to communications and serving as nodes in a network. These systems generally include three basic types of products: front-end processors, intelligent switches, and remote concentrators.

In the late 1970s, IBM's SNA and the ISO's OSI model advanced data communications as a function separate from applications processing. SNA and OSI defined a network as a

physical entity, separate from its participating hosts and terminals. The implementation of a physically separate communications function occurred through a system of small dedicated computers. Users placed these communications processors at the front end of a mainframe or allowed them to function independently as concentrators and switches within their architectures.

In most communications processors, under the direction of the CPU, some components perform functions for the whole communications processor, while others perform functions for specific groups of lines. Among the former are host interfaces, input/output (I/O) processors, reference clocks, and operator interfaces. Among the latter are the processor's line bases and line sets.

There are two kinds of network architectures: those for communications among computers and terminals from a specific vendor, and those for open communications regardless of the vendor of the communicating devices.

This report discusses communications processor design, evolution, and position in modern network architectures. It concludes with Selection Guidelines for users.

—By *Barbara Rinehart*
Associate Editor/Analyst

Analysis

Technology Basics

The definition of a communications processor varies greatly. Network designers hold one view of what a communications processor does, but equipment manufacturers hold another. The term "communications processor" has covered equipment ranging from an IBM 3745 to a four-port packet assembler/disassembler (PAD).

A network designer believes that a communications processor should set up connections to transmit and receive data, multiplex and demultiplex data, frame and unframe messages, perform error correction and protocol conversion, choose transmission routes, and collect performance and traffic statistics. Unfortunately, this definition has led many manufacturers to classify their protocol converters, PADs, terminal controllers, and multiplexers as communications processors. Manufacturers consider communications processors as devices that connect terminals to networks and maintain control through changing network conditions. This concept clouds the definition of the equipment—an IBM 3745 and a protocol converter do not belong in the same category.

Datapro defines a communications processor as a multifunctional, intelligent device dedicated to communications and serving as a control point, or node, in a data communications network. It functions as a front end to a mainframe, as an intelligent switch, or as a remote concentrator. As a *front-end processor (FEP)*, the communications processor acts as a peripheral device locally attached to one or more large computers, relieving them of the overhead involved in message handling and network control. An *intelligent switch* routes messages among the network's various end points and participates in the network's control and management, either under the control of a master (usually front-end) processor or as a peer of other intelligent switches. A *concentrator* controls a community of terminals, clusters of terminals, or

distributed applications processors; gathers, queues, and multiplexes their transmissions onto one or more high-speed network trunks; and participates in the network's control and management, either under the direction of a master processor or as a peer of other concentrators and switches.

Network Architectures

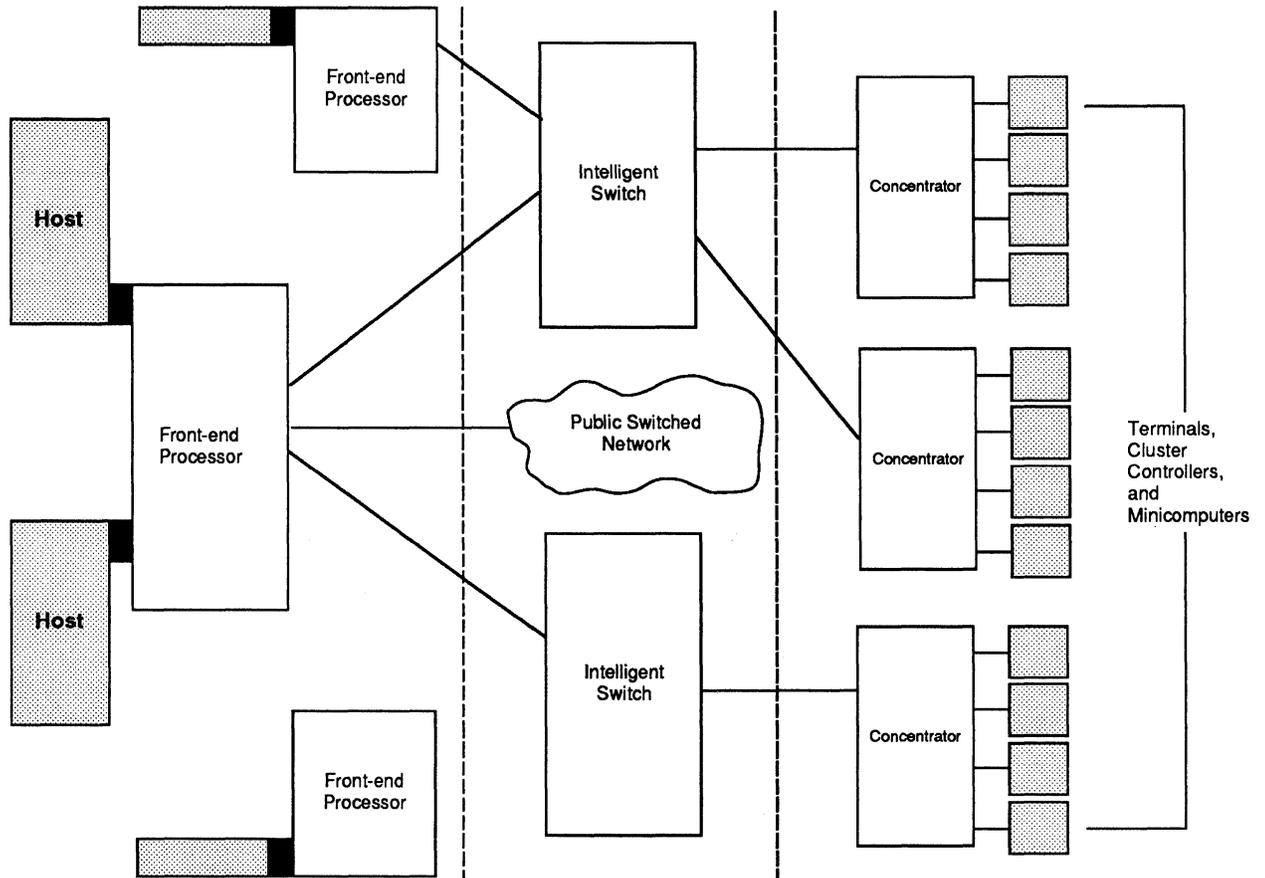
In general, there are two kinds of network architectures: those designed to provide communications among computers and terminals from a specific vendor, and those designed to provide open communications regardless of the vendor of the communicating devices.

Mainframe vendor architectures include IBM's SNA, Bull's DSA, and Unisys' BNA and DCA. Open architectures include the CCITT X.25 packet-switching specification and several "transparent" network schemes marketed by communications vendors. The communications processor plays an important part in vendor-specific and open architectures. The International Organization for Standardization (ISO) reference model for Open Systems Interconnection (OSI) provides a framework in which to examine the functions performed by communications processors in different kinds of network architectures.

Mainframe Architectures

In network architectures designed by mainframe vendors, the communications processor functions most often as a front end and controls communications in conjunction with one or more software systems in the host computer. In general, the front-end processor handles the Data Link through Session layers of the ISO model, with host software implementing the Presentation and Application layers. The activity in the layers varies, depending on the architecture. In Unisys' DCA, the DCP-Series front end controls many Presentation layer functions, while in IBM's SNA, the host's access method (along with software residing in the terminal controllers) handles communications down to the Session layer, with the 37XX front end acting almost as a channel-attached packet switch. The range of control assigned to front-end processors in other mainframe architectures varies between those extremes.

In all mainframe architectures, the same communications processor models that serve as front ends also function as intelligent switches and as

Figure 1.
Applications

A communications processor can function as a front end for one or more host computers, as an intelligent switching node not attached directly to any applications equipment, or as a remote terminal concentrator.

remote concentrators. In these functions, the communications processors usually appear in smaller configurations than they do as front ends. Communications processors working in mainframe architectures also perform intelligent gateway functions. In this application, the communications processor provides the interface between the mainframe network and communications facilities outside the architecture, particularly public, packet switched data networks using X.25 protocols.

Open Architectures

In an open architecture, such as X.25, the communications processor serves as an intelligent packet switch, implementing the Data Link through Transport layers via a uniform set of complementary protocols. Designed specifically for public data networks, X.25 protocols establish virtual circuits, or logical paths through the network, for devices from any vendor. Communicating devices at

either end of the virtual circuit must handle the Session, Presentation, and Application layers according to their own protocols.

In a public network, the network provider is responsible for network management. The X.25 communications processors in such a network, therefore, carry a heavy load of access, error, and class-of-service control, along with provisions for statistically recording traffic and usage data for individual users.

Communications processors operating in full-scale X.25 configurations seldom perform gateway functions. The user must comply with the network's protocols, either through X.25 software residing in a participating host or its front-end processor, or through a packet assembler/disassembler (PAD) that handles the Physical and Data Link layers of the architecture.

Vendors offer transparent architectures as low-cost alternatives to mainframe architectures

and X.25 implementations. These architectures are usually stripped-down versions of X.25 without the network administration and class-of-service overhead necessary to operate a public or large private network. In these architectures, the communications processor functions primarily as a switching concentrator, providing services at the Data Link, Network, and Transport layers. Most of these concentrators evolved at the high ends of lines of statistical multiplexers, adding the crucial routing and flow control features that qualify them as communications processors. Some of these products offer integrated network management functions, such as error logging and performance statistics, but most rely on separate, complementary network management systems for these functions.

Evolution of the Communications Processor

Two developments in the late 1960s provided the technical base for the modern communications processor: the minicomputer and ARPAnet. The minicomputer performed a number of functions more efficiently than a mainframe and supplied the bus architecture that gave communications processors modularity and flexibility. ARPAnet, the first large-scale packet switched data network, produced the fundamental design principles for current data communications architectures. From these principles originated the intelligent virtual circuit switch, the first functional communications processor.

A later development in minicomputer applications created the distributed processor, a small computer dedicated to part of a larger application that performed communications with its peers in a distributed network. Distributed processing contributed the idea of intelligent communications handling under software control.

The lower cost of dedicated processing in small computers made feasible the idea of dedicating a small computer to off-load intelligent communications handling from the mainframe. The first intelligent front ends, such as IBM's 3704, predate modern network architectures and, to a large extent, made such architectures possible.

The microprocessor also contributed to the development of the communications processor. The advent of inexpensive silicon intelligence enabled designers to implement the hierarchical scheme of the typical communications architecture

in hardware, with dedicated microprocessors performing low-level functions and reporting to larger, more complex processors at higher levels. Indeed, some line bases in present-day communications processors are programmable, receiving downloads from the units' CPUs that describe protocol and synchronization. Some systems comprise entirely redundant, microprocessor-controlled modules that perform the functions of other modules, using the proper software load.

Products

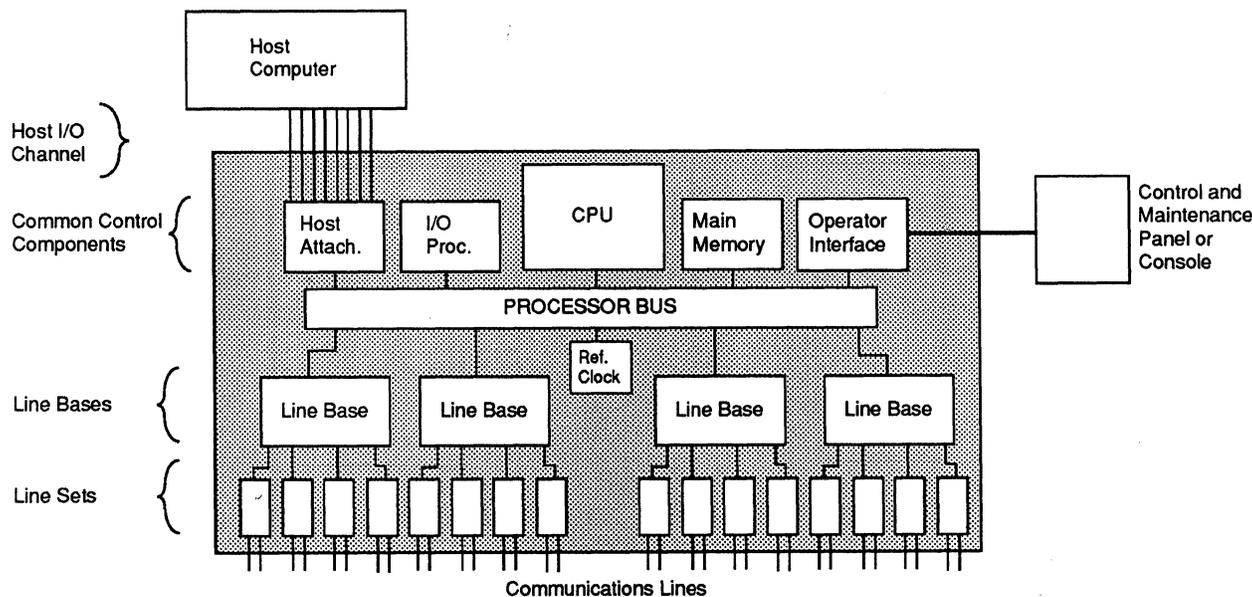
Front-end processing is the most difficult task performed by a communications processor. In a large, complex network governed by one or more mainframe hosts, a front end must perform the following: physical transmission and reception of data; data buffering and queuing; multiplexing; message framing and unframing; control transmission errors; message sequencing; protocol conversion; message pacing and flow control; message or packet assembly and disassembly; route selection; session establishment and disconnection; and data formatting.

Intelligent switching is slightly less complex. When acting as a dedicated switch, the communications processor does not carry on a running dialog with a host computer and is not responsible for end-to-end establishment and disconnection of sessions. Still, an intelligent switch in normal operation must perform several basic functions.

Since *concentration* is the simplest task performed by a communications processor, it can be confused with less sophisticated, single-function devices like statistical multiplexers, protocol converters, PADs, and terminal cluster controllers. Indeed, the widespread use of microprocessors and the declining cost of silicon intelligence, have enabled many devices at the high ends of these lines to approach the functions of true communications processors. In true communications processing like concentration, however, a dynamic process occurs that involves feedback from other intelligent devices in the network. Statistical multiplexing, protocol conversion, and packet assembly/disassembly are basically static processes that do not change as conditions change in the network.

An intelligent concentrator participates in the control of the network, either under the direction

Figure 2.
Hierarchical Architecture



The diagram shows the hierarchical, bus-based architecture of a typical communications processor. Such a processor can contain more than one host interface, several I/O processors, and many line bases. Each line base serves communications lines of a specific synchronization, speed, and protocol. Each line set serves lines with a specific, physical interface. The modular arrangement of line bases and line sets on the processor bus allows easy configuration and reconfiguration.

of a master processor or as a peer of other concentrators and switches, receiving status information from the network and changing its behavior accordingly. These changes include accelerating or withholding transmissions, initiating diagnostic procedures for pathways and devices in its local domain, and controlling access to the network from its locally attached devices. Some sophisticated terminal controllers, notably IBM's 3174s, perform some or all of these functions.

Design

The basic design of almost all communications processors follows a three-tiered, hierarchical plan—a plan that they share in common with digital PBXs and with a number of other data communications components.

The device's central processing unit (CPU) with its main memory sits at the top of the hierarchy. The CPU controls the communications processor's operation according to the rules and parameters of its operating software and, in front-end configurations, in conjunction with instructions from the host computer. In general, the CPU performs addressing, route selection, protocol conversion, access control, session establishment,

application-level formatting, and error logging. It also delegates rote operations to subsidiary components.

Front-End Processors (FEPs): Communications processors configured as front ends must have at least one host interface, which handles communications between the front-end processor and the host's byte or block multiplexer, or selector channel. The host interface buffers data from the front-end's CPU, assembles it into parallel bit streams of a format specific to the attached host channel, and transmits it up the channel to the host. For data from the host, it performs the same process in reverse. The host interface converts data from the communications processor's internal word size to that of the host computer.

Input/Output Processors: Some communications processors contain one or more input/output processors that transfer data between the CPU and attached storage peripherals. In some cases, the I/O processors arbitrate among the various line bases for access to main memory and to the CPU, handling interrupts generated by the line bases or host

interfaces to gain the attention of the CPU, or controlling the line bases' and host interfaces' access to main memory. In communications processors with more than one I/O processor, each I/O processor usually controls a set complement of storage units or communications lines.

Reference Clock: The reference clock generates a timing signal for other components of the communications processor. In many systems, the CPU performs reference timing. Some systems have separate reference clocks for timing signals at different data rates.

Operator Interface: The operator interface allows an operator to monitor and control the communications processor and to run diagnostic tests. In newer and more sophisticated systems, the operator interface works under software control from a dedicated console, which usually contains a display unit and a printer for logging. In older communications processors, the operator interface works through a front panel equipped with manual switches and indicator lights.

Line Bases and Line Sets: All of the aforementioned devices perform functions that are shared among all communications lines; they sit just below the CPU in the communications processor's internal hierarchy. On the network side, the "business end" of a communications processor, the line bases and line sets complete the hierarchy.

A line base, sometimes called an attachment base, interface base, or interface module, handles communications at the Data Link layer between the communications processor and a group of attached communications lines that share a common synchronization pattern, line speed, and (sometimes) protocol. Each line base usually contains a dedicated microprocessor that performs framing and stripping, message buffering, message sequencing, synchronization, and error detection under the direction of the CPU. Most current communications processors accommodate from 8 to 32 line bases, each of which handles from two to eight line sets.

A line set handles communications at the Physical layer between its attached line base and from one to eight communications lines. All the communications lines attached to a line set must use the same physical interface at approximately

the same data rate. The line set handles serialization of data and interface-level control signaling.

Parallel Data Bus: All components of the communications processor communicate with one another over a parallel data bus, usually located along the backplane or a side plane of the processor's cabinet. The physical bus architecture, popularized by minicomputer design, supports easy installation and replacement of parts. In a hierarchical architecture, the bus also accommodates easy reconfiguration. To replace asynchronous communications over voice grade lines with HDLC communications over wideband or satellite circuits for a 16-line segment of a network, a user might need only to replace one line base and eight line sets, rather than swapping out an entire front-end processor. The hierarchical design extends the communications processor's functionality over time and helps to protect the user's investment. Figure 2 shows the hierarchical configuration of a generalized communications processor.

Selection Guidelines

The principal advantage of a communications processor as a networking tool is the physical and logical separation of the networking function from the applications of its end users. Whatever its architecture, such a network functions for any application, grows in size without qualitative change to accommodate new applications, and runs new applications through the installation of relatively standard, intelligent components. The user need not redesign and rebuild a modular network to change the network's ultimate purpose.

Programmable, software-controlled communications processors are especially useful tools in standalone networks because they accommodate not only changes in application but also the effects of technical progress. A software-controlled communications processor with a good design can survive breakthroughs in networking techniques through relatively simple upgrades. The microprocessor-controlled line bases, and even line sets, provide an even more flexible buffer against obsolescence.

In operation, a network controlled by communications processors survives the total failure of one or more of its host processors. In a multihost network, front-end processors switch users from

applications in a failed host to similar or identical applications in a backup host, perhaps elsewhere on the network. In a single-host network, a functioning front end allows service to degrade gracefully in the event of a host failure, sometimes allowing users to terminate their tasks before total system failure or allowing communications among distributed application processors in the absence of the controlling host.

The communications processor still fulfills its original purpose: relieving the host of the overhead generated by keeping track of a network. Today's networks are orders of magnitude more complex than those of the mid-1970s when the first communications processors appeared. Thanks to the declining costs of memory and processing power,

many of today's communications processors are faster and more powerful than mainframes of that era.

The complexity of communications processors, however, poses problems. In an era of user-friendly hardware and software, the communications processor remains a device hospitable only to trained engineers. Most require programs written in an arcane, Assembler-level language, sometimes (but not always) with the benefit of pregenerated macros in the host access method. ■

Communications Processors: Technology Overview

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Synopsis

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these communications processors at the front end of a mainframe, or allowed them to function independently as concentrators and switches within their architectures.

In most communications processors, under the direction of the CPU, some components perform functions for the whole communications processor, while others perform functions for specific groups of lines. Among the former are host interfaces, input/output (I/O) processors, reference clock, and operator interface. Among the latter are the processor's line bases and line sets.

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distributed applications processors; gathers, queues, and multiplexes their transmissions onto one or more high-speed network trunks; and participates in the network's control and management, either under the direction of a master processor or as a peer of other concentrators and switches.

Table 1 lists the major functions of a communications processor in a typical network.

Network Architectures

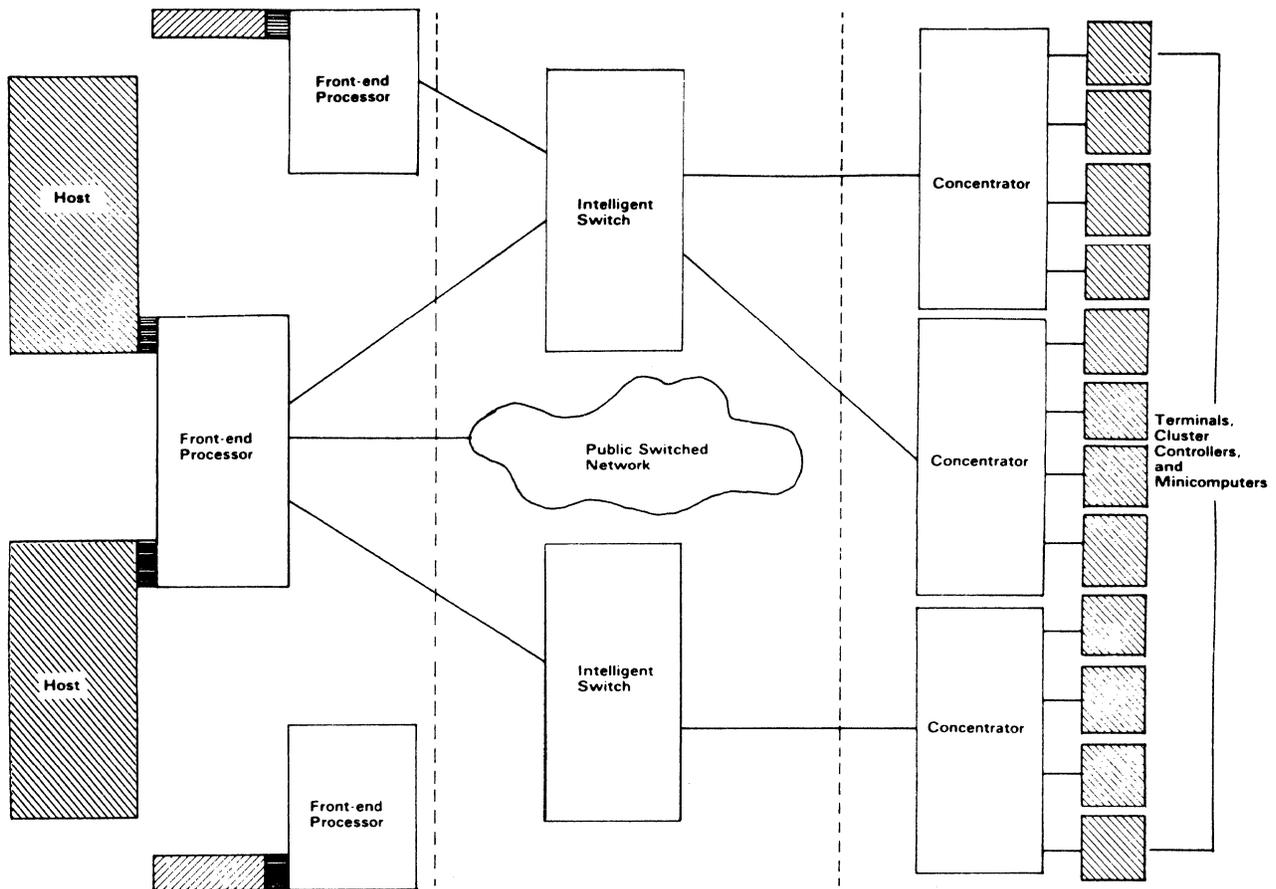
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Table 1. Communications Processors Functions

Physical transmission and reception of data
Data buffering and queuing
Multiplexing
Message framing and unframing
Control of transmission errors
Message sequencing
Protocol conversion
Message pacing and flow control
Message or packet assembly and disassembly
Route selection
Session establishment and disconnection
Formatting of data for use by specific host or terminal applications
Reporting and logging of device or transmission errors or failures
Fallback switching in case of host, device, or transmission line failure
Gather and record network performance and traffic statistics

*Figure 1.
Applications*



A communications processor can function as a front end for one or more host computers, as an intelligent switching node not attached directly to any applications equipment, or as a remote terminal concentrator.

Open Systems Interconnection (OSI) provides a framework in which to examine the functions performed by communications processors in different kinds of network architectures.

Mainframe Architectures

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method (along with software residing in the terminal controllers) handles communications down to the Session layer, with the 37XX front end acting almost as a channel-attached packet switch. The range of control assigned to front-end processors in other mainframe architectures varies between those extremes.

In all mainframe architectures, the same communications processor models that serve as front ends also function as intelligent switches and as remote concentrators. In these functions, the communications processors usually appear in smaller configurations than they do as front-ends. Communications processors working in mainframe architectures also perform intelligent gateway functions. In this application, the communications processor provides the interface between the mainframe network and communications facilities outside the

architecture, particularly public, packet-switched data networks using X.25 protocols.

Open Architectures

In an open architecture, such as X.25, the communications processor serves as an intelligent packet switch, implementing the Data Link through Transport layers via a uniform set of complementary protocols. Designed specifically for public data networks, X.25 protocols establish virtual circuits, or logical paths through the network, for devices from any vendor. Communicating devices at either end of the virtual circuit must handle the Session, Presentation, and Application layers according to their own protocols.

In a public network, the network provider is responsible for network management. The X.25 communications processors in such a network, therefore, carry a heavy load of access, error, and class-of-service control, along with provisions for statistically recording traffic and usage data for individual users.

Communications processors operating in full-scale X.25 configurations seldom perform gateway functions. The user must comply with the network's protocols, either through X.25 software residing in a participating host or its front-end processor, or through a packet assembler/disassembler (PAD) that handles the Physical and Data Link layers of the architecture. Table 2 shows the protocols supported by various vendors' communications processors.

Vendors offer transparent architectures as low-cost alternatives to mainframe architectures and X.25 implementations. These architectures are usually stripped-down versions of X.25 without the network administration and class-of-service overhead necessary to operate a public or large private network. In these architectures, the communications processor functions primarily as a switching concentrator, providing services at the Data Link, Network, and Transport layers. Most of these concentrators evolved at the high ends of lines of statistical multiplexers, adding the crucial routing and flow control features that qualify them as communications processors. Some of these products offer integrated network management functions, such as error logging and performance statistics, but most rely on separate, complementary network management systems for these functions.

Evolution of the Communications Processor

Two developments in the late 1960s provided the technical base for the modern communications processor: the minicomputer and ARPAnet. The minicomputer performed a number of functions more efficiently than a mainframe and supplied the bus architecture that gave communications processors modularity and flexibility. ARPAnet, the first large-scale packet switched data network, produced the fundamental design principles for current data communications architectures. From these principles originated the intelligent virtual circuit switch, the first functional communications processor.

A later development in minicomputer applications created the distributed processor, a small computer dedicated to part of a larger application that performed communications with its peers in a distributed network. Distributed processing contributed the idea of intelligent communications-handling under software control.

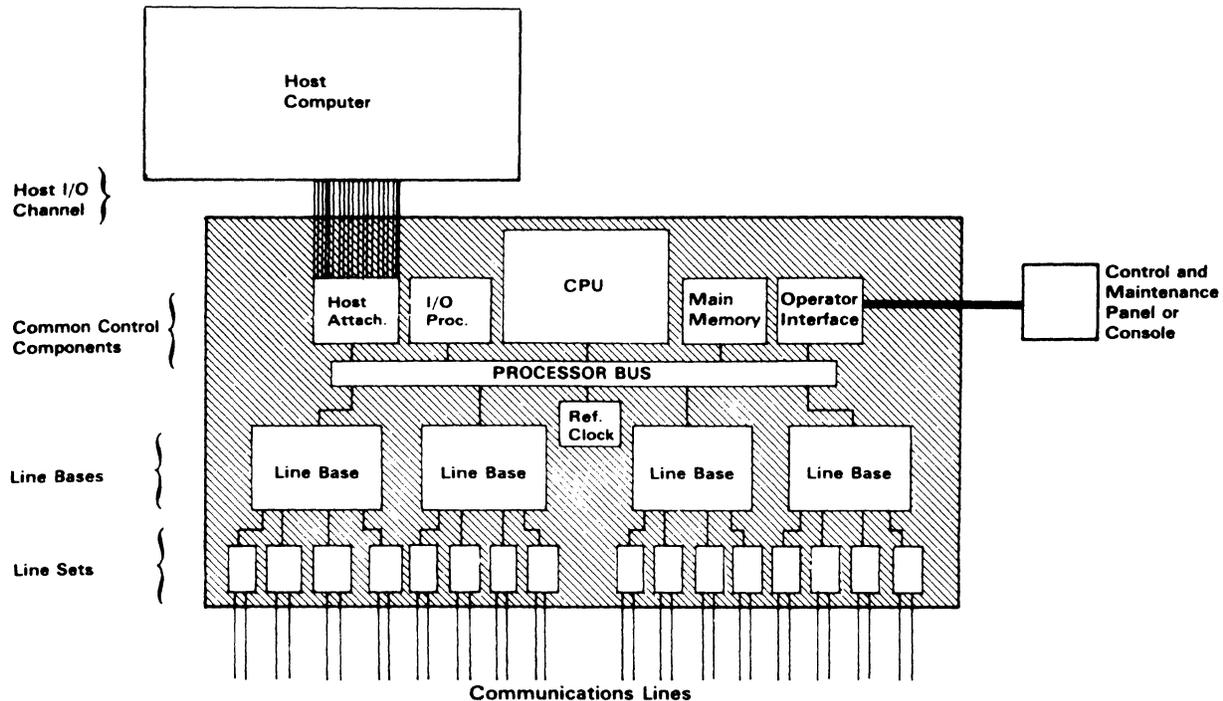
The lower cost of dedicated processing in small computers made feasible the idea of dedicating a small computer to off-load intelligent communications-handling from the mainframe. The first intelligent front ends, such as IBM's 3704, predate modern network architectures and, to a large extent, made such architectures possible.

The microprocessor also contributed to the development of the communications processor. The advent of inexpensive silicon intelligence enabled designers to implement the hierarchical scheme of the typical communications architecture in hardware, with dedicated microprocessors performing low-level functions and reporting to larger, more complex processors at higher levels. Indeed, some line bases in present-day communications processors are programmable, receiving downloads from the units' CPUs that describe protocol and synchronization. Some systems comprise entirely redundant, microprocessor-controlled modules that perform the functions of other modules, using the proper software load.

Products

Front-end processing is the most difficult task performed by a communications processor. In a large, complex network governed by one or more mainframe hosts, a front end must perform the following: physical transmission and reception of data;

Figure 2.
Hierarchical Architecture



The diagram shows the hierarchical, bus-based architecture of a typical communications processor. Such a processor can contain more than one host interface, several I/O processors, and many line bases. Each line base serves communications lines of a specific synchronization, speed, and protocol. Each line set serves lines with a specific, physical interface. The modular arrangement of line bases and line sets on the processor bus allows easy configuration and reconfiguration.

data buffering and queuing; multiplexing; message framing and unframing; control transmission errors; message sequencing; protocol conversion; message pacing and flow control; message or packet assembly and disassembly; route selection; session establishment and disconnection; and data formatting.

Intelligent switching is slightly less complex. When acting as a dedicated switch, the communications processor does not carry on a running dialog with a host computer and is not responsible for end-to-end establishment and disconnection of sessions. Still, an intelligent switch in normal operation must perform several basic functions.

Since *concentration* is the simplest task performed by a communications processor, it can be confused with less sophisticated, single-function devices like statistical multiplexers, protocol converters, PADs, and terminal cluster controllers. Indeed, the widespread use of microprocessors and the declining cost of silicon intelligence, has enabled many devices at the high ends of these lines

to approach the functions of true communications processors. In true communications processing, like concentration, however, a dynamic process occurs that involves feedback from other intelligent devices in the network. Statistical multiplexing, protocol conversion, and packet assembly/disassembly are basically static processes that do not change as conditions change in the network.

An intelligent concentrator participates in the control of the network, either under the direction of a master processor or as a peer of other concentrators and switches, receiving status information from the network and changing its behavior accordingly. These changes include accelerating or withholding transmissions, initiating diagnostic procedures for pathways and devices in its local domain, and controlling access to the network from its locally attached devices. Some sophisticated terminal controllers, notably IBM's 3174s, perform some or all of these functions.

Design

The basic design of almost all communications processors follows a three-tiered, hierarchical plan—a plan that they share in common with digital PBXs and with a number of other data communications components.

The device's central processing unit (CPU) with its main memory sits at the top of the hierarchy. The CPU controls the communications processor's operation according to the rules and parameters of its operating software and, in front-end configurations, in conjunction with instructions from the host computer. In general, the CPU performs addressing, route selection, protocol conversion, access control, session establishment, application-level formatting, and error logging. It also delegates rote operations to subsidiary components.

Front-End Processors (FEPs): Communications processors configured as front ends must have at least one host interface, which handles communications between the front-end processor and the host's byte or block multiplexer, or selector channel. The host interface buffers data from the front end's CPU, assembles it into parallel bit streams of a format specific to the attached host channel, and transmits it up the channel to the host. For data from the host, it performs the same process in reverse. The host interface converts data from the communications processor's internal word size to that of the host computer.

Input/Output Processors: Some communications processors contain one or more input/output processors that transfer data between the CPU and attached storage peripherals. In some cases, the I/O processors arbitrate among the various line bases for access to main memory and to the CPU, handling interrupts generated by the line bases or host interfaces to gain the attention of the CPU, or controlling the line bases' and host interfaces' access to main memory. In communications processors with more than one I/O processor, each I/O processor usually controls a set complement of storage units or communications lines.

Reference Clock: The reference clock generates a timing signal for other components of the communications processor. In many systems, the CPU

performs reference timing. Some systems have separate reference clocks for timing signals at different data rates.

Operator Interface: The operator interface allows an operator to monitor and control the communications processor and to run diagnostic tests. In newer and more sophisticated systems, the operator interface works under software control from a dedicated console, which usually contains a display unit and a printer for logging. In older communications processors, the operator interface works through a front panel equipped with manual switches and indicator lights.

Line Bases and Line Sets: All of the aforementioned devices perform functions that are shared among all communications lines; they sit just below the CPU in the communications processor's internal hierarchy. On the network side, the "business end" of a communications processor, the line bases and line sets complete the hierarchy.

A line base, sometimes called an attachment base, interface base, or interface module, handles communications at the Data Link layer between the communications processor and a group of attached communications lines that share a common synchronization pattern, line speed, and (sometimes) protocol. Each line base usually contains a dedicated microprocessor that performs framing and stripping, message buffering, message sequencing, synchronization, and error detection under the direction of the CPU. Most current communications processors accommodate from 8 to 32 line bases, each of which handles from 2 to 8 line sets.

A line set handles communications at the Physical layer between its attached line base and from one to eight communications lines. All the communications lines attached to a line set must use the same physical interface at approximately the same data rate. The line set handles serialization of data and interface-level control signaling.

Parallel Data Bus: All components of the communications processor communicate with one another over a parallel data bus, usually located along the backplane or a side plane of the processor's cabinet. The physical bus architecture, popularized by minicomputer design, supports easy installation

and replacement of parts. In a hierarchical architecture, the bus also accommodates easy reconfiguration. To replace asynchronous communications over voice grade lines with HDLC communications over wideband or satellite circuits for a 16-line segment of a network, a user might need only to replace one line base and eight line sets, rather than swapping out an entire front-end processor. The hierarchical design extends the communications processor's functionality over time and helps to protect the user's investment. Figure 2 shows the hierarchical configuration of a generalized communications processor.

Selection Guidelines

The principal advantage of a communications processor as a networking tool is the physical and logical separation of the networking function from the applications of its end users. Whatever its architecture, such a network functions for any application; grows in size without qualitative change to accommodate new applications; and runs new applications through the installation of relatively standard, intelligent components. The user need not redesign and rebuild a modular network to change the network's ultimate purpose.

Programmable, software-controlled communications processors are especially useful tools in standalone networks because they accommodate not only changes in application but also the effects of technical progress. A software-controlled communications processor with a good design can survive breakthroughs in networking techniques through relatively simple upgrades. The

microprocessor-controlled line bases, and even line sets, provide an even more flexible buffer against obsolescence.

In operation, a network controlled by communications processors survives the total failure of one or more of its host processors. In a multihost network, front-end processors switch users from applications in a failed host to similar or identical applications in a backup host, perhaps elsewhere on the network. In a single-host network, a functioning front end allows service to degrade gracefully in the event of a host failure, sometimes allowing users to terminate their tasks before total system failure, or allowing communications among distributed application processors in the absence of the controlling host.

The communications processor still fulfills its original purpose: relieving the host of the overhead generated by keeping track of a network. Today's networks are orders of magnitude more complex than those of the mid-1970s when the first communications processors appeared. Thanks to the declining costs of memory and processing power, many of today's communications processors are faster and more powerful than mainframes of that era.

The complexity of communications processors, however, poses problems. In an era of user-friendly hardware and software, the communications processor remains a device hospitable only to trained engineers. Most require programs written in an arcane, Assembler-level language, sometimes (but not always) with the benefit of pregenerated macros in the host access method. ■

Communications Capabilities of Minicomputers and Small Business Computers

The minicomputer market has increased in size by 20 percent per year for the past five years and will continue at that pace for the next few. This growth has occurred despite the now ubiquitous presence of the microcomputer. In order for minicomputers to continue to earn their keep in favor of lower priced microcomputers, they must be able to support multiple terminals and applications, and, generally, be more versatile. One application which has taken on greater significance for minicomputers and small business systems is communications. Minicomputers are now being used with increased frequency as gateways for the subordinate terminals they service.

Virtually every currently marketed small computer system is now equipped with some sort of data communications capability, ranging from simple dumb terminal emulation to sophisticated communication software and hardware packages that permit it to serve effectively as a complete communications processing product. Interfacing with mainframe equipment and/or other small computers permits these systems to perform an endless variety of communication processing functions, including front-end processing, remote concentration, message switching, network processing, and terminal control. The small computer system's internal processing and storage capabilities enable it to do some data processing locally as well as handling code translation, editing and control functions in connection with the data communications activities. Whether utilized as a dedicated communications processor or as an applications processor that performs some communications functions, a small business computer can be used to form a basic building block of a data communications network.

In general, the level of sophistication of the data communications capabilities of a particular system can be assessed by the variety and number of communications features—both hardware and software—it supports. Naturally, not every small system is supported for all types of functions to the same extent.

Support may be provided only for basic batch terminal communications. Remote job entry products and procedures established in the 1960's by IBM, Burroughs, Control Data, Honeywell, and Univac have become de facto standards for batch data communications and it is not uncommon on small computer systems for a vendor to provide a variety of interchangeable software packages with which the user can emulate IBM's 2780 or 3780 Data Communications Terminal or its 360/20 HASP Multileaving workstation, Burroughs' TC Series terminals, Control Data's 200 User Terminal, Honeywell's GERTS, or Univac's 1004 or DCT 2000.

More extensive communications capabilities are represented by those systems that can support multiple workstations, enabling the system's processor to function as an intelligent clustered terminal controller. Some

A comprehensive report in Datapro's handy chart format which highlights the capabilities and prices of communicating minicomputers. High performance superminicomputers have been added to this survey for the first time. This year's expanded report includes 71 vendors representing 244 minicomputer systems. All systems featured have been judged by Datapro to offer substantial communications support.

systems provide emulation packages for popular interactive mainframe-produced terminals, such as the IBM 3270 Information Display System, while others leave the management of the interaction between the workstations and a remote host to be programmed by the user.

Systems that can handle multiple communication lines, support a variety of communications protocols, and serve in any of several communications capacities are available from a number of minicomputer and small business computer vendors. For example, Data General's Nova and Eclipse minicomputers have been continuously enhanced with communications hardware and software to provide for a wide range of communications applications, and can be configured as channel-attached front-end processors, remote communications concentrators, or distributed processing systems. And Digital Equipment's PDP-11 family supports virtually all modes and types of data communications protocols, and facilities, and provides over twenty different line controller and interface sets to handle local, remote and interprocessor communications.

When not available directly through the manufacturer, communications features are often added by OEMs, distributors, and similar third party organizations. And, of course, because the equipment is essentially a computer, the user can program whatever special requirements are not supported by the vendor.

The Comparison Charts

The comparison chart data presented in this report was gathered as a part of Datapro's preparation of the 1982 versions of "All About Minicomputers" and "All About Small Business Computers," and "All About Superminis," which appear in DATAPRO 70, and "Minicomputer Specifications," "Small Business Computer Specifications," and "Supermini Specifications" which appear in DATAPRO REPORTS ON MINICOMPUTERS. As the title of the present report suggests, the broad-based information presented in the "All About..." reports has been condensed and edited, to enable us to zero in on those products which provide significant data communications features and to concentrate on just those capabilities. All models selected for inclusion in this report were judged to

Communications Capabilities of Minicomputers and Small Business Computers

▷ have substantial communications capabilities using several criteria. For example, systems to which at least 16 communications lines can be attached or that provide interprocessor communications functions under major network architectures have been included.

The resulting comparison charts can be effectively used to conduct a first-level search of minicomputers and small business computers that meet your communications requirements. For example, if you are looking for a system that can support high speed data transmission to a remote host, quickly scan the charts and jot down those vendors/models which provide the range of speeds you require. Or, if you know that your applications require a certain minimum main memory capacity for off-line processing, and you are looking for a system that can also provide support for interactive IBM 3270-type data communications, a complete list of those systems that satisfy both requirements can easily be made.

Once your search has narrowed down the manufacturers and model numbers of equipment that satisfies your needs, you may wish to know full details about the computers you've selected. If so, simply turn to the Index of this service and locate each system's detailed report, which contains complete information on the communications capabilities of the system, including our analysis of how it fits into the data processing environment from a data communications point of view and pricing details of all communications hardware and software features offered.

Whenever you seek more information on a system that is not covered in an in-depth report in DATAPRO REPORTS ON DATA COMMUNICATIONS, please contact us directly via the Inquiry Service and get the facts you need by telephone or mail. (This service is fully described behind the Inquiry Service index tab.)

Comparison Chart Entries

The accompanying comparison charts summarize the key characteristics of the data communications functions of 244 commercially available minicomputers and small business computers from 71 vendors. The information presented in the charts was supplied by the manufacturers and suppliers from November 1981 to February 1982. The cooperation of the vendors who provided this information to the Datapro staff for these reports is gratefully acknowledged.

Main Storage

Our comparison charts show the *maximum capacity* of main memory available for each computer expressed in bytes.

The amount of internal storage is one of the most significant characteristics in appraising the power of any computer. The amount of productive processing that a computer can perform during any one run is largely determined by the number of instructions and/or operands it can hold. It is important to choose the right storage capacity; for nonmultiprogramming systems, that usually means enough storage to hold your largest

program, operating system, and all associated subroutines and data, but not too much more than that. It's also wise to make sure that your computer's main storage capacity can be expanded if necessary, preferably by simply plugging in an additional storage module.

Number of Workstations Connectable

Another very important consideration for many users who are considering the acquisition of a minicomputer or small business computer for use in a communications processing environment is the number of workstations it can support. Workstations, in this case, can mean most any type of device, whether remotely or locally connected, that can input and/or receive data from the minicomputer or small business computer. When the system is used in a business environment, for instance, the workstation would normally be a data processing device or terminal, but in a manufacturing or distribution environment the workstation could be a sensor or transmission unit that simply transmits signals back to the system for processing.

Communications Capabilities

Maximum no. of lines indicates how many communications lines can be physically connected to a particular system. The types of lines are specified in the next two entries. The entries in these three categories represent the raw outer limits of line number, type, and speed provided by each system.

To utilize this information properly, the reader must take into consideration two important factors. First, the line mix (the number of lines of each type and speed) and the resource mix (the number and type of workstations, peripherals, and other facilities) determine the actual practical limits of the system. For example, the number of high speed communications lines that are physically attachable to a processor is generally much less than the number of low or medium speed lines. Secondly, the throughput capabilities of the system vary radically, depending not only on the physical configuration of the hardware but also on the system's software requirements. Even if the system is configured within recommended physical bounds, a heavy processing load can reduce throughput to below an acceptable level.

Synchronous and *asynchronous* have entries of standard, optional, or no, indicating their availability, and also a notation as to the speed of each line in bits per second (bps). Most entries are of the type "to 4800 bps," indicating one or more lines supporting transmission up to a maximum of 4800 bps.

Protocols supported indicates the type of communication protocols accommodated by hardware and software for the model.

Network architecture supported indicates the communications network architecture support by this model. Entries may include, for example, Burroughs BNA, DEC's DECnet, or IBM's SNA.

RJE terminals emulated indicates whether there is software available from the vendor for this system to ▷

Communications Capabilities of Minicomputers and Small Business Computers

▷ enable it to function as a "look-alike" for remote job entry terminals. The terminals for which support is provided are indicated.

IBM 3270 emulation is listed as a separate entry as a result of an increasing amount of interest from our users concerning the emulation of the IBM 3270 Information Display System.

Pricing and Availability

Purchase price of basic system shows the minimum purchase price of the system. In the case of a system in which each component is sold as a separate item, the comparison chart shows the price of the CPU, power supply, front panel, and minimum memory in the chassis. In the case of a packaged system, the price includes all standard components and facilities of the entry-level model. For many of the systems listed, itemized pricing, including all communications hardware and software features, is provided in the system's detailed report, which you can find using the Index of this service. If the system is not covered in an in-depth report, detailed pricing can be obtained through the Datapro Inquiry Service or directly from the vendor.

Purchase price of memory module stipulates the costs of various sizes (when available) of memory increments, with the actual sizes in parentheses.

Monthly maintenance price of basic system shows the maintenance costs of the basic system as described above.

If you'll need two or more systems, it's worth noting that some of the manufacturers offer sizeable discounts from their list prices on orders for multiple computers. Discounts of up to 40 percent are not unusual on large orders. *Discounts available* indicates the types of discounts offered by the vendor for each model. This entry will vary by model for many manufacturers with multiple lines of systems.

Date of first U.S. delivery tells when the first production models of each system were delivered (or are scheduled to be delivered) to customers in the United States.

Number installed to date shows how many systems of each type had been delivered to customers as of approximately February, 1982. Nearly all of the figures were supplied by the manufacturers themselves, and a number of companies chose not to release this information.

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, or applications.

Dashes (—) will occasionally appear in the chart. This indicates that Datapro lacks the information needed to provide the required answer.

Suppliers

Listed below, for your convenience in obtaining additional information, are the full names, addresses, and telephone

numbers of the 71 suppliers whose products are listed in the comparison charts that follow.

Able Computer, 1732 Reynolds Avenue, Irvine, CA 92714. Telephone (714) 979-7030.

Accelerated Data Systems, 1183 Bordeau, Suite 18, Sunnyvale, CA 94086. Telephone (408) 744-0264.

Alpha Micro, 17881 Sky Park North, P.O. Box 18347, Irvine, CA 92713. Telephone (714) 957-1404.

AM Jacquard Systems, Executive Branch, 3340 Ocean Park Boulevard, Santa Monica, CA 90405. Telephone (213) 450-1242.

Applied Digital Communications, 214 Flynn Avenue, Moorestown, NJ 08057. Telephone (609) 234-3666.

Applied Digital Data Systems (ADDS), 100 Marcus Boulevard, Hauppauge, NY 11787. Telephone (516) 231-5400.

Applied Systems Corporation, 26401 Harper Avenue, St. Clair Shores, MI 48081. Telephone (313) 779-8700.

BBN Computer Corporation, 33 Moulton Street, Cambridge, MA 02238. Telephone (617) 491-1850.

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

Burroughs Corporation, Burroughs Place, Detroit, MI 48232. Telephone (313) 972-7000.

CDA (Computer Data Access), Inc., 1373 Broad Street, Clifton, NJ 07011. Telephone (201) 473-4700.

Central Data Corporation, P.O. Box 2530, Station A, Champaign, IL 61820. Telephone (217) 359-8010.

Centurion Computer Corporation, 1780 Jay Ell Drive, Richardson, TX 75081. Telephone (214) 699-8400.

Century Computer Corporation, 14453 Gillis Road, Dallas, TX 75234. Telephone (214) 233-3238.

Charles River Data Systems, Inc., 4 Tech Circle, Natick, MA 01760. Telephone (617) 655-1800.

Complete Computer Systems, 159 Gibraltar Road, Horsham, PA 19044. Telephone (215) 441-4200.

Computer Automation, Inc., 2181 Dupont Avenue, Irvine, CA 92713. Telephone (714) 833-8830.

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

Computer Hardware, Inc., 4111 North Freeway Boulevard, P.O. Box 25500, Sacramento, CA 95834. Telephone (916) 929-2020.

Computer Talk Inc., P.O. Box 148, Morrison, CO 80465. Telephone (303) 697-5485.

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

Data Communications Corporation, 3000 Directors Row, Memphis, TN 38131. Telephone (901) 345-3544.

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

Datapoint Corporation, 9725 Datapoint Drive, San Antonio, TX 78284. Telephone (512) 690-7000. ▷

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- **Digital Equipment Corporation (DEC)**, 129 Parker Street, Maynard, MA 01754. Telephone (617) 897-5111.
- Digital Scientific Corporation**, 11425 Sorrento Valley Road, San Diego, CA 92121. Telephone (714) 453-6050.
- Digital Systems Corporation**, P.O. Box 158, Walkersville, MD 21793. Telephone (301) 845-4141.
- Dimis, Incorporated**, 1060 Highway 35, Middletown, NJ 07748. Telephone (201) 671-1011.
- Display Data Corporation**, Executive Plaza IV, Hunt Valley, MD 21031. Telephone (301) 667-9211.
- Distribution Management Systems Inc.**, 11 De Angelo Drive, Bedford, MA 01730. Telephone (617) 272-2000.
- Evolution Computer Systems Corporation**, 17911 Sky Park Circle, Suite E, Irvine, CA 92714. Telephone (714) 974-7670.
- Formation**, 823 East Gate Drive, Mt. Laurel, NJ 08054. Telephone (609) 234-5020.
- Four-Phase Systems, Inc.**, 10700 North De Anza Boulevard, Cupertino, CA 95014. Telephone (408) 255-0900.
- Geac Incorporated**, 309 Seaside Avenue, Milford, CT 06460. Telephone (203) 877-1486.
- General Automation Corporation**, 1055 S. East Street, Anaheim, CA 92805. Telephone (714) 778-4800.
- Gould Inc., S.E.L. Computer Systems Division**, (formerly SYSTEMS Engineering Laboratories, Inc.), 6901 West Sunrise Boulevard, Fort Lauderdale, FL 33313. Telephone (305) 587-2900.
- Harris Corporation, Computer Systems Division**, 2101 West Cypress Creek Road, Fort Lauderdale, FL 33309. Telephone (305) 974-1700.
- Hewlett-Packard, Data Systems Division**, 11000 Wolfe Road, Cupertino, California 95014. Telephone (408) 257-7000.
- Hewlett-Packard, Computer Systems Division**, 19447 Pruneridge Avenue, Cupertino, CA 95014. Telephone (408) 725-8111.
- Honeywell Information Systems, Inc.**, 200 Smith Street, Waltham, MA 01821. Telephone (617) 671-6000.
- IBM Corporation**, 1133 Westchester Avenue, White Plains, NY 10604. Telephone (914) 696-1900.
- ICL/North America Operations**, 415 East Airport Freeway, Irving, TX 75062. Telephone (214) 258-8525.
- Industrial Micro Systems, Inc.**, 2800 Lockheed Way, Carson City, NV 89701. Telephone (702) 883-7611.
- Infomark, Inc.**, 9 North Bacton Hill Road, Frazer, PA 19355. Telephone (215) 647-8685.
- Inforex, Inc.**, 186 Middlesex Turnpike, Burlington, MA 01803. Telephone (617) 272-6470.
- Infotecs Computer Systems**, One Perimeter Road, Manchester, NH 03103. Telephone (603) 624-2700.
- MAI/Basic Four Corporation**, 14101 Myford Road, Tustin, CA 92680. Telephone (714) 731-5100.
- MCM Computers Ltd.**, 6815 Rexwood Road, Unit #9, Mississauga, Ontario, Canada L4V 1R2. Telephone (416) 678-7854.
- Mercator Business Systems**, 1294 Lawrence Station Road, Sunnyvale, CA 94086. Telephone (408) 734-5134.
- Microdata Corporation**, P.O. Box 19501, Irvine, CA 92713. Telephone (714) 540-6730.
- Microtech Business Systems**, 3180 Pullman Street, Costa Mesa, CA 92626. Telephone (714) 557-8640.
- Mitsubishi Electronics America, Inc.** 2200 W. Artesia Boulevard, Compton, California 90220. Telephone (213) 979-6055.
- Modular Computer Systems, Inc.**, 1650 West McNab Road, Fort Lauderdale, FL 33310. Telephone (305) 974-1380.
- Mylee Digital Sciences, Inc.**, 155 Weldon Parkway, Maryland Heights, MO 63043. Telephone (314) 567-3420.
- NCR Corporation**, 1700 South Patterson Boulevard, Dayton, OH 45479. Telephone (513) 445-5000.
- Nixdorf Computer Inc.**, 300 Third Avenue, Waltham, MA 02154. Telephone (617) 890-3600.
- Olivetti Corporation of America**, 155 White Plains Road, Tarrytown, NY 10591. Telephone (914) 631-8100.
- 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.
- Quodata Corporation**, 196 Trumbull Street, Hartford, CT 06103. Telephone (203) 728-6777.
- Raytheon Data Systems Company, a division of Raytheon Company**, 360 Forbes Boulevard, Mansfield, MA 02048. Telephone (617) 339-5731.
- SCI Systems, Inc.**, 5000 Technology Drive, P.O. Box 1000, Huntsville, AL 35807. Telephone (205) 882-4800.
- Sentinel Computer Corporation**, 9902 Carver Road, Cincinnati, OH 45242. Telephone (513) 984-6622.
- Sperry Univac Division, Sperry Corporation**, P.O. Box 500, Blue Bell, PA 19424. Telephone (215) 542-4011.
- STC Systems, Inc.**, Nine Brook Avenue, Maywood, NJ 07607. Telephone (201) 845-0500.
- Stratus Computer, Inc.**, 17-19 Strathmore Road, Natick, MA 01760. Telephone (617) 653-1466.
- Tandem Computers, Inc.**, 19333 Vallco Parkway, Cupertino, CA 95014. Telephone (408) 725-6000.
- Technico, Incorporated**, 9103 Red Branch Road, Columbia, MD 21045. Telephone (301) 995-1995 or (301) 596-4100.
- Texas Instruments, Incorporated**, P.O. Box 290, Austin, TX 78769. Telephone (512) 250-7305.
- The TRW-Fujitsu Company**, 9841 Airport Boulevard, Suite 620, Los Angeles, CA 90045. Telephone (213) 535-3777.
- Wang Laboratories, Inc.**, One Industrial Avenue, Lowell, MA 01851. Telephone (617) 459-5000.
- Xylogics, Inc.**, 42 Third Avenue, Burlington, MA 01803. Telephone (617) 272-8140. ➤

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	ABLE Computer 34/MAGNUM	ABLE Computer 44/MAGNUM	Accelerated Data Systems Infinity System One	Accelerated Data Systems Infinity System 100	Accelerated Data Systems Infinity System 200
MAIN STORAGE Min./Max. capacity, words or bytes	256K	4M	64K	128K	16M
NO. WORKSTATIONS CONNECTABLE	—	—	32	32	256
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	128 (SW limited) Opt.: 56K bps Std.: 9.6K bps DDCMP DECnet NA No	128 (SW limited) Opt.: 56K bps Std.: 9.6K bps DDCMP DECnet NA No	256 Optional Std.: 19.2K bps 2780/3780, SDLC Infinity Network IBM 2780/3780 No	256 Optional Std.: 19.2K bps 2780/3780, SDLC Infinity Network IBM 2780/3780 No	Unlimited 1.9K bps 1200 bps 3270, SDLC — 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	21,000 4,500 (256K) — Qty., dol. vol., ed.	27,000 4,500 (256K) — Qty., dol. vol., ed.	15,000 140 Up to 40 percent	9,900 100 Up to 40 percent	14,900 150 To 40 percent
Date of first U.S. delivery Number installed to date	October 1981 —	October 1981 —	— —	— —	1982 —
COMMENTS	DEC-embedded CPU; wide range of software and peripheral options available	DEC-embedded CPU; wide range of software and peripheral options available	MIPS time-sharing system allows easy program development from up to 32 terminals; extensive data base, virtual memory, intertask features available; large application library (G/L, A/P, A/R, etc.)	Multiprocessor redundant systems available; "Team Computer" architecture	

MANUFACTURER & MODEL	Accelerated Data Systems Infinity System 300	Accelerated Data Systems Infinity System 400	Alpha Micro AM-1030	Alpha Micro AM-1031	Alpha Micro AM-1050
MAIN STORAGE Min./Max. capacity, words or bytes	33M	33M	2M	2M	1920K
NO. WORKSTATIONS CONNECTABLE	32	32	16	16	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	256 Optional Std.: (32) 19.2K bps IBM 2780/3780 — Infinity Network IBM 2780/3780 No	256 Optional Std.: (32) 19.2K bps IBM 2780/3780 — Infinity Network IBM 2780/3780 No	24 6 std. 6 std. 2780/3780 Via AlphaLINK (Currently in devel.) (Currently in devel.)	24 6 std. 6 std. 2780/3780 Via AlphaLINK (Currently in devel.) (Currently in devel.)	24 (plus) 6 std. 6 std. 2780/3780 Via AlphaLINK (Currently in devel.) (Currently in devel.)
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	37,700 6,900 (512K) 350 Up to 40 percent	52,700 6,900 (512K) 500 Up to 40 percent	Contact vendor Contact vendor Contact vendor Contact vendor	Contact vendor Contact vendor Contact vendor Contact vendor	Contact vendor Contact vendor Contact vendor Contact vendor
Date of first U.S. delivery Number installed to date	— —	— —	June 1978 —	June 1978 —	June 1979 —
COMMENTS					

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MANUFACTURER & MODEL	Alpha Micro AM-1051	Alpha-Micro AM-1061	AM Jacquard J-100 Series 1	AM Jacquard J-100 Series 2	AM Jacquard J-100 Series 3
MAIN STORAGE Min./Max. capacity, words or bytes	2M	1M	128K	512K	512K
NO. WORKSTATIONS CONNECTABLE	16	16	16	16	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	24 (plus) 6 std. 2780/3780 Via AlphaLINK (Currently in devel.) (Currently in devel.)	26 Standard Standard 2780/3780 — —	19 Opt.; to 4800 bps Opt.; to 9600 bps See Comments Yes, PAKNET 2780/3780, Univac Yes	19 Opt.; to 4800 bps Opt.; to 9600 bps See Comments Yes, PAKNET 2780/3780, Univac Yes	19 Opt.; to 9600 bps Opt.; to 9600 bps See Comments Yes, PAKNET 2780/3780, Univac Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	Contact vendor Contact vendor Contact vendor Contact vendor	Contact vendor Contact vendor Contact vendor Contact vendor	— 2,900 3,850 GSA	— — — GSA	— — — GSA
Date of first U.S. delivery Number installed to date	June 1979 —	1981 —	August 1975 1000	June 1981 —	November 1981 —
COMMENTS	Includes the Alpha Micro Operating System (AMOS); supports RS-232-C-compatible peripherals; over 150 application programs available	See AM-1051 Comments; *streaming tape drive	Optional 150-cps printer available; protocols supported include 2780/3780, 3270, TTY; word processing software; phototypesetter int.; electronic mail; up-gradable to Series 2 or 3	See J-100 Series 1 Comments, up-gradable to Series 3	See J-100 Series 1 Comments

MANUFACTURER & MODEL	Applied Digital Communications 401	Applied Digital Data Systems (ADDS) MENTOR 4000	Applied Systems Corp. ASC/80	BBN Computer Corp. C/60	BBN Computer Corp. C/70
MAIN STORAGE Min./Max. capacity, words or bytes	256K	512K	128K	1M	2M
NO. WORKSTATIONS CONNECTABLE	16	16	16	16	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	256 Optional Optional Bisync — —	32 async, 4 sync Opt.; 19.2K bps Std.; (8) 19.2K bps 2780/3780 — 2780/3780 Yes	32 Opt.; to 50K bps Opt.; to 9600 bps ASCII/Bisync Optional Optional Optional	66 Optional Std.; to 19.2K bps ARPANET ARPANET None No	66 Optional Std.; to 19.2K bps ARPANET ARPANET None No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	— — — —	30,000-50,000 995 4,500 (128K) Contact dealer	2,900+ 150 (8K bytes) Contact vendor Contact vendor	— — — On request	— — — On request
Date of first U.S. delivery Number installed to date	1979 5	March 1981 175	1979 —	— —	— —
COMMENTS	Manufacturing and accounting software CAD systems for Numeric Control mfg. operations, NC tape verification, NC tape translation; piece part drawings with incremental plotter	Sold through authorized dealer network; *also used in medical billing, litigations support, and construction applications	Modular computer design for business and remote communications applications; multi-processing systems featuring Zilog Z80 or Z8000, Intel 8085/8086, or Motorola's 68000	UNIX-based system; user-micro-programmable; number of terminals active on system via N/W, limited only by memory available	See C/60 Comments

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MANUFACTURER & MODEL	BTI 5000	BTI 8000	Burroughs B 1855	Burroughs B 1885	Burroughs B 1955
MAIN STORAGE Min./Max. capacity, words or bytes	64K	16M	1M	1M	2M
NO. WORKSTATIONS CONNECTABLE	32	200	256	256	256
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 No Std.: to 9600 bps Async No No No	200 No Std.: to 19,200 bps Async No No No	32 Opt.: 50,000 bps Opt.: 19,200 bps 2780/3780, 360-20 BNA 2780/3780, 360-20 No	32 Opt.: 50,000 bps Opt.: 19,200 bps 2780/3780, 360-20 BNA 2780/3780, 360-20 No	32 Opt.: 50,000 bps Opt.: 19,200 bps 2780/3780, 360-20 BNA 2780/3780, 360-20 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	29,950 — 365 Quantity	57,000 16,000 (512K bytes) 827 Quantity	7,000 (262K) 2,700 — Quantity	7,000 (262K) 2,700 — Quantity	5,750 (262K) 2,700 — Quantity
Date of first U.S. delivery Number installed to date	August 1978 3000 (all models)	April 1981 —	June 1978 —	June 1978 —	March 1980 —
COMMENTS	Packaged system includes non-removable and/or pack disk drives, cartridge magnetic tape drives; reel-to-reel tape drives and line printers are standard options; up to 32 users supported; price is for minimum system (ES) configuration	Packaged system for interactive and multi-stream batch workload			

MANUFACTURER & MODEL	Burroughs B 1985	CDA Parts Handler Nova 4/X	CDA Parts Handler Eclipse Line S/140-M/600	Central Data Corp. Roloff System	Centurion 6300
MAIN STORAGE Min./Max. capacity, words or bytes	2M	256K	2M	16M	256K
NO. WORKSTATIONS CONNECTABLE	256	32	58	32	32
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 Opt.: 50,000 bps Opt.: 19,200 bps 2780/3780, 360-20 BNA 2780/3780, 360-20 Yes	33 Optional Standard 2780/3780 2780/3780, HASP No No	128 Optional Standard 2780/3780 2780/3780, HASP Yes Yes	32 Optional Standard — — — —	31 Opt.: 1,2-9.6K bps Std.: 300 bps IBM 3780 None IBM 2780/3780 No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	148,960 5,750 (256K) 2,700 Quantity	— 2,800 5,000 —	10,000 2,800 5,000 —	— — — 35%, qty. & dealer	See comments 2,400 (32K) — —
Date of first U.S. delivery Number installed to date	March 1980 —	September 1979 3	December 1980 1	November 1980 35	Fourth qtr. 1979 250 (all 6000 Series)
COMMENTS		Includes Winchester disk drive, PARTS HANDLER inventory system, Accounts Receivable and POS Billing Program	Includes Winchester disk drive, PARTS HANDLER inventory system, Accounts Receivable and POS Billing Program		Basic system includes 64K bytes, 4 ports, 10.4M-byte fixed/removable disk drive, a CRT, a 150-cps printer, for \$33,123

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MANUFACTURER & MODEL	Centurion 6400	Century Computer 400	Century Computer 700	Century Computer Century 900	Century Computer 1000
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	256K 32	256K 16	256K 20	1M 32	1M 32
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	31 Opt.: 1.2-9.6K bps Std.: 300 bps IBM 3780 None IBM 2780/3780 No	16 Opt.: 9600 bps Std.: 19,200 bps Bisync/Async — 2780/3780 Yes	20 Opt.: 9600 bps Std.: 19,200 bps Bisync/Async — 2780/3780 Yes	32 Opt.: to 9600 bps 19,200 bps — No IBM 3780 Yes, optional	32 Opt.: 9600 bps Std.: 19,200 bps Bisync/Async — 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	See comments 2,400 (32K) Set by dealers For dealers Fourth qtr. 1980 250 (all 6000 Series)	26,500 — Contact vendor OEM June 1975 —	34,000 — Contact vendor OEM June 1975 —	— — OEM June 1975 —	42,500 — Contact vendor OEM June 1975 —
COMMENTS	Basic system includes 64K bytes, 4 ports, 32M-byte fixed/removable disk drive, a CRT, a 150-cps printer, for \$41,465	Additional workstations available; complete turnkey system for gen. business, acctg., fleet mgt., credit unions, inv. control, finance, construction, school district acctg.; package works on all models	See Century Computer 400 Comments		See Century Computer 400 Comments; also available is an auto parts package, an aircraft parts package, and a word processing package

MANUFACTURER & MODEL	Century Computer X100/X200	Charles River Data Systems Universe System Model 80/82	Charles River Data Systems Universe System Model PB07/CP68	Complete Computer Systems #4016	Complete Computer Systems #4026
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	956K 32	6M 34	2M 10	1M 33	1M 33
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 Std.: 9600 bps Opt.: 19,200 bps 2780/3780 Not available 2780/3780 Yes	34 Optional Std.; to 9600 bps — — —	34 Optional Std.; to 9600 bps — — —	32 Opt.: to 9600 bps Opt.: to 9600 bps 2780/3780, SDLC Yes Yes	32 Opt.: to 9600 bps Opt.: to 9600 bps 2780/3780, SDLC Yes Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	Contact vendor — Contact vendor April 1981 93	38,500 5,450 (512K) — Quantity September 1981 —	9,600 1,825 (128K) — Quantity January 1982 —	59,595 8,000 (256K) — Turnkey & govt. 1975 —	72,000 8,000 (256K) 1,550-1,950 Turnkey & govt. 1976 —
COMMENTS	Turnkey applications for gen. business, credit unions, CPAs, order entry, inventory control, fleet mgt., school administration, and construction	*UNOS is a UNIX-Rev. 7-compatible OS; inc. 2 serial ports, 1 printer port, 80MB disk drive, 512KB floppy disk drive	Includes 2 serial ports and 1 printer port	CREATE DBMS also compatible with ROLM computer using RDDS; government installations	Property management, HMO, foundations, manufacturing, distribution, and construction

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MANUFACTURER & MODEL	Complete Computer Systems #4032	Computer Automation NAKED MINI 4 (NM 4/04)	Computer Automation NAKED MINI 4 (NM 4/10, 4/30, 4/90)	Computer Automation NAKED MINI 4 (NM 4/95)	Computer Automation SyFA 1000
MAIN STORAGE Min./Max. capacity, words or bytes	1M	128K	128K	128K	320K
NO. WORKSTATIONS CONNECTABLE	33	16	32	32	32
COMMUNICATIONS Maximum no. of lines	32	32	64	64	33
Synchronous	Opt.; to 9600 bps	Opt.; 19.2-56K bps	Opt.; 1200-56K bps	Opt.; 1200-56K bps	Opt.; 4800 bps
Asynchronous	Std.; to 9600 bps	Opt.; 300-19,200 bps	Opt.; 300-19,200 bps	Opt.; 300-19.2K bps	Opt.; 9600 bps
Protocols supported	2780/3780, SDLC	—	2780/3780, SDLC*	2780/3780, SDLC*	3780/3270 BSC
Network architecture supported	—	—	—	—	SNA PU Type 2; X.25
RJE terminals emulated	Yes	—	2780/3780 (opt.)	IBM 2780 (opt.)	3780/HASP
IBM 3270 emulation	Yes	—	—	—	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	78,735	11,500	11,500-26,800	11,500-26,800	44,630
Purchase price of memory module, \$	8,000 (256KB)	—	1,050	3,000 (128K)	6,400 (64K)
Monthly maint. price of basic system, \$	1,550-1,950	—	—	—	Not available
Discounts available	Turnkey & govt.	Yes	Yes	Yes	No
Date of first U.S. delivery	1977	1979	1977	1980	July 1975
Number installed to date	—	3500	12,500	150	1000
COMMENTS	Commercial printers, publishing, lumber distribution, textile mills; CREATE System generator and report writer	Sold to OEMs and systems houses for resale to end users with value added	Sold to OEMs and systems houses for resale to end user with value added;* HDLC also available	Sold to OEMs and systems houses for resale to end user with value added;* HDLC also available	Can operate in an IBM SNA network as a physical unit (PU) Type 2

MANUFACTURER & MODEL	Computer Automation SyFA 2000	Computer Designed Systems Adviser IV/900	Computer Designed Systems Adviser IV-3160	Computer Designed Systems Adviser IV-4240	Computer Designed Systems Adviser IV-5320
MAIN STORAGE Min./Max. capacity, words or bytes	512K	8M	192K	256K	320K
NO. WORKSTATIONS CONNECTABLE	64	128	16	24	32
COMMUNICATIONS Maximum no. of lines	65	128	16	24	32
Synchronous	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps
Asynchronous	Std.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps
Protocols supported	3780/3270 BSC	2780/3780, SNA/ SDLC, SNA (opt.)	Bisync, Async, SDLC	Bisync, Async, SDLC	Bisync, Async, SDLC
Network architecture supported	SNA PU Type 2; X.25	2780/3780	SNA/SDLC	SNA/SDLC	SNA/SDLC
RJE terminals emulated	3780/HASP	2780/3780	2780/3780	2780/3780	2780/3780
IBM 3270 emulation	Yes	Optional	Yes	Yes	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	86,250	100,000	39,700	48,900	59,900
Purchase price of memory module, \$	15,000 (256K)	18,000 (64K)	Varies	Varies	Varies
Monthly maint. price of basic system, \$	770	5,400	290	380	535
Discounts available	Not available	Quantity	Quantity	Quantity	Quantity
Date of first U.S. delivery	April 1981	November 1978	1976	1977	1977
Number installed to date	4	—	—	—	—
COMMENTS	Can operate in an IBM SNA network as a physical unit (PU) Type 2	Single source responsibility, turnkey interactive, direct processing system	Single source responsibility for hardware, software, service; pre-processors available	Single source responsibility for hardware, software, service; pre-processors available	Single source responsibility for hardware, software, service; pre-processors available

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MANUFACTURER & MODEL	Computer Hardware Inc. 2130	Computer Hardware Inc. 3230	Computer Talk Model 400	Computer Talk Model 407	Computer Talk Model 408
MAIN STORAGE Min./Max. capacity, words or bytes	4M	128K	1M	1M	1M
NO. WORKSTATIONS CONNECTABLE	32	32	256	256	256
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 async.; 4 sync. Opt.; to 4800 bps Opt.; to 9600 bps Bisync NA 2780/3780, 3741 No	32 async.; 4 sync. Opt.; to 4800 bps Opt.; to 9600 bps Bisync NA 2780/3780 No	256 Opt.; 50-9600 bps Opt.; 50-9600 bps Async, Bisync, SDLC None Most RJE terminals Yes	256 Opt.; 50-9600 bps Opt.; 50-9600 bps Async, Bisync, SDLC None Most RJE terminals Yes	256 Opt.; 50-9600 bps Opt.; 50-9600 bps Async, Bisync, SDLC None Most RJE terminals Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	Contact vendor 1,500 (16K) Contact vendor Contact vendor	Contact vendor 1,500 (16K) Contact vendor Contact vendor	32,144 6,569 (32K) Not available Volume	40,572 6,569 (32K) Not available Volume	41,474 6,569 (32K) Not available Volume
Date of first U.S. delivery Number installed to date	1974 —	1976 —	May 1975 —	January 1978 —	January 1978 —
COMMENTS	Hardware floating point available	Hardware floating point available	Storage protection std. by memory partition and opt. by page; mapping to 512K opt.; 4K PROM opt.; on low power, memory is stored on disk; price includes CRT, light pen, modem, 1.2M-byte disk, arith. & I/O processors, & battery pack operation	Expanded Model 400 with additional features; disk expanded to 30M bytes, 300-lpm x 132 printer and mini-floppy disk for I/O	Expanded Model 400 with additional features; disk expanded to 30M bytes, 300-lpm x 132 printer and mini-floppy disk for I/O

MANUFACTURER & MODEL	Convergent Technologies IWS-110	Convergent Technologies IWS-120	Data Communications Corp. DPS	Data Communications Corp. RTS	Data Communications Corp. TPS
MAIN STORAGE Min./Max. capacity, words or bytes	1M	1M	256K	32K	256K
NO. WORKSTATIONS CONNECTABLE	16	16	39	39	39
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	22 Opt.; to 9600 bps Std.; to 19,200 bps Bisync, Async CT-NET, X.25 2780/3780 Yes	22 Opt.; to 9600 bps Std.; to 19,200 bps Bisync, Async CT-NET, X.25 2780/3780 Yes	256 Opt.; to 50K bps Opt.; to 9600 bps All TNA, SNA, X.25 2780/3780 Yes	256 Opt.; to 9600 bps Opt.; to 9600 bps All TNA, SNA, X.25 2780/3780 Yes	256 Opt.; to 9600 bps Opt.; to 9600 bps All TNA, SNA, X.25 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	6,500 1,950 (128K) — OEM	10,500 1,950 (128K) — OEM	On request 8,000 (256K) — Quantity	25,000 8,000 (256K) — Quantity	85,000 8,000 (256K) — Quantity
Date of first U.S. delivery Number installed to date	1980 —	1981 —	September 1976 —	March 1977 —	— —
COMMENTS	Includes 15-in., high-resolution CRT; stand-alone or multiple IWS & AWS workstations can be connected in a local network sharing data bases & peripherals	See IWS-110 Comments	CPUs include DG Nova 3/D, DG Eclipse S130/S230/S330		CPUs include DG Nova 3/D, DG Eclipse S130/S230/S330

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MANUFACTURER & MODEL	Data Communications Corp. DCS	Data General Nova 4C	Data General Nova 4S	Data General Nova 4X	Data General Eclipse C/350
MAIN STORAGE Min./Max. capacity, words or bytes	32K	64K	64K	256K	2M
NO. WORKSTATIONS CONNECTABLE	64	64	64	64	64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	256 Opt.; to 9600 bps Opt.; to 9600 bps All TNA, SNA 2780/3780 Yes	128 Opt.; (32) 56K bps Opt.; (128) 19.2K bps Bisync., X.25 Xodiac, IBM BSC 2780/3780, HASP II No	128 Opt.; (32) 56K bps Opt.; (128) 19.2K bps Bisync., X.25 Xodiac, IBM BSC 2780/3780, HASP II No	128 Opt.; (32) 56K bps Opt.; (128) 19.2K bps Bisync., X.25 Xodiac, IBM BSC 2780/3780, HASP II No	— Opt.; 56,000 bps Opt.; 9600 bps Bisync., X.25, SNA/ X.25, SNA, Xodiac 2780/3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	50,000 8,000 (256K) — Quantity	3,500 — 47 —	6,800 — 59 —	12,000 — 82 —	59,000 6,000 (64K) 347 —
Date of first U.S. delivery Number installed to date	March 1977 —	1979 40,000 (all Nova models)	1979 40,000 (all Nova models)	1979 40,000 (all Nova Models)	October 1978 —
COMMENTS					Standard features include extended floating-point functions, and a commercial instruction set; a 10MB/second Burst Multiplexer Channel is optional

MANUFACTURER & MODEL	Data General Eclipse M/600	Data General Eclipse S/130	Data General Eclipse S/140	Data General Eclipse S/250	Data General Eclipse MV/6000
MAIN STORAGE Min./Max. capacity, words or bytes	2M	1M	1M	2M	2M
NO. WORKSTATIONS CONNECTABLE	64	64	64	64	128
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	— Opt.; 56,000 bps Opt.; 9600 bps Bisync., X.25 SNA/SDLC, Xodiac 2780/3780, HASP Yes	— Opt.; 56,000 bps Opt.; 9600 bps Bisync., X.25 X.25 2780/3780, HASP Yes	— Opt.; 56,000 bps Opt.; 9600 bps Bisync., X.25 X.25 2780/3780, HASP Yes	— Opt.; 56,000 bps Opt.; 9600 bps Bisync., X.25 X.25 2780/3780, HASP Yes	64 Up to 56,000 bps Up to 9600 bps BSC, X.25, SNA/SDLC Xodiac, X.25, SNA 2780/3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	99,300 6,000 (64K) 520 —	14,715 5,000 (128K) 155 —	19,400 5,250 (128K) 125 —	40,000 5,000 (128K) 300 —	87,000 14,000 (512K) 395 —
Date of first U.S. delivery Number installed to date	April 1978 —	March 1977 —	November 1979 —	August 1978 —	1981 —
COMMENTS	Includes I/O processor with 64KB for handling low-speed character-oriented data movement; a 10MB/second Burst Multiplexer channel is optional; supports a variety of data base management systems and the AZ-TEXT WP package	256 56-bit words of Writable Control Storage (VCS) optionally available; 1K of user control storage, character instruction set, firm-ware FPU, and hard-ware FPU are also optionally available	Options include firm-ware FPU, hardware FPU, character instruction set, and Burst Multiplexer Channel	Options include a high-speed Burst Multiplexer Channel (BMC), an Integral Array Processor, a Character Instruction Set, and a Writable or Fixed User Control Storage	Uses a compatible superset of the 16-bit Eclipse instruction set

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MANUFACTURER & MODEL	Data General Eclipse MV/8000	Datapoint 6600	Datapoint 8800	Digital Equipment Datasytem 522	Digital Equipment Datasytem 528
MAIN STORAGE Min./Max. capacity, words or bytes	4M	256K	1M	768K	1M
NO. WORKSTATIONS CONNECTABLE	128	24	24	16	16
COMMUNICATIONS Maximum no. of lines	128	24	24	—	—
Synchronous	Up to 56,000 bps	Opt.; to 9600 bps	Opt.; to 9600 bps	No	No
Asynchronous	Up to 9600 bps	Opt.; to 9600 bps	Opt.; to 9600 bps	Yes	Yes
Protocols supported	BSC, X.25, SNA/SDLC	Async, Bisync	Async, Bisync	2780/3780	2780/3780
Network architecture supported	X.25, SNA, Xodiac	ARC	ARC	DECnet	DECnet
RJE terminals emulated	2780/3780, HASP	2780/3780, HASP	2780/3780	2780/3780	2780/3780
IBM 3270 emulation	Yes	Yes	Yes	No	No
PRICING & AVAILABILITY Purchase price of basic system, \$	166,860	—	—	46,700	65,700
Purchase price of memory module, \$	8,500 (256K)	—	—	—	—
Monthly maint. price of basic system, \$	766	—	—	270	426
Discounts available	—	OEM	OEM	OEM and volume	OEM and volume
Date of first U.S. delivery	October 1980	July 1976	December 1980	1981	1981
Number installed to date	—	—	1500	—	—
COMMENTS	Uses a compatible superset of the 16-bit Eclipse instruction set	*Also supports the AIM file access method	*Also supports the AIM file access method	*Requires the Physical Address Extension memory module; includes the CTS-500 operating system	See Datasytem 522 Comments

MANUFACTURER & MODEL	Digital Equipment Datasytem 532	Digital Equipment Datasytem 538	Digital Equipment Datasytem 546	Digital Equipment PDP-11/24	Digital Equipment PDP-11/34A
MAIN STORAGE Min./Max. capacity, words or bytes	256K	256K	1M	1M	124K
NO. WORKSTATIONS CONNECTABLE	16	16	16	—	—
COMMUNICATIONS Maximum no. of lines	—	—	—	—	—
Synchronous	No	No	No	Up to 1M bps	Up to 1M bps
Asynchronous	Yes	Yes	Yes	Up to 9600 bps	Up to 9600 bps
Protocols supported	2780/3780	2780/3780	2780/3780	DDCMP, DNA	DDCMP, DNA
Network architecture supported	DECnet	DECnet	DECnet	DECnet	DECnet
RJE terminals emulated	2780/3780	2780/3780	2780/3780	IBM, CDC, Univac	Control Data, Univac
IBM 3270 emulation	No	No	No	—	—
PRICING & AVAILABILITY Purchase price of basic system, \$	50,300	72,500	91,200	See comments	13,800
Purchase price of memory module, \$	—	—	—	—	2,200 (32K)
Monthly maint. price of basic system, \$	287	440	409	—	94
Discounts available	OEM and volume	OEM and volume	OEM and volume	Contact vendor	Quantity
Date of first U.S. delivery	1981	1981	1981	3rd qtr. 1981	March 1976
Number installed to date	—	—	—	—	Over 750
COMMENTS	Includes the CTS-500 operating system	Includes the CTS-500 operating system	*Requires the Physical Address extension memory module; includes the CTS-500 operating system	\$11,000 for 5.25-in. mounting box with 28KB; \$12,500 or 5.25-in. mounting box with 256KB; \$15,000 for 10.5-in. mounting box with 256KB	Uses similar technology to PDP-11/04; includes memory management for greater addressing capability; packaged version called Data-system 530 is also available

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Digital Equipment PDP-11/44	Digital Equipment PDP-11/70	Digital Equipment VAX-11/750	Digital Equipment VAX-11/780	Digital Scientific 5020
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	1M — — Up to 1M bps Up to 9600 bps DDCMP, DNA DECnet Control Data, Univac — 31,800 6,000 (256K) 150 Quantity June 1980 — Optional CIS processor & 1M-byte memory increment (\$20,000) available; enhanced main-table features and an intelligent console subsystem	1M — — Up to 1M bps Up to 9600 bps DDCMP, DNA DECnet Control Data, Univac — 89,500 — 361 Quantity — — Uses same technology as PDP-11/45 and includes 2048 bytes of cache memory for increased performance; disk storage & mag tape peiphs. avail. in packaged system called Datasystem 570; includes an LA DECwriter 120	2M 80 80 Up to 1M bps Up to 9600 bps DDCMP, X.25 DNA, X.25 — — 92,600 13,800 (1M) — Quantity November 1980 — Uses gate array technology; 488 logic gates per chip	12M 112 112 Up to 1M bps Up to 9600 bps DDCMP, X.25 DNA, X.25 — — 219,000 7,700 (256K) 1,339 Quantity February 1978 2000+ High-performance floating-point accelerator is optional	64K 32 96 (adapter) Opt.; to 9600 bps Opt.; to 19,200 bps Bisync, SDLC, HDLC SNA 2780/3780, 3741 Optional 24,500 2,500 (32K) 222 Quantity — — Accommodates up to 32 concurrent users in a mixed conversational and batch mode; expandable to Model 5030

MANUFACTURER & MODEL	Digital Scientific 5030	Digital Systems Galaxy/3	Digital Systems Galaxy/5	Dimis, Inc. Total 100 (10)	Dimis, Inc. Total 100 (30)
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	16M 48+ 96 (adapter) Opt.; to 56K bps Opt.; to 19.2K bps Bisync, SDLC HDLC, X.25, SNA 2780/3780, 3741 Optional 39,600 8,800 (128K) 433 Yes June 1980 — Accommodates 48+ concurrent users in a mixed conversational and batch mode; attached processor available	128K 15 15 CPU to mux.* Mux. to CRT* 2741, SDLC, program. Galaxy to Galaxy None No 49,900 3,400 (32K) 650 Yes February 1980 3 Sys. includes CPU, 5 comm. ports, 32-meg. drive, 300-lpm printer; Galaxy integrated word processing system available in June 1982; *transmission speed of 9600 bps	1M 300+ 300 CPU to mux.* Mux. to CRT* 2741, SDLC, program. Galaxy to Galaxy None No 89,900 6,200 (64K) 640 Yes August 1976 25 Sys. includes CPU, 15 comm. ports, two 80-meg. drives, one CRT, one 600-lpm printer; Galaxy integrated word processing system available in June 1982; *trans. speed of 9600 bps	128K 27 32 Optional Std.; to 9600 bps Programmable — No No 209,300 — 1,075 — September 1980 6 3 CRTs & 1 MTU std.; package includes staff and management training and conversion support	512K 50 32 Optional Std.; to 9600 bps Programmable — No No 276,700 — 1,475 — June 1974 25* 6 CRTs & 1 MTU std.; package includes staff and mgmt. training and conversion support; *includes compatible Modcomp II

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Dimis, Inc. Total 100 (70)	Display Data Corporation in*sight	Distribution Management Systems BS 11/44	Distribution Management Systems BS 11/70	Distribution Management Systems BS 11/750
MAIN STORAGE Min./Max. capacity, words or bytes	4M	128K	1M	4M	2M
NO. WORKSTATIONS CONNECTABLE	50	18	64	64	64
COMMUNICATIONS Maximum no. of lines	32	32	64	64	64
Synchronous	Optional	No	Standard	Standard	Standard
Asynchronous	Std.; to 9600 bps	Std.; to 9600 bps	Standard	Standard	Standard
Protocols supported	Programmable	ANSI std. Async	Various	Various	Various
Network architecture supported	—	None	Yes	Yes	Yes
RJE terminals emulated	No	None	2780/3780	2780/3780	2780/3780
IBM 3270 emulation	No	No	Yes	Yes	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	276,700	29,700	150,000	197,000	200,000
Purchase price of memory module, \$	—	4,000 (64K)	8,900 (512K)	10,200 (512K)	—
Monthly maint. price of basic system, \$	1,475	274	990	1,291	1,530
Discounts available	—	Quantity	Quantity	Quantity	Quantity
Date of first U.S. delivery	December 1978	1974	December 1980	April 1979	June 1981
Number installed to date	19	1300	5	8	2
COMMENTS	10 CRTs and 2 MTUs std.; package includes staff and mgmt. training and conversion support				

MANUFACTURER & MODEL	Distribution Management Systems BS 11/780	Evolution Computer Systems 240	Evolution Computer Systems 260	Evolution Computer Systems 270	Evolution Computer Systems 280
MAIN STORAGE Min./Max. capacity, words or bytes	8M	256K	512K	768K	1M
NO. WORKSTATIONS CONNECTABLE	64	24	32	48	64
COMMUNICATIONS Maximum no. of lines	64	24	32	48	64
Synchronous	Standard	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps
Asynchronous	Standard	Std.; 9600 bps	Std.; 9600 bps	Std.; 9600 bps	Std.; 9600 bps
Protocols supported	Various	Async, Bisync	Async, Bisync	Async, Bisync	Async, Bisync
Network architecture supported	Yes	No	No	No	No
RJE terminals emulated	2780/3780	2780/3780	2780/3780	2780/3780	2780/3780
IBM 3270 emulation	Yes	No	No	No	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	320,000	36,390	55,190	80,420	95,940
Purchase price of memory module, \$	13,800 (1M)	—	—	—	—
Monthly maint. price of basic system, \$	2,155	320	554	—	870
Discounts available	Quantity	Dealer only	Dealer only	Dealer only	—
Date of first U.S. delivery	January 1981	December 1980	January 1977	December 1981	January 1981
Number installed to date	6	10	203	2	56
COMMENTS		"Jet" word processing optional; no extra peripherals needed	"Jet" word processing optional; no extra peripherals needed	*25-100 ips, start/ stop streaming tape drive; "Jet" word processing optional; no extra peripherals needed	"Jet" word processing optional; no extra peripherals needed

**Communications Capabilities of
Minicomputers and Small Business Computers**

MANUFACTURER & MODEL	Formation 4000 Information System	Four-Phase IV/60	Four-Phase IV/65	Four-Phase IV/70	Four-Phase IV/80
MAIN STORAGE Min./Max. capacity, words or bytes	8M	432K	480K	—	480K
NO. WORKSTATIONS CONNECTABLE	96	16	24	32	32
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	100 Opt.; 19.2K bps Opt.; up to 9600 bps Async, Bisync, SDLC IBM SNA, Ethernet 2780/3780, HASP Yes	16 Opt.; 9600 bps Opt.; 9600 bps 2780/3780, HASP SNA 2780/3780, HASP Yes	16 9600 bps 9600 bps 2780/3780, HASP, SNA 2780/3780, HASP Yes	16 Up to 9600 bps Up to 2400 bps Async, Bisync SNA/SDLC 2780/3780, HASP Yes	16 Opt.; 9600 bps Opt.; 9600 bps 2780, 3780, SDLC SDLC, SNA 2780/3780/3770 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	45,500 3,000 (256K) 162 Quantity	109,170 (192K) — — —	131,480 (192K) — — —	149,620 (96K bytes) — — —	217,175 (480K) — — Contact vendor
Date of first U.S. delivery Number installed to date	August 1980 26	June 1979 13,000 (all sys.)	June 1979 13,000 (all sys.)	February 1972 13,000 (all sys.)	August 1981 13,000 (all sys.)
COMMENTS	IBM/370 software-compatible with Full Failsoft architecture remote opt.	Price also includes 16 CRTs, a 5-megabyte disk drive, a 120-lpm printer, and a bisync communications controller	Price also includes 13 CRTs, a 5-megabyte disk drive, a 300-lpm printer, and a SDLC communications controller	Price also includes 17 CRTs, a 67.5MB disk drive, a 9-track mag. tape drive, a 300-lpm printer, and a bisync communications controller	Price also includes 15 CRTs, a 40MB disk drive, a card reader, a 430-lpm printer, and an SDLC communications controller

MANUFACTURER & MODEL	Four-Phase IV/90	Four-Phase IV/95	Geac 6000 (6020)	Geac 6000 (6040)	Geac 8000
MAIN STORAGE Min./Max. capacity, words or bytes	480K	768K	640K	1M	2M
NO. WORKSTATIONS CONNECTABLE	32	32	—	—	—
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	16 Up to 9600 bps Up to 9600 bps Bisync, Async SNA/SDLC 2780/3780, HASP Yes	16 Opt.; 9600 bps Opt.; 9600 bps 2780, 3780, SDLC, SDLC, SNA 2780/3780/3770 Yes	23 (multidrop) Optional Opt.; 9600 bps Async, 3780 Datapac, HDLC* 2780/3780 Yes	63 (multidrop) Optional Opt.; 9600 bps Async, 3780 Datapac, HDLC* 2780/3780 Yes	63 (multidrop) Optional Opt.; 9600 bps Async, 3780 Datapac, HDLC* 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	163,535 — — —	241,075 — — —	59,500 3,825 (128K) 540 OEM volume	59,500 3,825 (128K) 540 OEM volume	104,480 3,825 (128K) 730 OEM volume
Date of first U.S. delivery Number installed to date	July 1977 13,000 (all sys.)	July 1981 13,000 (all sys.)	July 1980 48	July 1980 48	February 1978 80
COMMENTS	Price also includes 10 CRTs, a 67.5MB disk drive, a 2.5MB drive, a 300-lpm printer, and a bisync communications controller	Price also includes 19 CRTs, a 135MB disk drive, a 55-cps printer, a 600-lpm printer, and an SDLC communications controller	*SDLC and X.25 networks also supported	Full support of redundant and linked systems. *SDLC and X.25 networks also supported	*SDLC and X.25 networks are also supported

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	General Automation Solution Series GA-16/240	General Automation Solution Series GA-16/250	General Automation Solution Series GA-16/440	General Automation Solution Series GA-16/460	General Automation Solution Series GA-16/470
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	512K 16	512K 16	2M 16	2M 16	128K 16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	See Comments Opt.; to 9600 bps Opt.; to 9600 bps 2780/3780, SDLC AUTONET 2780/3780, HASP Yes	See Comments Opt.; to 9600 bps Opt.; to 9600 bps 2780/3780, SDLC AUTONET 2780/3780, HASP Yes	See Comments Opt.; to 9600 bps Opt.; to 9600 bps 2780/3780, SDLC AUTONET 2780/3780, HASP Yes	See Comments Opt.; to 9600 bps Opt.; to 9600 bps 2780/3780, SDLC AUTONET 2780/3780, HASP Yes	See Comments Opt.; to 9600 bps Opt.; to 9600 bps 2780/3780, SDLC AUTONET 2780/3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	9,000 3,250 (128KB) 126 Quantity, 5-40% May 1980 200	Contact vendor Contact vendor Contact vendor Quantity, 5-40% 1982 —	12,000 4,000 (32K Core) 108 Quantity, 5-40% June 1975 1800	15,000 3,500 (64KB), 6,250 134 Quantity, 5-40% May 1978 870	16,000 — 131 Quantity, 5-40% August 1980 180
COMMENTS	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds; features 14 I/O slots	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds

MANUFACTURER & MODEL	General Automation Solution Series GA-16/480	Gould Inc., S.E.L. 32/27	Gould Inc., S.E.L. 32/30A	Gould, Inc., S.E.L. 32/57	Gould, Inc., S.E.L. 32/75
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	2M 16	16M 96	16M 96	16M 96	16M 96
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	See Comments Opt.; to 9600 bps Opt.; to 9600 bps 2780/3780, SDLC AUTONET 2780/3780, HASP Yes	— Opt.; to 9600 bps Std.; 19.2K bps Bisync, HDLC, SDLC HASP —	— Opt.; to 9600 bps Std.; 9600 bps Bisync, HDLC, SDLC HASP —	— Opt.; to 9600 bps Std.; 9600 bps Bisync, HDLC, SDLC HASP —	— Opt.; to 9600 bps Std.; 9600 bps Bisync, HDLC, SDLC HASP —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	20,500 3,250 (128KB), 7,500 168 Quantity, 5-40% August 1980 340	25,000 9,000 (256K bytes) 225 Yes March 1980 35	26,610 (128K bytes) 14,310 (256KB) 212 Yes September 1979 45	41,870 (256K bytes) 14,310 (256K bytes) 339 Yes April 1979 60	74,800 (128K bytes) 18,020 (128K bytes) 424 Yes January 1978 220
COMMENTS	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	Single vendor graphics support, tools available, RTPs	See 32/27 Comments	See 32/27 Comments	See 32/27 Comments

**Communications Capabilities of
Minicomputers and Small Business Computers**

MANUFACTURER & MODEL	Gould Inc., S.E.L. 32/77	Gould Inc., S.E.L. 32/7780	Gould Inc., S.E.L. 32/87	Gould Inc., S.E.L. VPS 3300CM	Gould Inc., S.E.L. VPS 6400CM
MAIN STORAGE Min./Max. capacity, words or bytes	16M	16M	16M	16M	16M
NO. WORKSTATIONS CONNECTABLE	96	96	96	96	96
COMMUNICATIONS Maximum no. of lines	—	—	—	—	—
Synchronous	Opt.; to 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; to 9600 bps	Opt.; to 9600 bps
Asynchronous	Std.; 9600 bps	Std.; 9600 bps	Std.; 19.2K bps	Std.; 9600 bps	Std.; 9600 bps
Protocols supported	Bisync, HDLC, SDLC	Bisync, HDLC, SDLC	Bisync, HDLC, SDLC	Bisync, HDLC, SDLC	Bisync, HDLC, SDLC
Network architecture supported	—	—	—	—	—
RJE terminals emulated	HASP	HASP	HASP	HASP	HASP
IBM 3270 emulation	—	—	—	—	—
PRICING & AVAILABILITY Purchase price of basic system, \$	49,080 (256K bytes)	84,000	235,000	96,000	146,000
Purchase price of memory module, \$	14,310 (256K bytes)	14,310 (256KB)	9,000 (256KB)	14,000 (128KB)	14,000 (128KB)
Monthly maint. price of basic system, \$	350	690	1,408	864	1,314
Discounts available	Yes	Yes	Yes	Yes	Yes
Date of first U.S. delivery	October 1978	April 1981	October 1981	—	—
Number installed to date	730 (77 Series CPUs)	730 (77 Series CPUs)	10	—	—
COMMENTS	Tools available, including symbolic debuggers, formatters, etc.; single vendor graphics support	See 32/77 Comments	See 32/77 Comments	Includes a 32/77 CPU for scalar arithmetic and a VPU for vector arithmetic	See VPS 3300CM Comments

MANUFACTURER & MODEL	Harris 80	Harris 100	Harris 300	Harris 500	Harris 800
MAIN STORAGE Min./Max. capacity, words or bytes	768K	768K	3M	3M	3M
NO. WORKSTATIONS CONNECTABLE	32	32	48	64	128
COMMUNICATIONS Maximum no. of lines	32	32	48	64	128
Synchronous	Opt.; 56K bps	Opt.; 56K bps	Opt.; 56K bps	Opt.; 56K bps	Opt.; 56K bps
Asynchronous	Opt.; 19.2K bps	Opt.; 19.2K bps	Opt.; 19.2K bps	Opt.; 19.2K bps	Opt.; 19.2K bps
Protocols supported	Async, Bisync	Async, Bisync	Async, Bisync	Async, Bisync	Async, Bisync
Network architecture supported	None	None	None	None	None
RJE terminals emulated	See Comments	See Comments	See Comments	See Comments	See Comments
IBM 3270 emulation	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	69,950	45,000	104,950	99,600	165,900
Purchase price of memory module, \$	15,300 (768KB)	15,300 (768KB)	19,700 (1.5MB)	19,700 (1.5MB)	19,700 (1.5MB)
Monthly maint. price of basic system, \$	536/429	500/400	631/505	477/382	936/749
Discounts available	—	Yes	Yes	Yes	Yes
Date of first U.S. delivery	1981	1977	1981	1979	1980
Number installed to date	—	—	—	—	—
COMMENTS	RJE terminals emulated; 2780/3780, HASP, VT-200, and U-1004	See Harris 80 Comments	See Harris 80 Comments	RJE terminals emulated; 2780/3780, HASP, UT-200, U-1004	RJE terminals emulated; 2780/3780, HASP, UT-200, U-1004

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Hewlett-Packard Data Systems Division HP 1000 E Series	Hewlett-Packard Data Systems Division HP 1000 F Series	Hewlett-Packard Data Systems Division HP 1000 L Series	Hewlett-Packard Data Systems Division HP 1000 M Series	Hewlett-Packard Computer Sys. Div. HP 3000 Ser. 40
MAIN STORAGE Min./Max. capacity, words or bytes	2M	2M	512K	2M	2M
NO. WORKSTATIONS CONNECTABLE	64	64	64	64	56
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	56 Opt.; to 19.2K bps Opt.; to 2.5M bps Bisync, Async, HDLC, DSN IBM 2780 No	56 Opt.; to 19.2K bps Opt.; to 2.5M bps Bisync, Async, HDLC, DSN IBM 2780 No	56 Opt.; to 19.2K bps Opt.; to 2M bps Async, Bisync, HDLC, DSN HDLC No	56 Opt.; to 19.2K bps Opt.; to 2.5M bps Bisync, Async, HDLC, DSN IBM 2780 No	35 Opt.; 56K bps Std.; 9600 bps SDLC, Bisync, LAP-B HP-DSN, SNA, X.25 2780/3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	9,100 (64K bytes) 4,500 (128K bytes) 74 OEM & end-user qty.	14,000 (64K bytes) 4,500 (128K bytes) 109 OEM & end-user qty.	4,450 (64K bytes) 2,800 (128K bytes) 25 OEM & end-user only	7,700 (64K bytes) 3,900 (128K bytes) 71 OEM & end-user qty.	86,615 5,250 (256KB)* 620 OEM and volume
Date of first U.S. delivery Number installed to date	November 1976 —	July 1978 —	March 1980 —	May 1974 —	November 1981 —
COMMENTS	HP1000 Model 20 & Model 40 packaged systems include E-Series; DS/1000 & DATACAP/1000 support; E-Series also available as board computer	HP1000 Model 25 & Model 45 packaged systems include F-Series; DS/1000 & DATACAP/100 support; F-Series scientific instruction set provides high performance transcendentals; optional vector instruction set provides high performance matrix operations		M-Series processor supports DS/1000, high-level networking software; factory data capture software (DATACAP/1000) supported; M-Series also available as a board computer	*\$16,000 for 1MB memory increment

MANUFACTURER & MODEL	Hewlett-Packard Computer Sys. Div. HP 3000 Ser. 40SX	Hewlett-Packard Computer Systems Division HP 3000 Ser. 64	Honeywell Series 60 Level 62	Honeywell Level 6 Model 33	Honeywell Level 6 Model 37
MAIN STORAGE Min./Max. capacity, words or bytes	2M	8M	992K	128K	1M
NO. WORKSTATIONS CONNECTABLE	56	144	744	No practical limit	No practical limit
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	35 Opt.; 56K bps Std.; 9600 bps SDLC, Bisync, LAP-B HP-DSN, SNA, X.25 2780/3780, HASP Yes	16 Opt.; 56K bps Opt.; 9600 bps Bisync, SDLC HPDSN, SNA/SDLC 2780/3780 Yes	25 Opt.; 19,200 bps Opt.; 9600 bps Bisync ISO, BSC, VIP 2780 — Yes	160 (any mixture) Opt.; 50-72,000 bps Opt.; 50-19,200 bps See Comments — 2780/3780, HASP Yes	160 Opt.; to 72K bps Opt.; to 19.2K bps H/SDLC, DSA, SNA 2780/3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	49,459 5,250 (256K)* 385 OEM and volume	164,700 (2M) 16,000 (1M) 719 Quantity, OEM	33,192 2,750 (128K) 160 Quantity	10,050 (32K) 2,250 (32K) 120 Yes	9,300 (no memory) 7,000 (256K) 76 Yes
Date of first U.S. delivery Number installed to date	February 1982 —	March 1982 8200 (all systems)	January 1979 Over 1,000	1976 —	1981 —
COMMENTS	*\$16,000 for 1MB memory increment	Highest performance HP 3000 for use in a major node in distributed processing networks; also stand-alone applications; for simultaneous transaction processing, data communications, on-line program development & batch proc.	Performance increase packages of 33, 78 or 90 percent optional	Field-upgradable to all higher models; protocols supported include Bisync, VIP, HDLC, TTY, Async, SDLC, 2780/3780, & HASP	Field-upgradable to all higher models; includes Cobol-oriented commercial instruction set, segment-based memory management and protection

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MANUFACTURER & MODEL	Honeywell Level 6 Model 43	Honeywell Level 6 Model 47	Honeywell Level 6 Model 53	Honeywell Level 6 Model 57	Honeywell DPS 6/31
MAIN STORAGE Min./Max. capacity, words or bytes	2M	2M	2M	2M	1M
NO. WORKSTATIONS CONNECTABLE	No practical limit	No practical limit	No practical limit	No practical limit	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	160 (any mixture) Opt.; 50-72,000 bps Opt.; 50-19,200 bps See Comments — 2780/3780, HASP Yes	152 (any mixture) Opt.; 50-72,000 bps Opt.; 50-19,200 bps See Comments — 2780/3780, HASP Yes	152 (any mixture) Opt.; 50-72,000 bps Opt.; 50-19,200 bps See Comments — 2780/3780, HASP Yes	144 (any mixture) Opt.; 50-72,000 bps Opt.; 50-19,200 bps See Comments — 2780/3780, HASP Yes	16 Opt.; 50-72,000 bps Std.; 50-19,200 bps HDLC* DSA, SNA HASP, 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	9,900 (no memory) 7,000 (256KB) 84 Yes 1977 —	27,000 (no memory) 7,000 (256KB) 203 Yes 1978 —	27,500 (no memory) 7,000 (256KB) 147 Yes 1978 —	43,200 (no memory) 7,000 (256KB) 315 Yes 1978 —	19,200 4,500 (256K) 2,000 (annual) Quantity 1982 —
COMMENTS	Field upgradable to all higher models; writable control store optional; protocols supported include Bisync, VIP, HDLC, TTY, Async, SDLC, 2780/3780, & HASP	Field upgradable to Model 57; writable control store optional; includes high-speed Cobol-oriented commercial instructions (decimal arithmetic, etc.); protocols supported include Bisync, VIP, HDLC, TTY, Async, SDLC, 2780/3780, & HASP	Field upgradable to Model 57; writable control store optional; includes 8K bytes of high-speed cache memory; protocols supported include Bisync, VIP, HDLC, TTY, Async, SDLC, 2780/3780, & HASP	Writable control store optional; includes Cobol-oriented high-speed commercial instructions (decimal arithmetic, etc.); includes 8K bytes of high-speed cache memory; protocols supported include Bisync, VIP, HDLC, TTY, Async, SDLC, 2780/3780 & HASP	

MANUFACTURER & MODEL	Honeywell DPS 6/38	Honeywell DPS 6/48	Honeywell DPS 6/54	Honeywell DPS 6/74	Honeywell DPS 6/76
MAIN STORAGE Min./Max. capacity, words or bytes	1M	1M	1M	1M	2M
NO. WORKSTATIONS CONNECTABLE	24	32	40	40	64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	24 Opt.; 50-72,000 bps Std.; 50-19,200 bps Async, Sync, HDLC* DSA, SNA HASP, 2780/3780 Yes	32 Opt.; 50-72,000 bps Std.; 50-19,200 bps Async, Sync, HDLC* DSA, SNA HASP, 2780/3780 Yes	40 Opt.; 50-72,000 bps Std.; 50-19,200 bps Async, Sync, HDLC* DSA, SNA HASP, 2780/3780 Yes	40 Opt.; 50-72,000 bps Std.; 50-19,200 bps Async, Sync, HDLC* DSA, SNA HASP, 2780/3780 Yes	64 Opt.; 50-72,000 bps Std.; 50-19,200 bps Async, Sync, HDLC* DSA, SNA HASP, 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	26,500 7,000 (256K) 1,720 (annual) Quantity 1981 —	32,500 7,000 (256K) 1,830 (annual) Quantity, volume 1981 —	38,500 7,000 (256K) 2,055 (annual) Quantity, volume 1981 —	65,000 7,000 (256K) 4,000 (annual) Quantity, volume 1981 —	75,000 7,000 (256K) 4,100 (annual) Quantity, volume 1981 —
COMMENTS		*Also supports SDLC, TTY, VIP, HASP, & 2780/3780; includes all DPS 6/38 features; field-upgradeable to a 32-bit system	See DPS 6/48 Comments	*Also supports SDLC, TTY, VIP, HASP & 2780/3780; includes all DPS 6/54 features, including field-upgradeability, plus 8KB cache memory	See DPS 6/74 Comments

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Honeywell DPS 6/92	Honeywell DPS 6/96	IBM Series/1 4952	IBM Series/1 4953	IBM Series/1 4955
MAIN STORAGE Min./Max. capacity, words or bytes	4M	16M	128K	64K	512K
NO. WORKSTATIONS CONNECTABLE	64	112	6	2	12
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	64 Opt.: 50-72,000 bps Std.: 50-19,200 bps Async, Sync, HDLC* DSA, SNA HASP, 2780/3780 Yes	112 Up to 72,000 bps Up to 9600 bps VIP, BSC, HDLC, SDLC DSA, SNA 2780/3780, HASP Yes	8 Opt.; to 56,000 bps Opt.; to 9600 bps Bisync, Async System/370 IBM 3780, HASP Yes	8 Opt.; to 56,000 bps Opt.; to 9600 bps Bisync, Async System/370 IBM 3780, HASP Yes	8 Opt.; to 56,000 bps Opt.; to 9600 bps Bisync, Async System/370 IBM 3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	110,000 28,000 (1M) 10,430 (annual) Quantity, volume	130,000 28,000 (1M) 10,890 (annual) —	5,060 (CPU only) 495 (32K bytes) 26.50 Contact vendor	4,800 (CPU only) 1,410 (16K bytes)* 80 Contact vendor	7,465 (CPU only) 1,160 (16K bytes)* 76.50 Contact vendor
Date of first U.S. delivery Number installed to date	1981 —	4th quarter 1981 —	February 1979 —	November 1976 —	November 1976 —
COMMENTS	*Also supports SDLC, TTY, VIP, HASP, & 2780/3780; standard fast floating-point & math functions, & 32-bit Bus with 13-megabyte per sec. transfer rate	Fully compatible with 16-bit members of DPS 6 line	Up to 256M bytes non-removable disk available	Up to 256M bytes non-removable disk available; *\$1,885 for 32KB memory increment	Up to 256M bytes non-removable disk available; *\$1,725, \$2,785, and \$3,200 for 32KB, 64KB, and 128KB memory increments, respectively

MANUFACTURER & MODEL	IBM System/34	IBM System/38	IBM 8100 Information System	ICL DRS 20	ICL System 25
MAIN STORAGE Min./Max. capacity, words or bytes	256K	2M	1M	7M	12M
NO. WORKSTATIONS CONNECTABLE	16	80	24	16	200
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	16 Opt.; to 9600 bps No SDLC, Bisync — Yes	8 Opt.; to 9600 bps Opt.; to 1200 bps Bisync Most IBM systems —	24 Std.; 600 to 9600 bps No Bisync SNA Most IBM systems Yes	16 Optional Optional BSC, SDLC, HDLC ICL IPA Yes Yes	16 Optional Optional BSC, SDLC, HDLC ICL IPA Yes Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	15,310* — 159 Education (10%)	59,210* — 358 Contact vendor	27,780 (256KB)* — 154 Contact vendor	7,500 — 72 Quantity/ISO	31,500 — 303 Quantity/ISO
Date of first U.S. delivery Number installed to date	January 1978 —	August 1980 —	August 1979 —	March 1982 —	December 1981 250 (worldwide)
COMMENTS	*Includes CPU, 32KB memory, one diskette drive and 8.6MB of disk storage	There are 114 sub-models of the System/38; *includes CPU, 512KB of memory, and 64.5MB of disk storage	*The 8140 processor-based system is available for \$59,730		*MAC (multiple access), TP (Transaction Processing) modes

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Industrial Micro Systems 5000SX	Infomark DMS-II	Infomark DMS-III	Inforex 9000	Infotecs Control Center II
MAIN STORAGE Min./Max. capacity, words or bytes	512K	256K	512K	256K	1M
NO. WORKSTATIONS CONNECTABLE	16	16	24	24	16
COMMUNICATIONS Maximum no. of lines	24	16	24	—	16
Synchronous	Optional	Opt.; 19.2K bps	Opt.; 19.2K bps	Std.; 9600 bps	Std.; 300-19,200 bps
Asynchronous	Std.; 9600-19.2K bps	Std.; 19.2K bps	Std.; 19.2K bps	Optional	Std.; 300-19,200 bps
Protocols supported	Async	2780/3780	2780/3780	2780/3780, HASP,	—
Network architecture supported	Turbodos (opt.)	—	—	ULTRANET, ARCNET	—
RJE terminals emulated	—	2780/3780	2780/3780	See Comments	—
IBM 3270 emulation	No	—	—	Yes	—
PRICING & AVAILABILITY Purchase price of basic system, \$	3,000-12,000	67,000	113,300	44,630	6,995
Purchase price of memory module, \$	—	—	—	—	—
Monthly maint. price of basic system, \$	—	—	—	800	—
Discounts available	Dealer, OEM	—	—	—	—
Date of first U.S. delivery	May 1979	1976	1976	July 1981	April 1980
Number installed to date	500	110	40	Contact vendor	Over 1000
COMMENTS	New table-top package; 5.5M-byte Winchester drive available	Basic system price includes hardware, application software installation, and training; *600- and 900-lpm printers are optional	Basic system price includes hardware, application software, installation, and training	RJE terminals emulated include 2770, 2780, 3770, 3780, RES; System 9000 is a distributed information processing system, specifically addressing distributed data entry and file management solutions for business	Programs compatible with DEC PDP-8; complete systems and software sold & serviced nationwide by Infotecs' dealers

MANUFACTURER & MODEL	MAI/Basic Four System 210	MAI/Basic Four System 310	MAI/Basic Four System 510	MAI/Basic Four System 610	MAI/Basic Four System 710
MAIN STORAGE Min./Max. capacity, words or bytes	64K	256K	256K	192K	256K
NO. WORKSTATIONS CONNECTABLE	16	16	16	16	32
COMMUNICATIONS Maximum no. of lines	16	16	16	16	32
Synchronous	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps
Asynchronous	Std.; 9600 bps	Std.; 9600 bps	Std.; 9600 bps	Std.; 9600 bps	Std.; 9600 bps
Protocols supported	Bisync	Bisync	Bisync	Bisync	Bisync
Network architecture supported	BFBIN	BFBIN	BFBIN	BFBIN	BFBIN
RJE terminals emulated	2780/3780	2780/3780	2780/3780	2780/3780	2780/3780
IBM 3270 emulation	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	25,740 (64K bytes)	55,885 (96K bytes)	50,360 (64K bytes)	51,400 (64K bytes)	69,100 (96K bytes)
Purchase price of memory module, \$	2,375 (32K bytes)	2,375 (32K bytes)	2,375 (32K bytes)	2,240 (32K bytes)	2,375 (32K bytes)
Monthly maint. price of basic system, \$	270	504	437	424	593.50
Discounts available	—	—	—	—	—
Date of first U.S. delivery	1981	1982	1980	1978	1982
Number installed to date	14,500 (all models)	14,500 (all models)	14,500 (all models)	14,500 (all models)	14,500 (all models)
COMMENTS	Price includes 64KB memory, 10MB fixed disk, 80-cps printer, 9.2MB magnetic tape cartridge drive, and one VDT	Price includes 96KB memory, 40MB fixed disk, 150-lpm printer, reel-to-reel tape drive, and 2 VDTs	Price includes 64KB memory, 20MB disk drive & pack, operating system, 120-cps printer, 1 VDT, & 9.2MB magnetic tape unit	Price includes 64KB memory, 35MB disk drive & pack, w/op. sys., 160 cps printer, and one VDT	Price includes 96KB memory, two 35MB disk drives & packs w/op. sys., 300-lpm printer, and one VDT

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MANUFACTURER & MODEL	MAI/Basic Four System 730	MCM Computers MCM/POWER	Mercator Business Systems System 5000	Microdata Reality Series 2000	Microdata Reality Series 4000
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	256K 32 32 Opt.; 9600 bps Std.; 9600 bps Bisync BFBIN 2780/3780 Yes 95,000 (96K bytes) 2,240 (32K bytes) 766 — 1978 14,500 (all models) Price includes 96KB memory, two 75MB disk drives & packs w/op. sys., 300 lpm printer, and four VDTs	64K 8 199 Opt.; 19.2K bps Opt.; to 19.2K bps Various None Various No Contact vendor Contact vendor Contact vendor Contact vendor September 1980 — MCM/POWER is a multi-user, hard-disk, upgradeable and upward compatible version of the MCM/900	1M 16 16 Optional Optional Bisync — 2780/3780 Optional 35,000 — — — January 1982 — —	64K 8 8 Opt.; to 9600 bps No Bisync — See Comments No 34,500-36,200 2,100 (16K bytes) 350-340 — December 1977 4000 (all mod.) Packaged system includes 32KB MOS memory, magnetic tape, 10MB disk drive, 165 cps printer, and 1 CRT; RJE terminals emulated include HASP, 2780/3780, 2770, 3741; *SCREENPRO	128K 32 32 Opt.; to 9600 bps No Bisync — See Comments No 42,700 2,950 (32K bytes) 350 — November 1973 4000 (all mod.) Packaged system includes 64KB MOS memory, magnetic tape, 30MB disk drive, 165 cps printer, and 1 CRT; RJE terminals emulated include HASP, 2780/3780, 2770, 3741; *SCREENPRO

MANUFACTURER & MODEL	Microdata Reality Series 6000	Microdata Reality Series 8000	Microtech Business Systems 300 Series	Microtech Business Systems 400 Series	Mitsubishi Electronics America, Inc. 8028
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	256K 32 32 Opt.; to 9600 bps No Bisync — See Comments No 52,800-67,600 2,950 (32K bytes) 395-515 — November 1973 4000 (all mod.) Packaged system includes 64KB MOS memory, magnetic tape, 48MB disk drive, 165 cps printer, and 1 CRT; RJE terminals emulated include HASP, 2780/3780, 2770, 3741; *SCREENPRO	512K 48 48 Opt.; to 9600 bps No Bisync — See Comments No 84,975-99,975 4,900 (128K bytes) 595-715 — October 1979 4000 (all mod.) Packaged system includes 256KB MOS memory, magnetic tape, 128MB disk drive, 300 lpm printer, and 2 CRTs; RJE terminals emulated include HASP, 2780/3780, 2770, 3741; PEP (Performance Enhanced Processor) provides improved CPU time; *SCREENPRO	1M 8 to 56 56 — Std.; 30-9600 bps Async None None No 11,000 (64K) 3,000 (64K), 6,300 Contact vendor Contact vendor October 1979 100 System 300 W34S, for \$23,650, includes 34MB Winchester, 1/4-in. tape drive in 29-in. enclosure with operating system; up to four 34MB or 68MB drives can be attached to system; \$26,650 for Sys. 300 W68S	1M 16 56 — Std.; 30-9600 bps Async None None No 11,000 (64K) 3,000 (64K), 6,300 Contact vendor Contact vendor May 1979 NA System 400 W158S includes 158MB Winchester, 1/4-in. tape drive in 29-in. enclosure with operating system	256K 4 32 Opt.; 1200-9600 bps Opt.; 300-9600 bps BSC, BC-1 — — No 38,000 3,800 (128K bytes) 268 — August 1980 NA —

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MANUFACTURER & MODEL	Mitsubishi Electronics America, Inc. 8038	Modular Computer Systems Inc. Classic 7810	Modular Computer Systems Inc. Classic 7820/7821	Modular Computer Systems Inc. Classic 7830/7835	Modular Computer Systems Inc. Classic 7840
MAIN STORAGE Min./Max. capacity, words or bytes	512K	128K	256K	512K	1M
NO. WORKSTATIONS CONNECTABLE	27	32	256	256	256
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 Opt.; 1200-9600 bps Opt.; 300-9600 bps BSC, BC-1 — — No	256 Opt.; 110-9600 bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 Yes	256 Opt.; 110-9600 bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 Yes	256 Opt.; 110-9600 bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 Yes	256 Opt.; 110-9600 bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	43,000 3,800 (128K bytes) 287 —	7,500 (64K) 1,180 (32K bytes) 80 —	15,900/20,900 8,000 (128K bytes) 148-165 —	25,500/31,500 8,000 (128K bytes) 164/204 —	27,800 13,000 (256K bytes) 235 —
Date of first U.S. delivery Number installed to date	November 1979 —	May 1979 —	October 1980 —	September 1979 —	October 1980 —
COMMENTS		Remote system diagnostics available on MODACS III process control system	Remote system diagnostics available on MODACS III process control system; includes TSX, time-sharing terminal executive and the INFINITY data base management system; 7820/7821 provides a 4-slot CPU chassis	Remote system diagnostics available on MODACS III process control system; includes TSX, time-sharing terminal executive and the INFINITY data base management system	See 7830/7835 Comments

MANUFACTURER & MODEL	Modular Computer Systems Inc. Classic 7860 Series	Modular Computer Systems Inc. Classic 7870	Modular Computer Systems Inc. Modcomp II	Modular Computer Systems Inc. Modcomp IV	Mylee Digital Sciences System 3000
MAIN STORAGE Min./Max. capacity, words or bytes	1M	2M	128K	1M	286K
NO. WORKSTATIONS CONNECTABLE	256	256	64	64	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	256 Opt.; 110-9600 bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET, X.25 HASP, 2780/3780 Yes	256 Opt.; 110-9600 bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET, X.25 HASP, 2780/3780 Yes	256 110-9600 bps 75-9600 bps SDLC/HDLC, Bisync MAXNET III 2780/3780, HASP —	256 110-9600 bps 75-9600 bps SDLC/HDLC, Bisync MAXNET III 2780/3780, HASP —	16 Opt.; to 9600 bps Opt.; to 1200 bps Bisync — IBM 2780/3780 No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	40,800-49,000 8,000 (128K bytes) 257-373 —	66,000 28,000 (512K bytes) 405 —	16,750 (64K bytes) 5,400 (16K bytes) — —	60,250 (IV/35-B) 22,450 (128K) 390-443 —	32,995 3,150 (96K) — —
Date of first U.S. delivery Number installed to date	April 1978 —	October 1978 —	December 1972 2600	September 1974 470	May 1976 200
COMMENTS	See 7830/7835 Comments	See 7830/7835 Comments	Three processor models; II/12, II/26, II/45	*Dual-axis structure of data path width; two models: IV/35-B and IV/35/CP-B	Total turnkey system from design to installation

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MANUFACTURER & MODEL	NCR I-9020	NCR I-9040	NCR I-9050	Nixdorf 8870/1	Nixdorf 8870/3
MAIN STORAGE Min./Max. capacity, words or bytes	512K	2M	3M	256K	512K
NO. WORKSTATIONS CONNECTABLE	24	21*	31*	16	32
COMMUNICATIONS Maximum no. of lines	24	21*	21*	Sync (2), Async (16)	Sync (2), Async (32)
Synchronous	Std.; to 9600 bps	Std.; to 9600 bps	Std.; to 19.2K bps	Opt.; to 9600 bps	Opt.; to 9600 bps
Asynchronous	Std.; to 9600 bps	Std.; to 9600 bps	Std.; to 19.2K bps	Std.; to 9600 bps	Std.; to 9600 bps
Protocols supported	Async, Bisync	Async, Bisync	Async, Bisync	Bisync, Async	Bisync, Async
Network architecture supported	—	—	—	—	—
RJE terminals emulated	2780/3780	2780/3780	2780/3780	2780, 3740, 3780	2780, 3740, 3780
IBM 3270 emulation	—	—	—	No	No
PRICING & AVAILABILITY Purchase price of basic system, \$	19,745*	36,575**	88,700**	11,500-15,500	19,400-23,400
Purchase price of memory module, \$	—	—	—	2,500 (32K bytes)	8,000 (128K)
Monthly maint. price of basic system, \$	878 (annual)	1,132 (annual)	2,377 (annual)	Contact vendor	Contact vendor
Discounts available	—	—	—	—	—
Date of first U.S. delivery	April 1981	April 1981	June 1981	1978	1980
Number installed to date	—	—	—	8000 (worldwide)	800 (worldwide)
COMMENTS	*Price includes processor, 64KB memory, cassette/cartridge interface, buffered & common trunk, 9.8MB disk storage, & 29-inch processor cabinet	*More workstations & lines can be supported with a communications multiplexer; **price includes processor, 256KB memory, & module control unit	*More workstations & lines can be supported with a multiplexer; **price includes processor, 512KB memory, & module control unit, and 45-inch processor cabinet		

MANUFACTURER & MODEL	Olivetti S6000	Perkin-Elmer 3210	Perkin-Elmer 3220	Perkin-Elmer 3230	Perkin-Elmer 3240
MAIN STORAGE Min./Max. capacity, words or bytes	1M	4M	4M	16M	16M
NO. WORKSTATIONS CONNECTABLE	24	32	32	64	32
COMMUNICATIONS Maximum no. of lines	24	63	63	63	63
Synchronous	Optional	Up to 2M bps	Up to 2M bps	Up to 2M bps	Up to 2M bps
Asynchronous	Std.; 110-19.2K bps	Up to 9600 bps	Up to 9600 bps	Up to 9600 bps	Up to 9600 bps
Protocols supported	Requires modem	SDLC, HDLC, ADCCP	SDLC, HDLC, ADCCP	SDLC, HDLC, ADCCP	SDLC, HDLC, ADCCP;
Network architecture supported	Req. prot. in mod.	MEGANET (PE X.25)	MEGANET (PE X.25)	MEGANET (PE X.25)	MEGANET (PE X.25)
RJE terminals emulated	Req. prot. in mod.	2780/3780, HASP	2780/3780, HASP	2780/3780, HASP	2780/3780, HASP
IBM 3270 emulation	—	Yes (BSC & SNA)	Yes (BSC & SNA)	Yes (BSC & SNA)	Yes (BSC & SNA)
PRICING & AVAILABILITY Purchase price of basic system, \$	21,000	See Comments	36,000 (256K bytes)	64,150 (512KB)	91,000 (256K bytes)
Purchase price of memory module, \$	2,400 (128KB)	15,900 (1M), 25,900	8,000 (256K bytes)	15,900 (1M), 25,900	8,000 (256K bytes)
Monthly maint. price of basic system, \$	227.50	480	330	430	600
Discounts available	—	Quantity, dol. vol.	Quantity	Quantity, dol. vol.	Quantity
Date of first U.S. delivery	October 1981	September 1981	May 1979	March 1981	September 1979
Number installed to date	—	100	1500	200	500
COMMENTS		Minimum system with 512KB memory & 32MB disk storage is available for \$49,900	128 32-bit general registers; optional 2K-word writable control store		128 32-bit general registers; optional 2K-word writable control store

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MANUFACTURER & MODEL	Perkin-Elmer 3250	Prime 1000	Prime 5000	Prime 150-II	Prime 250-II
MAIN STORAGE Min./Max. capacity, words or bytes	16M	8M	8M	1M	1M
NO. WORKSTATIONS CONNECTABLE	128	63	63	32	32
COMMUNICATIONS Maximum no. of lines	63	20	45	32	32
Synchronous	Up to 2M bps	—	—	—	—
Asynchronous	Up to 9600 bps	—	—	Standard	Standard
Protocols supported	SDLC, HDLC, ADCCP	HASP II, RJE, X.25	HASP II, RJE, X.25	See Comments	See Comments
Network architecture supported	MEGANET (PE X.25)	PRIMENET	PRIMENET	PRIMENET	PRIMENET
RJE terminals emulated	2780/3780, HASP	—	—	2780/3780	2780/3780
IBM 3270 emulation	Yes (BSC & SNA)	—	—	—	—
PRICING & AVAILABILITY Purchase price of basic system, \$	150,000 (2M)	118,000	296,200	54,000	65,500
Purchase price of memory module, \$	15,900 (1M), 25,900	—	—	15,000 (256K)	15,000 (256K)
Monthly maint. price of basic system, \$	882	—	—	272	368
Discounts available	Quantity, dol. vol.	—	—	Contact vendor	Contact vendor
Date of first U.S. delivery	January 1982	1979	1979	Second qtr. 1981	Second qtr. 1981
Number installed to date	50	—	—	3000 (all systems)	3000 (all systems)
COMMENTS				Protocols supported include Bisync, HASP, 2780/3780, HDLC, 200UT, Univac 1004, Honeywell GRTS, and ICL 7020	Upgradeable to Prime 550, and 750; protocols supported include Bisync, HASP, 2780/3780, HDLC, 200UT, Univac 1004, Honeywell GRTS, and ICL 7020

MANUFACTURER & MODEL	Prime 550-II	Prime 750	Prime 850	Quodata Q 521	Quodata Q 850
MAIN STORAGE Min./Max. capacity, words or bytes	4M	8M	8M	1M	1M
NO. WORKSTATIONS CONNECTABLE	64	96	128	16	64
COMMUNICATIONS Maximum no. of lines	64	96	128	32	63
Synchronous	Std.; 56K bps	Std.; 56K bps	Std.; 56K bps	Optional	Optional
Asynchronous	Std.; 9600 bps	Std.; 9600 bps	Std.; 9600 bps	Standard	Std.; to 9600 bps
Protocols supported	Async, Bisync	Async, Bisync	Async, Bisync	Bisync, SDLC	Bisync, SDLC
Network architecture supported	PRIMENET, X.25	PRIMENET, X.25	PRIMENET, X.25	DECnet	DECnet
RJE terminals emulated	HASP, 2780/3780	HASP, 2780/3780	HASP, 2780/3780	3780, HASP	3780, HASP
IBM 3270 emulation	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	89,000	154,000	295,000	—	—
Purchase price of memory module, \$	40,000 (1M)	40,000 (1M)	40,000 (1M)	—	—
Monthly maint. price of basic system, \$	499	1,049	2,065	—	—
Discounts available	—	—	—	—	—
Date of first U.S. delivery	1979	1979	1979	1979	1973
Number installed to date	3000 (all systems)	3000 (all systems)	3000 (all systems)	50	Over 50
COMMENTS	Protocols supported include Bisync, HASP, 2780/3780 HDLC, 200UT, Univac 1004, Honeywell GRITS, and ICL 7020	See 550-II Comments	See 550-II Comments	Word processing and data management available as options	See Q 990 Comments

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MANUFACTURER & MODEL	Quodata Q 990	Raytheon RDS-7500	SCI Systems, Inc. Mercury 2	SCI Systems, Inc. Mercury 3	Sentinel Computer Model 10
MAIN STORAGE Min./Max. capacity, words or bytes	8M	256K	256K	256K	1M
NO. WORKSTATIONS CONNECTABLE	200	—	32	32	17
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	63 Optional Std.; to 9600 bps Bisync, SDLC DECnet 3780, HASP Yes	128 Standard (128) Standard (128) PARS, SLC, U-100 RAYNET — — Yes	Async (16); Sync (4) Opt.; 9600 bps Std.; 9600 bps 2780/3780, SDLC — — Yes	Async (16); Sync (4) Opt.; 9600 bps Std.; 9600 bps 2780/3780, SDLC — — Yes	16 Opt.; 9600 bps Opt.; 9600 bps 2780/3780 — — Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	141,000 — — —	32,450 (64K) 6,000 (64K) 338 —	3,500 368 (32K) — Quantity	5,300 (64KB) 368 (32K) — Quantity	16,000 Contact vendor Contact vendor Contact vendor
Date of first U.S. delivery Number installed to date	1976 —	1980 Approx. 100	— —	June 1978 —	1981 150 (all models)
COMMENTS	Data management and word processing specifically designed for educational institutions, government entities, and non-profit organizations	Multiprocessing system capability	DG Nova 3-compatible; price includes 1-year warranty on parts and labor	See Mercury 2 Comments	Interactive Query and Report Writer System available for all models; *streaming tape drive

MANUFACTURER & MODEL	Sentinel Computer Model 30	Sentinel Computer Model 40	Sentinel Computer Model 50	Sentinel Computer Model 80	Sperry Univac V77-200
MAIN STORAGE Min./Max. capacity, words or bytes	1M	1M	1M	1M	64K
NO. WORKSTATIONS CONNECTABLE	17	17	17	17	128
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	16 Opt.; 9600 bps Opt.; 9600 bps 2780/3780 — — Yes	128 50K bps 9600 bps UDLC/SDLC, Bisync — — HASP + 1004 —			
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	25,300 Contact vendor Contact vendor Contact vendor	32,800 Contact vendor Contact vendor Contact vendor	41,900 Contact vendor Contact vendor Contact vendor	45,950 Contact vendor Contact vendor Contact vendor	12,495 — 1,350 (16K) —
Date of first U.S. delivery Number installed to date	1979 150 (all models)	1979 150 (all models)	1980 150 (all models)	1981 150 (all models)	— —
COMMENTS	See Model 10 Comments	See Model 10 Comments	See Model 10 Comments	See Model 10 Comments	—

Communications Capabilities of
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MANUFACTURER & MODEL	Sperry Univac V77-500	Sperry Univac V77-600	Sperry Univac V77-700	Sperry Univac V77-800	STC Systems Inc. System 4000
MAIN STORAGE Min./Max. capacity, words or bytes	1M	2M	2M	2M	64K
NO. WORKSTATIONS CONNECTABLE	128	128	128	128	3
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	128 50K bps 9600 bps UDLC/SDLC, Bisync Univac DCA HASP + 1004 SDLC/BISYNC	Unlimited Opt.; to 9600 bps Opt.; to 1200 bps Bisync — 2780/3780 Yes			
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	29,500 (128K) 9,450 (256K) — —	33,950 (32K) 2,900 (32K) — —	36,100 (256K) 9,450 (256K) — —	38,500 (256K) 9,450 (256K) — —	34,900 — 345 —
Date of first U.S. delivery Number installed to date	December 1980 —	December 1976 —	December 1980 —	July 1979 —	1973 125
COMMENTS	Price includes CRT console terminal; field-upgradeable to a V77-700 and V77-800		Price includes CRT console terminal; field-upgradeable to a V77-800		System price includes all hardware, software, installation, training, and maintenance (1 year on software, 90 days on hardware)

MANUFACTURER & MODEL	STC Systems Inc. System 5000	STC Systems Inc. System 6000	Stratus Computer STRATUS/32	Tandem Computers NonStop (T16/244-3)	Tandem Computers NonStop II
MAIN STORAGE Min./Max. capacity, words or bytes	512K	512K	16M	2M	16M
NO. WORKSTATIONS CONNECTABLE	40	40	64	No set limit	No set limit
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	Unlimited Opt.; to 9600 bps Opt.; to 1200 bps Bisync — 2780/3780 Yes	Unlimited Opt.; to 9600 bps Opt.; to 1200 bps Bisync — 2780/3780 Yes	Async (64); Sync (32)* Opt.; to 56K bps Std.; to 19.2K bps Bisync, Stratalink X.25, StrataNet 2780/3780, HASP Yes	4 (sync); 32 (asynch) Opt.; up to 56K bps Opt.; up to 19.2K bps — HYPERchannel — —	252 Opt.; 56K bps Opt.; to 19.2K bps S, M, UDLC, ADCCP HYPERchannel 2780/3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	51,000 3,800 (32K) 435 —	183,000 12,500 (128K) 1,145 —	123,350 (see com.) 10,000 (1MB) 589 —	94,975* — 726 —	— — — —
Date of first U.S. delivery Number installed to date	1974 125	1982 —	1981 —	May 1976 —	April 1981 —
COMMENTS	System price includes all hardware, software, installation, training, and maintenance (1 year on software, 90 days on hardware)	System price includes training, installation, hardware, software, and maintenance (1 year on software, 90 days on hardware)	*Per processor; includes 2 CPUs, 2 disk cont., 2 comm. cont. 2MB mem., two 30MB disks, CRT, tape, etc.	*Price includes 2 processors, 768KB memory, 13 slots, cabinet, mag. tape controller and drive, hardcopy console, and 2 battery packs	Control storage includes PROM (2K x 36 bits) and RAM (16K x 36 bits)

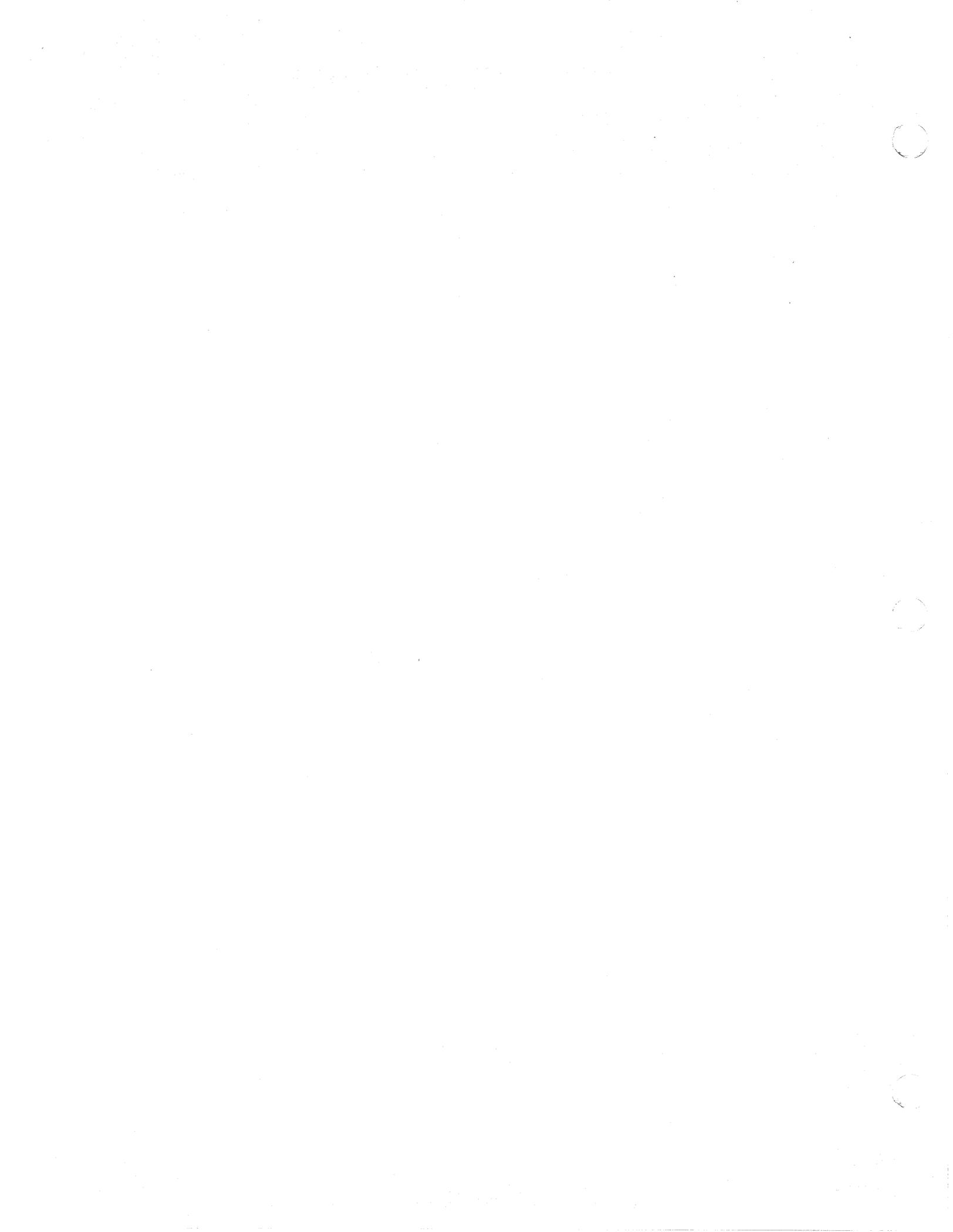
Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Technico T.I. 32-8H	Technico T.I. 32-14H	Texas Instruments DS990 Series Model 2	Texas Instruments DS990 Series Model 3	Texas Instruments DS990 Series Model 4
MAIN STORAGE Min./Max. capacity, words or bytes	256K	256K	64K	352K	2M
NO. WORKSTATIONS CONNECTABLE	18	18	1	4	8
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	18 Opt.; to 19,200 bps Opt.; to 19,200 bps Opt.; 2780/3780 Optional Optional Optional	18 Opt.; to 19,200 bps Opt.; to 19,200 bps Opt.; 2780/3780 Optional Optional Optional	Std.; 3/opt.; 16+ Std.; 9600 bps Std.; 9600 bps Bisync No 2780/3780 No	Varies Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Bisync No 2780/3780, HDLC No	Varies Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Bisync — 2780/3780, HDLC Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	16,999 Optional 1 percent OEM, 150, distrib.	19,999 Optional 1 percent OEM 150, distrib.	13,995 — 172 Yes	15,700 2,000 (64K) 212 Yes	25,950 2,000 (64K) 285 Yes
Date of first U.S. delivery Number installed to date	September 1980 50	December 1980 20	June 1979 —	1981 —	— —
COMMENTS	Multiprocessor design uses two 16-bit microprocessors; *CRT models (IBM, DEC, ADM3A, Beehive, Datamedia) may be intermixed within the same system	Multiprocessor design uses two 16-bit microprocessors; *CRT models (IBM, DEC, ADM3A, Beehive, Datamedia) may be intermixed within the same system			

MANUFACTURER & MODEL	Texas Instruments DS990 Series Model 7	Texas Instruments DS990 Series Model 8	Texas Instruments DS990 Series Model 9	Texas Instrument DS990 Series Model 20	Texas Instrument DS990 Series Model 29
MAIN STORAGE Min./Max. capacity, words or bytes	2M	2M	2M	2M	2M
NO. WORKSTATIONS CONNECTABLE	16	16	16	24	24
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	Varies Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Bisync — 2780/3780, HDLC Yes	Varies Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Async, Bisync NA 2780/3780, HDLC Yes	Varies Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Async, Bisync NA 2780/3780, HDLC Yes	Varies Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Async, Bisync NA 2780/3780 Yes	Varies Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Async, Bisync NA 2780/3780 Yes 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	37,000 2,000 (64K) 375 Quantity	45,700 2,000 (64K) 500 Quantity	38,000 2,000 (64K) 405 Quantity	65,750 3,500 (128K) 618 Quantity	63,000 3,500 (128K) 553 Quantity
Date of first U.S. delivery Number installed to date	1981 —	— —	1981 —	May 1979 —	January 1981 —
COMMENTS					

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MANUFACTURER & MODEL	Texas Instrument DS990 Series Model 30	TRW-Fujitsu TFC 8540	Wang VS 100	Xylogics XL-2300
MAIN STORAGE Min./Max. capacity, words or bytes	2M	16M	2M	4M
NO. WORKSTATIONS CONNECTABLE	24	32	128	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	Varies Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Async, Bisync NA 2780/3780 Yes	32 Opt.; 9600 bps Opt.; 9600 bps BSC, HDLC, 2770, 3270 — 2780 Yes	16 No Up to 9600 bps Bisync WANGNET 2780/3780 Yes	16 Opt.; 1200-4800 bps Std.; 110-9600 bps 2780/3780 SNA, DECnet 2780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	84,500 3,500 (128K) 663 Quantity	66,130 13,825 (768K) 270 Contact vendor	75,000 (512K) 16,000 (1M) 638 —	22,500-26,900 1,800 (64K) 187-224 Quantity, Educ.
Date of first U.S. delivery Number installed to date	May 1979 —	May 1981 NA	December 1980 —	October 1980 30
COMMENTS		Includes DBMS; price includes CPU, power supply, front panel, minimum memory in chassis, a floppy disk unit, a fixed disk unit, and a console CRT		



Communications Capabilities of Minicomputers and Small Business Computers

Dynamism and proliferation continue in the world of the small computer. We hear daily of a continual stream of new products entering the marketplace, with hardware and software that take on many names. We hear of minicomputers, small business computers, microcomputers, programmable controllers, microprogrammable data entry units, intelligent terminals, accounting machines, large-scale programmable calculators, etc. We also regularly hear of old-line peripheral device and terminal manufacturers announcing their entry into the "mini-computer business" as they add programmable logic and memory to their formerly unintelligent, hard-wired devices.

Within this vast array of offerings, one need is becoming clear, and that is the need to communicate. Virtually every currently marketed small computer system is now equipped with some sort of data communications capability, ranging from simple batch terminal emulation to sophisticated communication software and hardware packages that permit it to serve effectively as a complete communications processing product. Interfacing with mainframe equipment and/or other small computers permits these systems to perform an endless variety of communication processing functions, including front-end processing, remote concentration, message switching, network processing, and terminal control. The small computer system's internal processing and storage capabilities enable it to do some data processing locally as well as handling code translation, editing and control functions in connection with the data communications activities. Whether utilized as a dedicated communications processor or as an applications processor that performs some communications functions, a minicomputer or small business computer can be used to form a basic building block of a data communication network.

In general, the level of sophistication of the data communications capabilities of a particular system can be assessed by the variety and number of communications features—both hardware and software—it supports. Naturally, not every small system is supported for all types of functions to the same extent.

Support may be provided only for basic batch terminal communications. Remote job entry products and procedures established in the 1960's by IBM, Burroughs, Control Data, Honeywell, and Univac have become de facto standards for batch data communications and it is not uncommon on small computer systems for a vendor to provide a variety of interchangeable software packages with which the user can emulate IBM's 2780 or 3780 Data Communications Terminal or its 360/20 HASP Multileaving workstation, Burroughs' TC Series terminals, Control Data's 200 User Terminal, Honeywell's GERTS, or Univac's 1004 or DCT 2000.

More extensive communications capabilities are represented by those systems that can support multiple

Detailed specifications of the communications hardware and software offered by those small computer systems judged by Datapro as having substantial communications support. Capabilities and prices of 185 systems from 62 vendors are presented in convenient comparison chart form.

workstations, enabling the system's processor to function as an intelligent clustered terminal controller. Some systems provide emulation packages for popular interactive mainframe-produced terminals, such as the IBM 3270 Information Display System, while others leave the management of the interaction between the workstations and a remote host to be programmed by the user.

Systems that can handle multiple communication lines, support a variety of communications protocols, and serve in any of several communications capacities are available from a number of minicomputer and small business computer vendors. For example, Data General's Nova and Eclipse minicomputers have been continuously enhanced with communications hardware and software to provide for a wide range of communications applications, and can be configured as channel-attached front-end processors, remote communications concentrators, or distributed processing systems. And Digital Equipment's PDP-11 family supports virtually all modes and types of data communications protocols, and facilities, and provides over twenty different line controller and interface sets to handle local, remote and interprocessor communications.

When not available directly through the manufacturer, communications features are often added by OEMs, distributors, and similar third party organizations. And, of course, because the equipment is essentially a computer, the user can program whatever special requirements are not supported by the vendor.

The Comparison Charts

The comparison chart data presented in this report was gathered as a part of Datapro's preparation of the 1981 versions of "All About Minicomputers" and "All About Small Business Computers," which appear in DATAPRO 70, and "Minicomputer Specifications," and "Small Business Computer Specifications," which appear in DATAPRO REPORTS ON MINICOMPUTERS. As the title of the present report suggests, the broad-based information presented in the "All About..." reports has been condensed and edited, to enable us to zero in on those products which provide significant data communications features and to concentrate on just those capabilities. All models selected for inclusion in this report were judged to have substantial communications capabilities using several criteria. For example, systems to which at least 16

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▷ communications lines can be attached or that provide interprocessor communications functions under major network architectures have been included.

The resulting comparison charts can be effectively used to conduct a first-level search of minicomputers and small business computers that meet your communications requirements. For example, if you are looking for a system that can support high speed data transmission to a remote host, quickly scan the charts and jot down those vendors/models which provide the range of speeds you require. Or, if you know that your applications require a certain minimum main memory capacity for off-line processing, and you are looking for a system that can also provide support for interactive IBM 3270-type data communications, a complete list of those systems that satisfy both requirements can easily be made.

Once your search has narrowed down the manufacturers and model numbers of equipment that satisfies your needs, you may wish to know full details about the computers you've selected. If so, simply turn to the Index of this service and locate each system's detailed report, which contains complete information on the communications capabilities of the system, including our analysis of how it fits into the data processing environment from a data communications point of view and pricing details of all communications hardware and software features offered.

Whenever you seek more information on a system that is not covered in an in-depth report in DATAPRO REPORTS ON DATA COMMUNICATIONS, please contact us directly via the Inquiry Service and get the facts you need by telephone or mail. (This service is fully described behind the Inquiry Service index tab.)

Comparison Chart Entries

The accompanying comparison charts summarize the key characteristics of the data communications functions of 185 commercially available minicomputers and small business computers from 62 vendors. The information presented in the charts was supplied by the manufacturers and suppliers during December 1980 and January 1981. The cooperation of the vendors who provided this information to the Datapro staff for these reports is gratefully acknowledged.

Main Storage

Our comparison charts show the amount of main storage available for each computer in terms of the *minimum capacity* and *maximum capacity*, expressed in words or bytes.

The amount of internal storage is one of the most significant characteristics in appraising the power of any computer. The amount of productive processing that a computer can perform during any one run is largely determined by the number of instructions and/or operands it can hold. It is important to choose the right

storage capacity; for nonmultiprogramming systems, that usually means enough storage to hold your largest program and all associated subroutines and data, but not too much more than that. It's also wise to make sure that your computer's main storage capacity can be expanded if necessary, preferably by simply plugging in an additional storage module.

Number of Workstations Connectable

Another very important consideration for many users who are considering the acquisition of a minicomputer or small business computer for use in a communications processing environment is the number of workstations it can support. Workstations, in this case, can mean most any type of device, whether remotely or locally connected, that can input and/or receive data from the minicomputer or small business computer. When the system is used in a business environment, for instance, the workstation would normally be a data processing device or terminal, but in a manufacturing or distribution environment the workstation could be a sensor or transmission unit that simply transmits signals back to the system for processing.

Communications Capabilities

Maximum no. of lines indicates how many communications lines can be physically connected to a particular system. The types of lines are specified in the next two entries. The entries in these three categories represent the raw outer limits of line number, type, and speed provided by each system.

To utilize this information properly, the reader must take into consideration two important factors. First, the line mix (the number of lines of each type and speed) and the resource mix (the number and type of workstations, peripherals, and other facilities) determine the actual practical limits of the system. For example, the number of high speed communications lines that are physically attachable to a processor is generally much less than the number of low or medium speed lines. Secondly, the throughput capabilities of the system vary radically, depending not only on the physical configuration of the hardware but also on the system's software requirements. Even if the system is configured within recommended physical bounds, a heavy processing load can reduce throughput to below an acceptable level.

Synchronous and *asynchronous* have entries of standard, optional, or no, indicating their availability, and also a notation as to the speed of each line in bits per second (bps). Most entries are of the type "to 4800 bps," indicating one or more lines supporting transmission up to a maximum of 4800 bps.

Protocols supported indicates the type of communication protocols accommodated by hardware and software for the model.

Network architecture supported indicates the communications network architecture support by this model. Entries ▷

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▷ may include, for example, Burroughs BNA, DEC's DECnet, or IBM's SNA.

RJE terminals emulated indicates whether there is software available from the vendor for this system to enable it to function as a "look-alike" for remote job entry terminals. The terminals for which support is provided are indicated.

IBM 3270 emulation is listed as a separate entry as a result of an increasing amount of interest from our users concerning the emulation of the IBM 3270 Information Display System.

Pricing and Availability

Purchase price of basic system shows the minimum purchase price of the system. In the case of a system in which each component is sold as a separate item, the comparison chart shows the price of the CPU, power supply, front panel, and minimum memory in the chassis. In the case of a packaged system, the price includes all standard components and facilities of the entry-level model. For many of the systems listed, itemized pricing, including all communications hardware and software features, is provided in the system's detailed report, which you can find using the Index of this service. If the system is not covered in an in-depth report, detailed pricing can be obtained through the Datapro Inquiry Service or directly from the vendor.

Purchase price of memory module stipulates the costs of various sizes (when available) of memory increments, with the actual sizes in parentheses.

Monthly maintenance price of basic system shows the maintenance costs of the basic system as described above.

If you'll need two or more systems, it's worth noting that some of the manufacturers offer sizeable discounts from their list prices on orders for multiple computers. Discounts of up to 40 percent are not unusual on large orders. *Discounts available* indicates the types of discounts offered by the vendor for each model. This entry will vary by model for many manufacturers with multiple lines of systems.

Date of first U.S. delivery tells when the first production models of each system were delivered (or are scheduled to be delivered) to customers in the United States.

Number installed to date shows how many systems of each type had been delivered to customers as of approximately December, 1980. Nearly all of the figures were supplied by the manufacturers themselves, and a number of companies chose not to release this information.

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, or applications.

Suppliers

Listed below, for your convenience in obtaining additional information, are the full names, addresses, and telephone numbers of the 62 suppliers whose products are listed in the comparison charts that follow.

Alpha Micro, 17881 Sky Park North, P.O. Box 18347, Irvine, California 92713. Telephone (714) 957-1404.

AM Jacquard Systems, Executive Branch, 3340 Ocean Park Boulevard, Santa Monica, California 90405. Telephone (213) 450-1242.

Applied Digital Communications, 214 Flynn Avenue, Moorestown, New Jersey 08057. Telephone (609) 234-3666.

Applied Digital Data Systems (ADDS), 100 Marcus Boulevard, Hauppauge, New York 11787. Telephone (516) 231-5400.

Applied Systems Corporation, 26401 Harper Avenue, St. Clair Shores, Michigan 48081. Telephone (313) 779-8700.

Basic/Four Corporation, 14101 Myford Road, Tustin, California 92680. Telephone (714) 731-5100.

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

Burroughs Corporation, Burroughs Place, Detroit, Michigan 48232. Telephone (313) 972-7000.

Business Controls Corporation, 507 Boulevard, Elmwood Park, New Jersey 07407. Telephone (201) 791-7661.

CDA (Computer Data Access), Inc., 1373 Broad Street, Clinton, New Jersey 07011. Telephone (201) 473-4700.

Centurion Computer Corporation, (formerly Warrex Computer Corporation), 1780 Jay Ell Drive, Richardson, Texas 75081. Telephone (214) 699-8400.

Century Computer Corporation, Spring Valley Business Center, 4410 Spring Valley Road, Dallas, Texas 75240. Telephone (214) 233-3238.

Complete Computer Systems, 159 Gibraltar Road, Horsham, Pennsylvania 19044. Telephone (215) 441-4200.

Computer Automation, Inc., 18651 Von Karman Irvine, California 92713. Telephone (714) 833-8830.

Computer Designed Systems, Inc., 8085 Wayzata Boulevard, Minneapolis, Minnesota 55426. Telephone (612) 545-2855.

Computer Hardware, Inc., 4111 North Freeway Boulevard, Sacramento, California 95834. Telephone (916) 929-2020.

Computer Talk Inc., P.O. Box 100, Idledale, Colorado 80453. Telephone (303) 697-5485.

Data Communications Corporation, 3000 Directors Row, Memphis, Tennessee 38131. Telephone (901) 345-3544.

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

Datapoint Corporation, 9725 Datapoint Drive, San Antonio, Texas 78284. Telephone (512) 690-7000. ▷

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- ▷ **Digital Equipment Corporation**, 129 Parker Street, Maynard, Massachusetts 01754. Telephone (617) 897-5111.
- Digital Scientific Corporation**, 11455 Sorrento Valley Road, San Diego, California 92121. Telephone (714) 453-6050.
- Digital Systems Corporation**, P.O. Box 158, Walkersville, Maryland 21793. Telephone (301) 845-4141.
- Dimis, Incorporated**, 1060 Highway 35, Middletown, New Jersey 07748. Telephone (201) 671-1011.
- Display Data Corporation**, Executive Plaza IV, Hunt Valley, Maryland 21031. Telephone (301) 667-9211.
- Distribution Management Systems Inc.**, 11 De Angelo Drive, Bedford, Massachusetts 01730. Telephone (617) 275-2000.
- Evolution Computer Systems Corporation**, 17911 Sky Park Circle, Suite E, Irvine, CA 92714. Telephone (714) 979-6663.
- Four-Phase Systems, Inc.**, 10700 North De Anza Boulevard, Cupertino, California 95014. Telephone (408) 255-0900.
- Functional Automation, Inc.**, 3 Graham Drive, Nashua, New Hampshire 03060. Telephone (603) 888-1905.
- General Automation Corporation**, 1055 S. East Street, Anaheim, California 92805. Telephone (714) 778-4800.
- Harris Corporation, Computer Systems Division**, 2101 West Cypress Creek Road, Fort Lauderdale, Florida 33309. Telephone (305) 974-1700.
- Hewlett-Packard, GSD Division**, 19420 Homestead, Cupertino, California 95014. Telephone (408) 725-8111.
- Hewlett-Packard, Data Systems Division**, 11000 Wolfe Road, Cupertino, California 95014. Telephone (408) 257-7000.
- Honeywell Information Systems, Inc.**, 200 Smith Street, Waltham, Massachusetts 01821. Telephone (617) 890-8400.
- IBM Corporation, General Systems Division**, P.O. Box 2150, Atlanta, Georgia 30301. Telephone (404) 238-2000.
- Industrial Micro Systems, Inc.**, 628 N. Eckhoff Street, Orange, California 92668. Telephone (714) 978-6966.
- Infomark, Inc.**, 9 North Bacton Hill Road, Frayer, Pennsylvania 19355. Telephone (215) 647-8685.
- Infotecs Computer Systems**, One Perimeter Road, Manchester, New Hampshire 03103. Telephone (603) 624-2700.
- Lazor Systems, Inc.**, 1050 E. Duane Avenue, Sunnyvale, California 94086. Telephone (408) 735-1188.
- Logical Machine Corporation**, 1294 Hammerwood Avenue, Sunnyvale, California 94086. Telephone (408) 744-1290.
- MCM Computers Ltd.**, 6700 Finch Avenue, Suite 600, Rexdale, Ontario M9W 5P5. Telephone (416) 675-1353.
- Microdata Corporation**, 17481 Red Hill Avenue, Irvine, California 92805. Telephone (714) 540-6730.
- Microtech Business Systems**, 3176 Pullman Street, Suite 108, Costa Mesa, California 92626. Telephone (714) 557-8640.
- Mitsubishi Electronics America, Inc.** (formerly Melcom Business Systems, Inc.), 2200 W. Artesia Boulevard, Compton, California 90220. Telephone (213) 979-6055.
- Modular Computer Systems, Inc.**, 1650 West McNab Road, Fort Lauderdale, Florida 33310. Telephone (305) 974-1380.
- Mylee Digital Sciences, Inc.**, 155 Weldon Parkway, Maryland Heights, Missouri 63043. Telephone (314) 567-3420.
- NCR Corporation**, Main and K Streets, Dayton, Ohio 45479. Telephone (513) 449-2000.
- New England Digital Corporation**, P.O. Box 305, Norwich, Vermont 05055. Telephone (802) 649-5183.
- Nixdorf Computer Inc.**, 168 Middlesex Turnpike, Burlington, Massachusetts 01803. Telephone (617) 273-0480.
- Omnicdata**, 5717 Corsa Avenue, Westlake Village, California 91361. Telephone (213) 991-5810.
- Point 4 Computer Corporation**, 2569 McCabe Way, Irvine, California 92714. Telephone (714) 754-4114.
- Prime Computer Inc.**, Prime Park, Natick, Massachusetts 01760. Telephone (617) 655-8000.
- Quodata Corporation**, 196 Trumbull Street, Hartford, Connecticut 06103. Telephone (203) 728-6777.
- Raytheon Data Systems Company**, 360 Forbes Boulevard, Mansfield, Massachusetts 02048. Telephone (617) 339-5731.
- Rolm Corporation**, 4900 Old Ironsides Drive, Santa Clara, California 95050. Telephone (408) 988-2900.
- Sperry Rand Corporation, Sperry Univac Division**, P.O. Box 500, Blue Bell, Pennsylvania 19424. Telephone (215) 542-4011.
- STC Systems, Inc.**, Nine Brook Avenue, Maywood, New Jersey 07607. Telephone (201) 845-0500.
- Stratmar Business Solutions Corporation**, 385 Madison Avenue, New York, New York 10017. Telephone (212) 838-1155.
- Tandem Computers, Inc.**, 19333 Vallico Parkway, Cupertino, California 95014. Telephone (408) 725-6000.
- Technico, Incorporated**, 9057 Red Branch Road, Columbia, Maryland 21045. Telephone (301) 995-1995.
- Texas Instruments, Incorporated**, P.O. Box 290, Austin, Texas 78769. Telephone (512) 250-7305.
- The Ultimate Corporation**, 77 Brant Avenue, Clark, New Jersey 07066. Telephone (201) 388-8800. □

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MANUFACTURER & MODEL	Alpha Micro AM-1030	Alpha Micro AM-1031	Alpha Micro AM-1050	Alpha Micro AM-1051	AM Jacquard J-100
MAIN STORAGE Min./Max. capacity, words or bytes	64K/2048K bytes	64K/2048K bytes	64K/1920K bytes	64K/1920K bytes	96K/128K words
NO. WORKSTATIONS CONNECTABLE	24	24	24	24	14
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	24 6 std. 6 std. 2780/3780 Via AlphaLINK (Currently in devel.) (Currently in devel.)	24 6 std. 6 std. 2780/3780 Via AlphaLINK (Currently in devel.) (Currently in devel.)	24 (plus) 6 std. 6 std. 2780/3780 Via AlphaLINK (Currently in devel.) (Currently in devel.)	24 (plus) 6 std. 6 std. 2780/3780 Via AlphaLINK (Currently in devel.) (Currently in devel.)	19 Opt.; to 4800 bps Opt.; to 9600 bps Async, Bisync, TTY None 2780/3780, Univac Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	Contact vendor Contact vendor Contact vendor Contact vendor	Contact vendor Contact vendor Contact vendor Contact vendor	Contact vendor Contact vendor Contact vendor Contact vendor	Contact vendor Contact vendor Contact vendor Contact vendor	19,900 2,100 (32K) 172 GSA
Date of first U.S. delivery Number installed to date	June 1978 NA	June 1978 NA	June 1979 NA	June 1979 NA	August 1975 80
COMMENTS	Includes the Alpha Micro Operating System (AMOS); supports any RS-232-compatible peripherals; over 150 application programs available	Includes the Alpha Micro Operating System (AMOS); supports any RS-232-compatible peripherals; over 150 application programs available	Includes the Alpha Micro Operating System (AMOS); supports any RS-232-compatible peripherals; over 150 application programs available	Includes the Alpha Micro Operating System (AMOS); supports RS-232-compatible peripherals; over 150 application programs available	Includes dual floppy disk; opt. 150-cps printer available; word processing, phototypesetting, electronic mail applications accommodated

MANUFACTURER & MODEL	Applied Digital Communications 103	Applied Digital Communications 202	Applied Digital Communications 401	Applied Digital Data Systems, Inc. (ADDs) MENTOR 4000	Applied Systems Corp. ASC/80
MAIN STORAGE Min./Max. capacity, words or bytes	64K bytes	64K/256K bytes	64K/256K bytes	128K/512K bytes	8K/128K bytes
NO. WORKSTATIONS CONNECTABLE	—	—	1	16	8 or 16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	256 Optional Optional Bisync None None No	64 No Yes None None None No	256 Optional Optional Bisync — — —	16 Optional Optional — — — —	32 Opt.; to 50K bps Opt.; to 9600 bps ASCII/Bisync Optional Optional Optional
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	75,000 up — — —	25,000 up — — —	15,000 up — — —	— — — —	2,900+ 150 (8K) — Quantity
Date of first U.S. delivery Number installed to date	1978 NA	1978 NA	1979 5	December 1980 NA	1979 NA
COMMENTS	Includes accounting system, job cost control, invoicing, personnel reports, solid audit trail, multitasking, civil engineering, CAD application, and report gen. packages	Same as Model 102 but faster & greater capacity; price includes accounting software	Manufacturing and accounting software CAD systems for Numeric Control mfg. operations, NC tape verification, NC tape translation; piece part drawings with incremental plotter	Sold through authorized dealer network	Modular computer design for business and remote communications applications

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Basic Four Corporation Model 510	Basic Four Corporation Model 610	Basic Four Corporation Model 730	BTI 5000	BTI 5000/ES
MAIN STORAGE Min./Max. capacity, words or bytes	64K/256K bytes	64K/192K bytes	96K/256K bytes	64K bytes	64K bytes
NO. WORKSTATIONS CONNECTABLE	16	16	32	32	32
COMMUNICATIONS Maximum no. of lines	16	16	32	8 std.; 32 opt.	4 std.; 32 opt.
Synchronous	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	No	No
Asynchronous	Opt.; 9600 bps	Std.; 9600 bps	Std.; 9600 bps	9600 bps	9600 bps
Protocols supported	Bisync	Bisync	Bisync	User-programmable	User-programmable
Network architecture supported	Business Info Net.	Business Info. Net.	Business Info. Net.	NA	NA
RJE terminals emulated	2780/3780	2780/3780	2780/3780	NA	NA
IBM 3270 emulation	No	No	No	No	No
PRICING & AVAILABILITY Purchase price of basic system, \$	44,000	51,400	95,100	38,950	29,950
Purchase price of memory module, \$	2,500 (16K bytes)	3,900 (32K bytes)	3,900 (32K bytes)	—	—
Monthly maint. price of basic system, \$	—	424	766	225	225
Discounts available	NA	NA	NA	Quantity	Quantity
Date of first U.S. delivery	1980	1978	1978	March 1978	September 1979
Number installed to date	9,000 (all models)	9,000 (all models)	9,000 (all models)	2,500	2,500
COMMENTS				Up to 32 user terminals can run concurrently	Up to 32 user terminals can run concurrently

MANUFACTURER & MODEL	BTI 8000	Burroughs B720/B730	Burroughs B1800 Series	Burroughs B1900 Series	Business Control System 8/11
MAIN STORAGE Min./Max. capacity, words or bytes	256K/8M bytes	32K/80K bytes	64K/1048K bytes	128K/2M bytes	64K/1M bytes
NO. WORKSTATIONS CONNECTABLE	512	9	16	—	—
COMMUNICATIONS Maximum no. of lines	8 std.; 160 opt.	22	4 to 32	32	64
Synchronous	No	To 9600 bps	Opt.; to 50,000 bps	Opt.; to 50,000 bps	Opt.; to 50K bps
Asynchronous	19.2 bps	To 9600 bps	Opt.; to 9600 bps	Opt.; to 9600 bps	Opt.; to 9600 bps
Protocols supported	User-programmable	BDLC, Bisync	Bisync, BDLC, BNA	BDLC, Bisync	Bisync; SDLC
Network architecture supported	NA	—	—	BNA	DECnet
RJE terminals emulated	NA	IBM 3780	HASP	HASP	—
IBM 3270 emulation	No	No	No	No	—
PRICING & AVAILABILITY Purchase price of basic system, \$	86,850	26,500	Contact vendor	71,500/148,960	40,000
Purchase price of memory module, \$	9,000 (128K bytes)	—	—	3,450 (128K bytes)	—
Monthly maint. price of basic system, \$	650	—	—	410/648	—
Discounts available	Quantity	Dollar Volume	—	—	—
Date of first U.S. delivery	April 1980	March 1973	May 1977	First qtr. 1980	1976
Number installed to date	NA	Over 3000	NA	NA	120
COMMENTS	Variable resource architecture permits expansion to main-frame capacity; up to 160 users	System price includes console printer; AEL and COBOL or RPG programs can run concurrently	Compilers include COBOL, RPG, AEL, NDLC, FORTRAN and BASIC	Compilers include BASIC, COBOL, MIL, SDL, RPG, FORTRAN 77, among others	Supports all DEC operating systems, sorts, etc.

**Communications Capabilities of
Minicomputers and Small Business Computers**

MANUFACTURER & MODEL	Business Controls System 80/8	CDA The Parts Handler DG Eclipse	Centurion 6300	Centurion 6400	Century Computer X100/X200
MAIN STORAGE Min./Max. capacity, words or bytes	32K/256K bytes	64K/1024K words	64K/256K words	64K/256K words	256K/956K words
NO. WORKSTATIONS CONNECTABLE	—	—	32	32	32
COMMUNICATIONS Maximum no. of lines	16	128	31	31	32
Synchronous	Opt.; to 4800 bps	Standard	Opt.; 1.2-9.6K bps	Opt.; 1.2-9.6K bps	Std.; 9600 bps
Asynchronous	Opt.; to 9600 bps	Std.; to 19.2K bps	Std.; 300 bps	Std.; 300 bps	Opt.; 19200 bps
Protocols supported	IBM 2780	2780/3780, HASP, X.25	IBM 3780	IBM 3780	2780/3780
Network architecture supported	—	—	None	None	NA
RJE terminals emulated	—	2780/3780, HASP	IBM 2780/3780	IBM 2780/3780	2780/3780
IBM 3270 emulation	—	No	No	No	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	29,990	Contact vendor	See Comments	See Comments	Contact vendor
Purchase price of memory module, \$	—	Contact vendor	2,400 (32K)	2,400 (32K)	Contact vendor
Monthly maint. price of basic system, \$	—	Contact vendor	Set by dealers	Set by dealers	Contact vendor
Discounts available	—	4 percent net 3	For dealers	For dealers	—
Date of first U.S. delivery	1971	March 1979	Fourth qtr. 1979	Fourth qtr. 1980	NA
Number installed to date	NA	2	150 (all 6000 Series)	150 (all 6000 Series)	NA
COMMENTS			Basic system includes 64K bytes, 4 ports, 10.4M-byte fixed/removable disk drive, a CRT, a 150-cps printer, for \$32,790	Basic system includes 64K bytes, 4 ports, 26.4M-byte fixed/removable disk drive, a CRT, a 150-cps printer, for \$40,299	Turnkey applications for gen. business, credit unions, CPAs, order entry, inventory control, fleet mgt., school administration, and construction

MANUFACTURER & MODEL	Century Computer 400	Century Computer 700	Century Computer 900	Complete Computer Systems #10	Complete Computer Systems #11
MAIN STORAGE Min./Max. capacity, words or bytes	64K/256K bytes	96K/256K bytes	160K/512K bytes	64K/256K bytes	64K/256K bytes
NO. WORKSTATIONS CONNECTABLE	8	20	32	16	16
COMMUNICATIONS Maximum no. of lines	16	20	32	16	16
Synchronous	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; to 9600 bps	Opt.; to 9600 bps
Asynchronous	Std.; 19,200 bps	Std.; 19,200 bps	Std.; 19,200 bps	Opt.; to 9600 bps	Opt.; to 9600 bps
Protocols supported	Bisync/async	Bisync/async	Bisync/async	Async, bisync	Async, bisync
Network architecture supported	—	—	—	IBM 360/370	IBM 360/370
RJE terminals emulated	2780/3780	2780/3780	2780/3780	2780/3780	RJE 80 (2780/3780)
IBM 3270 emulation	Yes	Yes	Yes	—	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	26,500	34,000	42,500	30,940	33,605
Purchase price of memory module, \$	—	—	—	4,000 (64K bytes)	4,000 (64K bytes)
Monthly maint. price of basic system, \$	Contact vendor	Contact vendor	Contact vendor	280	310
Discounts available	OEM	OEM	OEM	Govt.; 10%	Govt.; 10%
Date of first U.S. delivery	June 1975	June 1975	June 1975	1974 (Nova 2/10)	1974 (Nova 2/10)
Number installed to date	NA	NA	NA	NA	NA
COMMENTS	Additional workstations available; complete turnkey system for gen. business, acctg., fleet mgt., credit unions, inv. control, finance, construction, school district acctg., package works on all models	See Century Computer 400 Comments	See Century Computer 400 Comments	Property management, rent and maintenance control, multi-entity financials	CREATE operates in shared-logic mode with business application; word processing with variable text fill-in

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MANUFACTURER & MODEL	Complete Computer Systems #12	Complete Computer Systems #14	Complete Computer Systems #22	Complete Computer Systems #26	Computer Automation NAKED MINI 4 (NM 4/04)
MAIN STORAGE Min./Max. capacity, words or bytes	64K/256K bytes	64K/256K bytes	96K/256K bytes	128K/256K bytes	32K/128K bytes
NO. WORKSTATIONS CONNECTABLE	16	16	16	16	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	16 Opt.; to 9600 bps Opt.; to 9600 bps Async, bisync IBM 360/370 RJE 80 (2780/3780) Yes	16 Opt.; to 9600 bps Opt.; to 9600 bps Bisync IBM 360/370 RJE 80 (2780/3780) Yes	16 Opt.; to 9600 bps Opt.; to 9600 bps Bisync IBM 360/370 RJE 80 (2780/3780) Yes	16 Opt.; to 9600 bps Opt.; to 9600 bps Bisync IBM 360/370 RJE 80 (2780/3780) Yes	32 Opt.; 19.2-56K bps Opt.; 300-19,200 bps — — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	33,825 4,000 (64K bytes) 325 Govt.; 10%	45,275 4,000 (64K bytes) 375 Govt.; 10%	63,605 4,000 (64K bytes) — Govt.; 10%	77,495 4,000 (64K bytes) — Govt.; 10%	11,500 625 — Yes
Date of first U.S. delivery Number installed to date	1975 (Nova 2/10) NA	1976 NA	1976 NA	1976 NA	1979 200
COMMENTS	Inventory control incl. LIFO, FIFO, avg. lot ctrl., serial no. ctrl., bulk qty.	HMO membership control, mail-order prospect control; CREATE report generator	CREATE operates in shared-logic mode with business application, word processing with variable text fill-in and preprinted forms fill-in	Mfg. and construction systems oriented to job costing estimating, projected completion cost, labor, cost ctr. efficiency	Sold to OEMs and systems houses for resale to end users with value added

MANUFACTURER & MODEL	Computer Automation NAKED MINI 4 (NM 4/10, 4/30, 4/90)	Computer Automation SyFA System 1000	Computer Automation SyFA System 2000	Computer Automation SyFA System 2500	Computer Designed Systems Adviser IV/700
MAIN STORAGE Min./Max. capacity, words or bytes	32K/128K bytes	64K/304K bytes	256K bytes	256K/512K bytes	16K/8000K words
NO. WORKSTATIONS CONNECTABLE	32	32	48	64	32
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	64 Opt.; 19.2-56K bps Opt.; 300-19,200 bps 2780/3780, SDLC — IBM 2780 (opt.) —	34 Opt. 4800 bps Std.; (8-32) 9600 bps Bisync, SDLC Opt.; SNA See Comments Optional	50 Opt.; 4800 bps Std.; (8-48) 9600 bps Bisync, SDLC Opt.; SNA See Comments Optional	66 Opt.; 4800 bps Std.; (8-64) 9600 bps Bisync, SDLC, Opt.; SNA See Comments Optional	32 Opt.; 9600 bps Opt.; 9600 bps 2780, 3780, SNA/SDLC SNA (opt.) 2780/3780 Optional
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	11,500-26,800 1,050 — Yes	102,500 6,400 220 No	205,000 — 350 No	Contact vendor 15,000 Contact vendor No	59,000 (64K) 18,000 (64K) 5,400 Quantity
Date of first U.S. delivery Number installed to date	1977 5000	1976 638 (all systems)	1981 638 (all systems)	March 1981 638 (all models)	October 1977 NA
COMMENTS	Sold to OEMs and systems houses for resale to end user with value added	Price includes 128K bytes of memory, 9-slot chassis, power supply, 8 CRTs, two 32MB disk drives, and a 600-lpm printer; RJE terminals; 3780, HASP Mod. 20, SNA PU-Type 2; LSI 2/120 CPU is optional	Price includes 256K bytes of memory, 16 CRTs, three 80MB-disk drives, a Bisync controller, and a 600-lpm printer; RJE terminals; 3780, HASP Mod. 20, SNA PU-Type 2	See SyFA System 2000 Comments	Single source responsibility, field upgradable, virtual mem., min. terminal degradation under load, turnkey systems avail., interactive, direct processing system

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MANUFACTURER & MODEL	Computer Designed Systems Adviser IV/800	Computer Designed Systems Adviser IV/3160	Computer Designed Systems Adviser IV/4240	Computer Designed Systems Adviser IV/5320	Computer Hardware Inc. 2130
MAIN STORAGE Min./Max. capacity, words or bytes	16K/8000K words	64K/192K bytes	64K/256K bytes	64K/320K bytes	16K/4M bytes
NO. WORKSTATIONS CONNECTABLE	64	16	24	32	32
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 Opt.: 9600 bps Opt.: 9600 bps 2780, 3780, SNA/SDLC SNA (opt.) 2780/3780 Optional	16 Opt.: 9600 bps Opt.: 9600 bps Bisync, async, SDLC SNA/SDLC 2780/3780 Yes	24 Opt.: 9600 bps Opt.: 9600 bps Bisync, async, SDLC SNA/SDLC 2780/3780 Yes	32 Opt.: 9600 bps Opt.: 9600 bps Bisync, async, SDLC SNA/SDLC 2780/3780 Yes	32 async.; 4 sync. Opt.; to 4800 bps Opt.; to 9600 bps Bisync NA 2780/3780, 3741 No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	82,000 (64K) 18,000 (64K) 5,400 Quantity	39,700 Varies 290 Quantity (5)	48,900 Varies 380 Quantity (5)	59,900 Varies 535 Quantity (5)	Contact vendor 1,500 (16K bytes) Contact vendor Contact vendor
Date of first U.S. delivery Number installed to date	October 1977 NA	1976 NA	1977 NA	1977 NA	1974 NA
COMMENTS	Single source responsibility, upgradable, virtual degradation, turnkey avail., interactive, direct processing system	Single source responsibility for hardware, software, service; preprocessors available	Single source responsibility for hardware, software, service; preprocessors available	Single source responsible for hardware, software, service; pre-processors avail., field upgrade-able	Hardware floating-point available

MANUFACTURER & MODEL	Computer Hardware Inc. 3230	Computer Hardware Inc. 4250	Computer Talk Model 400	Computer Talk Model 407	Computer Talk Model 408
MAIN STORAGE Min./Max. capacity, words or bytes	16K/128K bytes	4K/1024K	16K/512K words	16K/512K words	16K/512K words
NO. WORKSTATIONS CONNECTABLE	32	16	256	256	256
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 async.; 4 sync. Opt.; to 4800 bps Opt.; to 9600 bps Bisync NA 2780/3780 No	16 Opt.: 50-9600 bps Opt.: 50-9600 bps Bisync None IBM 2780/3780 Yes	256 Opt.: 50-9600 bps Opt.: 50-9600 bps Async, Bisync, SDLC None Most RJE terminals Yes	256 Opt.: 50-9600 bps Opt.: 50-9600 bps Async, Bisync, SDLC None Most RJE terminals Yes	256 Opt.: 50-9600 bps Opt.: 50-9600 bps Async., Bisync., SDLC None Most RJE terminals Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	Contact vendor 1,500 (16K bytes) Contact vendor Contact vendor	37,800 2,160 (16K bytes) Contact vendor Contact vendor	28,700 (16K MOS) 2,530 (16K words) — Volume	36,225 (16K MOS) 2,530 (16K words) — Volume	37,030 (16K MOS) 2,530 (16K words) — Volume
Date of first U.S. delivery Number installed to date	1976 NA	January 1978 NA	May 1975 NA	January 1978 NA	January 1978 NA
COMMENTS	Hardware floating-point available	Price includes 96K bytes of ECC memory, a 10M byte disk cartridge, cassette, CRT, 60 cps printer, DX10 operating system, FORTRAN compiler, sort/merge, and time system application	Storage protection std. by memory partition and opt. by page; mapping to 512K opt.; 4K PROM opt.; on low power, memory is stored on disk; price includes CRT, light pen, modem, 1.2M-byte disk, arith. & I/O processors, & battery pack oper.	Expanded Model 400 with additional features; disk expanded to 30M bytes, 300-lpm x 132 printer and mini-floppy disk for I/O	Expanded Model 400 with additional features; disk expanded to 30M bytes, 300-lpm x 132 printer and mini-cassette for I/O

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Data Communications Corp. DCS	Data Communications Corp. DPS	Data Communications Corp. RTS	Data Communications Corp. TPS	Data General Eclipse C/150
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	8K/32K bytes 64	32K/256K bytes 39	8K/32K bytes 39	96K/256K bytes 39	64K/512K words 64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	256 Opt.; to 9600 bps Opt.; to 9600 bps ALL TNA, SNA 2780/3780 Yes	256 Opt.; to 50K bps Opt.; to 9600 bps ALL TNA, SNA, X.25 2780/3780 Yes	256 Opt.; to 9600 bps Opt.; to 9600 bps ALL TNA, SNA, X.25 2780/3780 Yes	256 Opt.; to 9600 bps Opt.; to 9600 bps ALL TNA, SNA, X.25 2780/3780 Yes	— Opt.: 56,000 bps Opt.: 9600 bps Bisync., X.25 X.25 2780/3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	50,000 8,000 (256K bytes) — Quantity March 1977 NA	Contact vendor 8,000 (256K bytes) — Quantity September 1976 NA	25,000 8,000 (256K bytes) — Quantity March 1977 NA	85,000 8,000 (256K bytes) — Quantity NA NA	34,000 (128K bytes) 6,000 (64K bytes) 285 Various types February 1979 NA
COMMENTS		CPUs include DG Nova 3/D, DG Eclipse S130/S230/S330		CPUs include DG Nova 3/D, DG Eclipse S130/S230/S330	C/150 AOS compatible with C/350 and M/600 AOS systems

MANUFACTURER & MODEL	Data General Eclipse C/300	Data General Eclipse C/330	Data General Eclipse C/350	Data General Eclipse M/600	Data General Eclipse S/130
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	32K/256K bytes 64	64K/512K bytes 64	32K/1024K words 64	32K/1024K words 64	16K/512K bytes 64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	— Opt.; 56K bps Opt.; 9600 bps Bisync, X.25 X.25 2780/3780, HASP Yes	— Opt.; 56K bps Opt.; 9600 bps Bisync, X.25 X.25 2780/3780, HASP Yes	— Opt.; 56,000 bps Opt.; 9600 bps Bisync., X.25 X.25 2780/3780, HASP Yes	— Opt.; 56,000 bps Opt.; 9600 bps Bisync., X.25 X.25 2780/3780, HASP Yes	— Opt.; 56,000 bps Opt.; 9600 bps Bisync., X.25 X.25 2780/3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	30,700 (32KB Core) 4,500 (32KB Core) 269 Various types March 1975 NA	33,000 (64KB Core) 4,500 (32KB Core) 280 Various types August 1976 NA	49,500 (128K bytes) 6,000 (64K MOS) 330 Various types October 1978 NA	80,000 (256K bytes) 8,000 (256K bytes) 470 Various types April 1978 NA	16,500 (128K bytes) 4,500 (32K core) 105 Various types March 1977 1000+ (all models)
COMMENTS	Includes Extended Arithmetic Processor (EAP)	Includes Extended Arithmetic Processor (EAP)	Standard features include extended floating-point functions, and a commercial instruction set; a 10MB/second Burst Multiplexer Channel is optional	Includes I/O processor with 64KB for handling low-speed character-oriented data movement; a 10MB/second Burst Multiplexer channel is optional; supports a variety of data base management systems and the AZ-TEXT WP package	1K 56-bit words of Writable Control Storage (WCS) optionally available

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MANUFACTURER & MODEL	Data General Nova 3/D	Data General Nova 4C	Data General Nova 4S	Data General Nova 3/4	Data General Nova 3/12
MAIN STORAGE Min./Max. capacity, words or bytes	64K/512K bytes	32K/512K bytes	64K/1024K bytes	8K/32K words	8K/128K words
NO. WORKSTATIONS CONNECTABLE	64	64	64	—	—
COMMUNICATIONS Maximum no. of lines	—	—	—	—	—
Synchronous	Opt.; 56,000 bps	Opt.; 56,000 bps	Opt.; 56,000 bps	Opt.; 56,000 bps	Opt.; 56,000 bps
Asynchronous	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps
Protocols supported	Bisync, X.25	Bisync, X.25	Bisync, X.25	Bisync, X.25	Bisync, X.25
Network architecture supported	X.25	X.25	X.25	X.25	X.25
RJE terminals emulated	2780/3780, HASP	2780/3780, HASP	2780/3780, HASP	2780/3780, HASP	2780/3780, HASP
IBM 3270 emulation	Yes	Yes	Yes	Yes	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	17,300 (128K bytes)	17,000 (32K Core)	31,500 (64K bytes)	4,080 (8K Core)	5,180 (8K Core)
Purchase price of memory module, \$	5,250 (128K bytes)	6,000 (64K bytes)	6,000 (64K bytes)	2,205 (8K Core)	2,205 (8K Core)
Monthly maint. price of basic system, \$	110	145	297	50	56
Discounts available	Various types	Various types	Various types	Various types	Various types
Date of first U.S. delivery	November 1979	September 1976	August 1978	April 1976	April 1976
Number installed to date	NA	NA	NA	40,000 (all Nova models)	40,000 (all Nova models)
COMMENTS	Includes AZ-TEXT word processing package	256 56-bit words of Writable Control Storage (WCS) optionally available	Options include a high-speed Burst Multiplexer Channel (BMC), and Integral Array Processor, a Character Instruction Set, and a Writable or Fixed User Control Storage		

MANUFACTURER & MODEL	Data General Nova 3/D	Data General Nova 4C	Data General Nova 4S	Data General Nova 4X	Datapoint 6600
MAIN STORAGE Min./Max. capacity, words or bytes	32K/128K words	16K/32K words	16K/32K words	16K/128K words	120K bytes
NO. WORKSTATIONS CONNECTABLE	—	64	64	64	24
COMMUNICATIONS Maximum no. of lines	—	128	128	128	25
Synchronous	Opt.; 56,000 bps	Opt.; (32) 56K bps	Opt.; (32) 56K bps	Opt.; (32) 56K bps	Opt.; to 9600 bps
Asynchronous	Opt.; 9600 bps	Opt.; (128) 19200 bps	Opt.; (128) 19200 bps	Opt.; (128) 19200 bps	Opt.; to 9600 bps
Protocols supported	Bisync, X.25	Bisync, X.25	Bisync, X.25	Bisync, X.25	Async, bisync
Network architecture supported	X.25	XODIAC, IBM BSC	XODIAC, IBM BSC	XODIAC, IBM BSC	—
RJE terminals emulated	2780/3780, HASP	2780/3780, HASP II	2780/3780, HASP II	2780/3780, HASP II	2780/3780
IBM 3270 emulation	Yes	No	No	No	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	13,320 (32KB Core)	2,940 (32K bytes)	6,090 (32K bytes)	10,920 (128K bytes)	Contact vendor
Purchase price of memory module, \$	2,205 (8K Core)	—	2,310 (32K bytes)	5,250 (128K bytes)	Contact vendor
Monthly maint. price of basic system, \$	135	47	59	82	Contact vendor
Discounts available	Various types	—	—	—	OEM
Date of first U.S. delivery	November 1976	1979	1979	1979	July 1977
Number installed to date	40,000 (all Nova models)	NA			
COMMENTS					

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Datapoint 8800	Digital Equipment Corp. PDP-8/A	Digital Equipment Corp. Datasytem 530	Digital Equipment Corp. Datasytem 540	Digital Scientific 5030
MAIN STORAGE Min./Max. capacity, words or bytes	256K/1024K bytes	8K/128K words	128K/256K bytes	256K/1M bytes	128K/2M words
NO. WORKSTATIONS CONNECTABLE	24	—	NA	NA	32
COMMUNICATIONS Maximum no. of lines	24	20	32 EIA	32 EIA	64
Synchronous	Opt.; to 9600 bps	No	Opt.; to 50K bps	Opt.; to 50K bps	3
Asynchronous	Opt.; to 9600 bps	To 9600 bps	Opt.; to 5600 bps	Opt.; to 9600 bps	64
Protocols supported	Async, bisync	—	2780/3271	2780/3271	3780, Bisync, HASP
Network architecture supported	—	—	DECNET	DECNET	Opt.; SDLC, HDLC
RJE terminals emulated	2780/3780	Any RS-232-C	2780/3780	IBM 2780/3780	2780, 3780, 3740
IBM 3270 emulation	Yes	—	Yes	Yes	Optional
PRICING & AVAILABILITY Purchase price of basic system, \$	42,500	4,750	44,700	56,700	39,600
Purchase price of memory module, \$	—	2,500 (8K bytes)	NA	NA	1,800/2,000 (8KB)
Monthly maint. price of basic system, \$	—	57	287	300	433
Discounts available	OEM	—	OEM and volume	OEM and volume	Quantity
Date of first U.S. delivery	December 1980	September 1974	April 1977	June 1980	NA
Number installed to date	NA	Over 40,000	NA	NA	NA
COMMENTS		Also available in packaged version called Datasytem 310; hardware configuration is software dependent; all prices subject to change			Up to 64 concurrent users in a mixed conversational and batch mode; attached processor available

MANUFACTURER & MODEL	Digital Systems Galaxy/5	Dimis, Inc. Total 100 (10)	Dimis, Inc. Total 100 (30)	Dimis, Inc. Total 100 (70)	Display Data Corporation in * sight
MAIN STORAGE Min./Max. capacity, words or bytes	128K/1024K bytes	128K words	128K/512K words	128K/4096K words	64K/128K words
NO. WORKSTATIONS CONNECTABLE	60	8	27	50	32
COMMUNICATIONS Maximum no. of lines	120	32	32	32	32
Synchronous	Std.; to 15,000 bps	Optional	Optional	Optional	No
Asynchronous	Std.; to 9,600 bps	Std.; to 9,600 bps	Std.; to 9600 bps	Std.; to 9600 bps	Std.; 9600 bps
Protocols supported	Programmable	Programmable	Programmable	Programmable	Async, X3.25
Network architecture supported	None	—	—	—	None
RJE terminals emulated	None	No	No	No	None
IBM 3270 emulation	No	No	No	No	No
PRICING & AVAILABILITY Purchase price of basic system, \$	44,930	110,000	165,000	220,000	29,700
Purchase price of memory module, \$	6,200 (64K bytes)	—	10,500 (128K bytes)	36,000 (512K bytes)	5,000 (64K bytes)
Monthly maint. price of basic system, \$	315	—	—	—	274
Discounts available	On request	—	—	—	Quantity
Date of first U.S. delivery	August 1976	October 1980	June 1974	December 1978	January 1974
Number installed to date	30	4	22*	19	1,200
COMMENTS	In-cabinet, on-site upgrades available on all configurations; Galaxy/5 is a multiple microprocessor system; DMA channel and communications interface are both microprocessor-based	One CRT (std.); package includes staff & mgmt. training & conversion support; available on a rental basis; system price includes all application software	Three CRTs standard; package includes staff & mgmt., training & conversion support; *includes compatible Mod-comp II; system price includes all applications software	Three CRTs standard; package includes staff & mgmt., training & conversion support; system price includes all applications software	Specialists in complete turnkey systems, support, forms, & maintenance for selected businesses

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Distribution Management Systems DS 11/44	Distribution Management Systems BS 11/70	Distribution Management Systems BS 11/750	Distribution Management Systems BS 11/780	Evolution Computer Systems 240
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	256K/1M bytes 64 64 Standard Standard Various Yes 2780/3780 Yes 163,000 11,800 (512K bytes) 1,340 Quantity December 1980 NA	512K/4M bytes 64 64 Standard Standard Various Yes 2780/3780 Yes 187,000 21,400 (512K bytes) 1,516 Quantity April 1979 8	2M bytes 64 64 Standard Standard Various Yes 2780/3780 Yes 230,000 — 1,575 Quantity June 1981 NA	512K/8M bytes 64 64 Standard Standard Various Yes 2780/3780 Yes 292,000 19,800 (1M byte) 2,249 Quantity January 1981 NA	64K/256K bytes 32 32 Opt.; 9600 bps Std.; 9600 bps Async/Bisync No 2780/3780 No 32,950 6,125 320 — December 1980 5 Word processing optional

MANUFACTURER & MODEL	Evolution Computer Systems 260	Evolution Computer Systems 280	Four-Phase IV/70	Four-Phase IV/90	Functional Automation F6424
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	128K/572K bytes 64 64 Opt.; 9600 bps Opt.; 9600 bps Async, Bisync No 2780/3780 No 69,750 10,225 554 — January 1977 150 Word processing optional	256K/1024K bytes 64 64 Opt.; 9600 bps Std.; 9600 bps Async/Bisync No 2780/3780 Yes 94,000 13,850 870 — January 1981 2 Word processing optional	24K/96K bytes 32 32 Up to 9600 bps Up to 2400 bps Async, bisync SNA/SDLC 2780/3780, HASP Yes 72,315 (48K bytes) — — — February 1971 10,000 (all sys.) System price also includes 12 CRTs, 2.5-megabyte disk drive, and 9-track magnetic tape drive	96K/384K bytes 32 32 Up to 9600 bps Up to 2400 bps Bisync, async SNA/SDLC 2780/3780, HASP Yes 1,930/month (42-mo. lease) — — — July 1977 10,000 (all sys.) System price also includes 12 CRTs, 2.5-megabyte disk drive, and 9-track magnetic tape drive	256K/16,384K bytes 32 — Std.; 19,200K bps FABUS FABUS None No 21,952 — — Quantity, 20% 1980 2 Interfaces via FABUS to other computers in network; intended for OEM market

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	General Automation Solution Series GA-16/110	General Automation Solution Series GA-16/220	General Automation Solution Series GA-16/230	General Automation Solution Series GA-16/240	General Automation Solution Series GA-16/440
MAIN STORAGE Min./Max. capacity, words or bytes	16K/64K words	16K/64K words	16K/64K words	16K/256K words	32K/1M words
NO. WORKSTATIONS CONNECTABLE	16	16	16	16	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	See Comments Opt.; to 9600 bps 2780/3780, SDLC AUTONET 2780/3780, HASP Yes				
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	3,275 1,500 (32K) None Quantity, 5-40%	3,600 1,500 (32K) 43 Quantity, 5-40%	7,325 — 147 Quantity, 5-40%	9,000 3,250 (128K) 126 Quantity, 5-40%	12,000 4,000 (32K core) 108 Quantity, 5-40%
Date of first U.S. delivery Number installed to date	December 1975 3,250	January 1976 4,290	May 1980 200	May 1980 200	June 1975 1800
COMMENTS	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds

MANUFACTURER & MODEL	General Automation Solution Series GA-16/110	General Automation Solution Series GA-16/220	General Automation Solution Series GA-16/230	Harris 80	Harris 100
MAIN STORAGE Min./Max. capacity, words or bytes	32K/1M words	64K words	128K/1M words	192K/768K bytes	192K/768K bytes
NO. WORKSTATIONS CONNECTABLE	16	16	16	Appl. dependent	Appl. dependent
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	See Comments Opt.; to 9600 bps 2780/3780, SDLC AUTONET 2780/3780, HASP Yes	See Comments Opt.; to 9600 bps 2780/3780, SDLC AUTONET 2780/3780, HASP Yes	See Comments Opt.; to 9600 bps 2780/3780, SDLC AUTONET 2780/3780, HASP Yes	32 Opt.; 56K bps Opt.; 19.2K bps — None See Comments Yes	32 Opt.; 56K bps Opt.; 19.2K bps Async, bisync None See Comments Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	15,000 3,500 (64K) 134 Quantity, 5-40%	16,000 — 131 Quantity, 5-40%	20,500 3,250 (128K) 168 Quantity, 5-40%	69,950 (192K bytes) 7,300 (192K bytes) Special quote Yes	45,000 (192K bytes) 7,300 (192K bytes) Special quote Yes
Date of first U.S. delivery Number installed to date	May 1978 870	August 1980 180	August 1980 340	First qtr. 1981 NA	First qtr. 1977 NA
COMMENTS	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	Up to 256 lines with 1800 bps, and 96 lines with 9600 bps communications speeds	RJE terminals emulated: 2780/3780, HASP workstation, UT-200, U-1004	RJE terminals emulated: 2780/3780, HASP workstation, UT-200, U-1004

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Hewlett-Packard General Systems Division HP 300	Hewlett-Packard HP 1000 E Series	Hewlett-Packard HP 1000 F Series	Hewlett-Packard HP 1000 L Series	Hewlett-Packard HP 1000 M Series
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	128K/512M bytes 16	64K/2048K bytes 64	64K/1024K bytes 64	64K/512K bytes 64	64K/2048K bytes 64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	16 No Opt.; to 9600 bps None None None No	56 Opt.; to 19.2K bps Opt.; to 2.5M bps Bisync, async, HDLC DS/1000-3000 IBM 2780 No	56 Opt.; to 19.2K bps Opt.; to 2.5M bps Bisync, async, HDLC DS/1000-3000 IBM 2780 No	56 Opt.; to 19.2K bps Opt.; to 2M bps Async, bisync, HDLC DS/1000-3000 HDLC No	56 Opt.; to 19.2K bps Opt.; to 2.5M bps Bisync, async, HDLC DS/1000-3000 IBM 2780 No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	35,000-63,000 2,500 (128K words) 153-245 OEM, volume December 1978 NA	9,100 (64K bytes) 4,500 (128K bytes) 74 OEM & end-user qty. November 1976 NA	14,000 (64K bytes) 4,500 (128K bytes) 109 OEM & end-user qty. July 1978 NA	4,450 (64K bytes) 2,500 (128K bytes) 25 OEM & end-user qty. March 1980 NA	7,700 (64K bytes) 3,900 (128K bytes) 71 OEM & end-user qty. May 1974 NA
COMMENTS		HP1000 Model 20 & Model 40 packaged systems include E-Series; DS/1000 & DATACAP/1000 support; E-Series also available as board computer	HP1000 Model 25 & Model 45 packaged systems include F-Series; DS/1000 & DATACAP/1000 support; F-Series scientific instruction set provides high performance transcendentals; optional vector instruction set provides high performance matrix operations		M-Series processor supports DS/1000, high-level networking software; factory data capture software (DATACAP/1000) supported; M-Series also available as a board computer

MANUFACTURER & MODEL	Honeywell Level 6 Model 23	Honeywell Level 6 Model 33	Honeywell Level 6 Model 43	Honeywell Level 6 Model 47	Honeywell Level 6 Model 53
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	16K/64K words 16	32K/128K bytes 160	32K/2048K bytes 160	32K/2048K bytes 152	32K/2048K bytes 152
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	16 (any mixture) Opt.; 50-9600 bps Opt.; 50-9600 bps Bisync, VIP, TTY, async — 2780/3780, HASP Yes	160 Opt.; 50-7200 bps Opt.; 50-19,200 bps Async, bisync, HDLC — HASP, 2780/3780 —	160 Opt.; 50-7200 bps Opt.; 50-19,200 bps Async, bisync, HDLC — HASP, 2780/3780 —	160 Opt.; 50-7200 bps Opt.; 50-19,200 bps Async, bisync, HDLC — HASP, 2780/3780 —	160 Opt.; 50-7200 bps Opt.; 50-19,200 bps Async, bisync, HDLC — HASP, 2780/3780 —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	4,800 2,525 (32K words) 52 Yes 1978 NA	7,275 875 (16K bytes) 77 Qty., vol., educ. 1976 NA	10,325 2,240 (64K bytes) 114 Qty., vol., educ. 1977 NA	22,275 2,250 (64K bytes) 227 Qty., vol., educ. 1978 NA	22,175 2,250 (64K bytes) 174 Qty., vol., educ. 1978 NA
COMMENTS		Field upgradable to all higher models; replaces models 34 and 36	Field upgradable to all higher models	Field upgradable to model 57; includes high speed commercial instructions	Field upgradable to model 57; includes 8K bytes high-speed cache memory

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Honeywell Level 6 Model 57	Honeywell Series 60 Level 62	IBM 8100 Information System	IBM System/34	IBM System/38
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	32K/2048K bytes 144	96K/992K bytes No practical limit	256K/1024K bytes 24	32K/128K bytes 16 local; 64 remote	512K/2048K bytes 80 local, plus remote clusters
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	160 Opt.; 50-7200 bps Opt.; 50-19,200 bps Async, bisync, HDLC — HASP, 2780/3780 Yes	25 Up to 19,200 bps Up to 9,600 bps Bisync TTY, ISO, BSC, VIP 2780/3780 Yes	19 Std.; 600 to 9600 bps No Bisync SNA — Yes	4 Opt.; to 56Kbps No SDLC, Bisync SNA — Yes	8 Opt.; to 9600 bps Opt.; to 1200 bps Bisync SNA — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	46,975 875 (16K bytes) 334 Qty., vol., educ. 1978 NA	33,192 2,750 (128K bytes) 160 — January 1979 Over 1000	91,815 (384K) 2,250 (128K) — Contact vendor August 1979 NA	34,700 1,175 (16K bytes) 240 (approx.) Education (10%) January 1978 NA	121,480 NA — Contact vendor August 1979 NA
COMMENTS	Includes 8K-byte high-speed cache memory and high-speed commercial instructions	CPU is available with four different performance levels			There are 96 packaged models of the System/38

MANUFACTURER & MODEL	IBM Series/1	Industrial Micro Systems Series 5000	Industrial Micro Systems Series 8000	Infomark, Inc. S/6000	Infomark, Inc. S/8000
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	16K/256K bytes Variable	64K/512K bytes 8	64K/512K bytes 8	128K/256K bytes 16	256K bytes 24
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	8 Up to 56,000 bps Up to 9600 bps Async, Bisync SNA 2780, 3780, HASP Yes	16 — Std.; 9600-19.2K bps Async — — No	16 — Std.; 9600-19.2K bps Async — — No	16 No Standard Async — — —	24 No Standard Async — — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	4,600 to 6,790 1,175 (16K bytes) 23-73 — — NA	3,000 to 12,000 — — Dealer, OEM May 1979 3000	3,000 to 12,000 — — Dealer, OEM May 1979 3000	112,000 (bundled) — — — 1976 NA	136,000 (bundled) — — — 1976 NA
COMMENTS	Offered on a purchase-only basis; eleven different CPU models				

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Infotecs, Inc. Control Center II	Lazor Systems L-10	Lazor Systems L-30	Logical Machine Corp. GOLIATH	MCM Computers MCM/900
MAIN STORAGE Min./Max. capacity, words or bytes	64K/1024K bytes	128K/1M bytes	128K/1M bytes	64K/256K bytes	64K words
NO. WORKSTATIONS CONNECTABLE	16	15	15	20	1
COMMUNICATIONS Maximum no. of lines	16	16	16	20	199
Synchronous	Std.; 300-19,200 bps	—	—	Standard	No
Asynchronous	Std.; 300-19,200 bps	Std.; 110-19,200 bps	Std.; 110-19,200 bps	Standard	Opt.; to 19.2K bps
Protocols supported	—	—	—	—	None
Network architecture supported	—	—	—	Yes	None
RJE terminals emulated	—	—	—	—	None
IBM 3270 emulation	—	No	No	—	No
PRICING & AVAILABILITY Purchase price of basic system, \$	6,995	15,050	20,575	33,325	Contact vendor
Purchase price of memory module, \$	—	2,400 (128K)	2,400 (128K)	3,117	Contact vendor
Monthly maint. price of basic system, \$	—	150	195	—	Contact vendor
Discounts available	—	No	No	Dealer	Contact vendor
Date of first U.S. delivery	April 1980	August 1980	August 1980	November 1980	October 1978
Number installed to date	Over 300	NA	NA	NA	NA
COMMENTS	Programs compatible with DEC PDP-8; complete systems and software sold & serviced nationwide by Infotecs' dealers				Floppy-based, single-user, desk-top APL computer

MANUFACTURER & MODEL	MCM Computers MCM/POWER	Microdata Reality Series 4000	Microdata Reality Series 6000	Microdata Reality Series 8000	Microtech Business Systems 400 Series
MAIN STORAGE Min./Max. capacity, words or bytes	64K words	64K/132K bytes	64K/256K bytes	256K/512K bytes	32K/1024K words
NO. WORKSTATIONS CONNECTABLE	8	32	32	48	32-64
COMMUNICATIONS Maximum no. of lines	199	32	32	48	31-63
Synchronous	Opt.; 19.2K bps	Opt.; to 9600 bps	Opt.; to 9600 bps	Opt.; to 9600 bps	No
Asynchronous	Opt.; to 19.2K bps	No	No	No	Std.; 30-9600 bps
Protocols supported	Various	Bisync	Bisync	Bisync	Async
Network architecture supported	None	—	—	—	None
RJE terminals emulated	Various	See Comments	See Comments	See Comments	None
IBM 3270 emulation	No	No	No	No	No
PRICING & AVAILABILITY Purchase price of basic system, \$	Contact vendor	42,700	52,800	84,975	11,000 (64K bytes)
Purchase price of memory module, \$	Contact vendor	2,950 (32K bytes)	2,950 (32K bytes)	4,900 (128K bytes)	3,000 (64K bytes)
Monthly maint. price of basic system, \$	Contact vendor	350	395	595	Contact vendor
Discounts available	Contact vendor	—	—	—	Contact vendor
Date of first U.S. delivery	September 1980	November 1973	November 1973	October 1979	May 1979
Number installed to date	NA	NA	NA	NA	25
COMMENTS	MCM/POWER is a multi-user, hard disk, upgradeable and upward compatible version of the MCM/900	Packaged system includes 64KB MOS memory, magnetic tape, 30MB disk drive, 165 cps printer, and 1 CRT; RJE terminals emulated include HASP, 2780/3780, 2770, 3741	Packaged system includes 64KB MOS memory, magnetic tape, 48MB disk drive, 165 cps printer, and 1 CRT; RJE terminals emulated include HASP, 2780/3780, 2770, 3741	Packaged system includes 256KB MOS memory, magnetic tape, 128MB disk drive, 300 lpm printer, and 2 CRTs; RJE terminals emulated include HASP, 2780/3780, 2770, 3741; PEP (Performance Enhanced Processor) provides improved CPU time	System 400-1 (\$39,500) includes two 50MB-disk drives; 400-2 (\$43,500) includes two 80MB-disk drives; 400-3 (\$63,500) includes two 300MB-disk drives

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Mitsubishi Electronics America, Inc. 8028	Mitsubishi Electronics America, Inc. 8038	Modular Computer Systems Inc. Classic 7810/3140	Modular Computer Systems Inc. Classic 7820/7821	Modular Computer Systems Inc. Classic 7830/7835
MAIN STORAGE Min./Max. capacity, words or bytes	256K bytes	128K/512K bytes	64K/128K bytes	128K/2048K bytes	128K/2048K bytes
NO. WORKSTATIONS CONNECTABLE	4	27	32	96	96
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 Opt.; 1200-19.2K bps Opt.; 300-9600 bps BC-1, BSC NA NA No	32 Opt.; 1200-19.2K bps Opt.; 300-9600 bps BC-1, BSC NA NA No	256 FDX Opt.; 48-230.4K bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 —	256 FDX Opt.; 48-230.4K bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 —	256 FDX Opt.; 48-230.4K bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	38,000 3,800 (128K bytes) 268 NA	43,000 3,800 (128K bytes) 287 NA	8,150 1,180 (32K bytes) 85 —	17,400 7,500 (128K bytes) — —	25,500/29,500 8,000 (128K bytes) 155/192 —
Date of first U.S. delivery Number installed to date	August 1980 NA	November 1980 NA	May 1979 NA	NA NA	September 1979 NA
COMMENTS			Remote system diagnostics available on MODACS II process control system	Remote system diagnostics available on MODACS II process control system; includes TSX, time-sharing terminal executive and the INFINITY data base management system; 7820/7821 provides a 4-slot CPU chassis	Remote system diagnostics available on MODACS II process control system; includes TSX, time-sharing terminals executive and the INFINITY data base management system

MANUFACTURER & MODEL	Modular Computer Systems Inc. Classic 7840	Modular Computer Systems Inc. Classic 7860	Modular Computer Systems Inc. Classic 7870	Mylee Digital Sciences System 3000	NCR Century 101
MAIN STORAGE Min./Max. capacity, words or bytes	256K/2M bytes	128K/4096K bytes	512K/4096K bytes	88K/286K bytes	16K/128K bytes
NO. WORKSTATIONS CONNECTABLE	96	128	128	16	—
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	256 FDX Opt.; 48-230.4K bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 —	256 FDX Opt.; 48-230.4K bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET, X.25 HASP, 2780/3780 —	256 FDX Opt.; 48-230.4K bps Opt.; 50-10.2K bps SDLC/HDLC, Bisync MAXNET, X.25 HASP, 2780/3780 —	16 Opt.; to 9600 bps Opt.; to 1200 bps Bisync — IBM 2780/3780 No	255 Opt.; to 9600 bps Opt.; to 9600 bps Bisync — — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	27,800 13,000 (256K bytes) — —	40,800 8,000 (128K bytes) 242 —	66,000 28,000 (512K bytes) 382 —	29,995 3,000 (96K bytes) 9% of purchase price —	69,520 — — —
Date of first U.S. delivery Number installed to date	NA NA	April 1978 NA	October 1978 NA	May 1976 175	August 1972 Over 1200
COMMENTS	See 7830/7835 Comments	See 7830/7835 Comments	See 7830/7835 Comments	Total turnkey system from design to installation	

**Communications Capabilities of
Minicomputers and Small Business Computers**

MANUFACTURER & MODEL	NCR Century 151	NCR 8250	New England Digital Able/40	New England Digital Able/60	Nixdorf 8870/1
MAIN STORAGE Min./Max. capacity, words or bytes	32K/131K bytes	48K/128K bytes	16K/64K words	16K/64K words	96K/256K bytes
NO. WORKSTATIONS CONNECTABLE	—	—	NA	NA	16
COMMUNICATIONS Maximum no. of lines	255	24	64	64	16
Synchronous	Opt.; to 9600 bps	Opt.; to 9600 bps	Optional 300-38.4K bps	Optional 300-38.4K bps	Opt.; to 9600 bps
Asynchronous	Opt.; to 9600 bps	Std.; 2400 bps	Bisync	Bisync	—
Protocols supported	Bisync	Bisync, async	NEDWORK	NEDWORK	Bisync, async
Network architecture supported	—	—	IBM 2780	IBM 2780	—
RJE terminals emulated	—	—	No	No	—
IBM 3270 emulation	—	—	—	—	—
PRICING & AVAILABILITY Purchase price of basic system, \$	120,325	34,420	7,950	9,650	30,750
Purchase price of memory module, \$	—	1,000 (16K bytes)	1,000 (8K words)	1,000 (8K words)	2,500
Monthly maint. price of basic system, \$	—	163	—	—	313
Discounts available	—	—	Educ., qty.	Educ., qty.	—
Date of first U.S. delivery	February 1975	March 1977	June 1977	April 1978	1975
Number installed to date	NA	NA	NA	NA	NA
COMMENTS			Includes minifloppy drives, RTC, APL, and serial port	Includes 8-inch floppy drives, RTC, APL, and serial port	

MANUFACTURER & MODEL	Nixdorf 8870/3	Omnidata OMNINET	Point 4 Data Corp. Mark 5 (4/3, 4/4)	Point 4 Data Corp. Mark 8	Prime 150
MAIN STORAGE Min./Max. capacity, words or bytes	128K/512K bytes	96K bytes	64K, 128K bytes	128K bytes	256K/1M bytes
NO. WORKSTATIONS CONNECTABLE	32	255	128	128	16
COMMUNICATIONS Maximum no. of lines	32	255	128	128	18
Synchronous	Opt.; to 9600 bps	Optional	Opt.; 110-19,200 bps	Opt.; 110-19,200 bps	9600 bps
Asynchronous	—	Optional	—	—	9600 bps
Protocols supported	Bisync, async	TTY, 2780/3780	—	—	See Comments
Network architecture supported	—	OMNILINK	—	—	Primenet
RJE terminals emulated	—	—	—	—	2780/3780, HASP
IBM 3270 emulation	—	No	—	—	No
PRICING & AVAILABILITY Purchase price of basic system, \$	46,200	30,000	6,090, 8,030	9,800	49,000 (256K bytes)
Purchase price of memory module, \$	2,500	—	—	—	15,000 (256K bytes)
Monthly maint. price of basic system, \$	364	3,000	—	—	340
Discounts available	—	—	Blanket, Staircase	Blanket, Staircase	Volume
Date of first U.S. delivery	1981	December 1980	March 1980	January 1981	February 1980
Number installed to date	NA	NA	500, 1000	NA	NA
COMMENTS			Point 4 has device handlers to support many peripherals not supplied by Point 4, processors include virtual front panels, self-test diagnostics, chassis, power supply	Point 4 has device handlers to support many peripherals not supplied by Point 4, processors include virtual front panels, self-test diagnostics, chassis, power supply	Protocols supported include most IBM, Univac, Honeywell and ICL

**Communications Capabilities of
Minicomputers and Small Business Computers**

MANUFACTURER & MODEL	Prime 250	Prime 450	Prime 550	Prime 650	Prime 750
MAIN STORAGE Min./Max. capacity, words or bytes	512K/1M bytes	256K/1024K bytes	512K/2048K bytes	512K/2048K bytes	512K/8192K bytes
NO. WORKSTATIONS CONNECTABLE	16	32	63	63	63
COMMUNICATIONS Maximum no. of lines	18	Async. (32); Sync (4)	Async. (63); Sync (8)	Async. (63); Sync (8)	Async. (63); Sync (8)
Synchronous	9600 bps	Std.; to 56K bps	Std.; to 56K bps	Std.; to 56K bps	Std.; to 56K bps
Asynchronous	9600 bps	Std.; to 9600 bps	Std.; to 9600 bps	Std.; to 9600 bps	Std.; to 9600 bps
Protocols supported	See Comments	HASP, 2780/3780	HASP, 2780/3780	HASP, 2780/3780	HASP, 2780/3780
Network architecture supported	Primenet	Primenet X.25	Primenet X.25	Primenet X.25	Primenet X.25
RJE terminals emulated	2780/3780, HASP	HASP, 2780/3780	HASP, 2780/3780	HASP, 2780/3780	HASP, 2780/3780
IBM 3270 emulation	No	Emulate & support	Emulate & support	Emulate & support	Emulate & support
PRICING & AVAILABILITY Purchase price of basic system, \$	59,500 (512K bytes)	65,000 to 73,000	80,000	105,000	130,000 to 149,000
Purchase price of memory module, \$	15,000 (256K bytes)	—	40,000 (1M bytes)	40,000 (1M byte)	40,000 (1M byte)
Monthly maint. price of basic system, \$	460	500 to 590	578	685	785 to 965
Discounts available	Volume	Volume	Volume	Volume	Volume
Date of first U.S. delivery	February 1980	1979	1979	1979	1979
Number installed to date	NA	NA	NA	NA	NA
COMMENTS	Protocols supported include most IBM, Univac, Honeywell and ICL	Virtual memory management system permits addressing up to 32M bytes per user; 2K-byte cache memory std.; 2 to 1 memory interleaving std.	Virtual memory management system permits addressing up to 32M bytes per user; 2K-byte cache memory std.; 2 to 1 memory interleaving std.	Virtual memory management system permits addressing up to 32M bytes per user; 2K-byte cache memory std.; 2 to 1 memory interleaving std.	Virtual memory management system permits addressing up to 32M bytes per user; 16K-byte cache memory std.; 2 to 1 memory interleaving std.

MANUFACTURER & MODEL	Prime 1000	Prime 5000	Quodata Q 620	Quodata Q 850	Quodata Q 970
MAIN STORAGE Min./Max. capacity, words or bytes	512K/8M bytes	1M/8M bytes	192K/256K bytes	256K bytes	512K/2M bytes
NO. WORKSTATIONS CONNECTABLE	63	63	16	64	128
COMMUNICATIONS Maximum no. of lines	20	45	32	63	63
Synchronous	—	—	Optional	Optional	Optional
Asynchronous	—	—	Standard	Std.; to 9600 bps	Std.; to 9600 bps
Protocols supported	HASP II, RJE, X.25	HASP II, RJE, X.25	Bisync, SDLC	Bisync, SDLC	Bisync, SDLC
Network architecture supported	PRIMENET	PRIMENET	DECnet	DECnet	DECnet
RJE terminals emulated	—	—	3780, HASP	3780, HASP	3780, HASP
IBM 3270 emulation	—	—	Yes	Yes	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	118,000	296,200	36,000	88,000	141,000
Purchase price of memory module, \$	—	—	—	—	—
Monthly maint. price of basic system, \$	—	—	—	—	—
Discounts available	—	—	—	—	—
Date of first U.S. delivery	1979	1979	1979	1973	1975
Number installed to date	NA	NA	25	Over 50	Over 50
COMMENTS			Word processing and data management available as options	See Q 970	Data management and word processing specifically designed for educational institutions, government entities, and non-profit organizations

**Communications Capabilities of
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MANUFACTURER & MODEL	Raytheon RDS-7500	Rolm MSE/800	Sperry Univac V77-200	Sperry Univac V77-400	Sperry Univac V77-500
MAIN STORAGE Min./Max. capacity, words or bytes	32K/128K words	256K/2048K words	8K/32K words	8K/1024K words	64K/512K words
NO. WORKSTATIONS CONNECTABLE	—	128	128	128	128
COMMUNICATIONS Maximum no. of lines	128	128	128	128	128
Synchronous	Standard (128)	No	50KB	50KB	50KB
Asynchronous	Standard (128)	Opt.; 19.2K bps	9600 bps	9600 bps	9600 bps
Protocols supported	PARS, Bisync, SDLC	None	UDLC/SDLC, bisync	UDLC/SDLC, bisync	UDLC, SDLC, bisync
Network architecture supported	SNA	—	HASP + 1004	HASP + 1004	Univac DCA
RJE terminals emulated	—	—	—	—	HASP + 1004
IBM 3270 emulation	Yes	No	—	SDLC/BISYNC	SDLC/BISYNC
PRICING & AVAILABILITY Purchase price of basic system, \$	17,100 (32K MOS)	268,100	5,350 (8K words)	7,850 (8K words)	29,500 (64K words)
Purchase price of memory module, \$	—	29,900 (256K bytes)	1,350 (8K words)	1,350 (8K words)	9,450 (128K words)
Monthly maint. price of basic system, \$	—	—	—	—	—
Discounts available	—	OEM, quantity	—	—	—
Date of first U.S. delivery	1980	December 1981	NA	NA	December 1980
Number installed to date	NA	NA	NA	NA	NA
COMMENTS	Multiprocessing system capability	I/O rate for BMC is 16.16M bps (input), 14.54M bps (output); for DMA is 2.27M bps (input) 1.3M bps (output)			Price includes CRT console terminal; field-upgradeable to a V77-700 and V77-800

MANUFACTURER & MODEL	Sperry Univac V77-600	Sperry Univac V77-700	Sperry Univac V77-800	STC Systems Inc. System 4000
MAIN STORAGE Min./Max. capacity, words or bytes	16K/1024K words	128K/1024K words	64K/1024K words	64K bytes
NO. WORKSTATIONS CONNECTABLE	128	128	128	3
COMMUNICATIONS Maximum no. of lines	128	128	128	Unlimited
Synchronous	50KB	50KB	50KB	Opt.; to 9600 bps
Asynchronous	9600 bps	9600 bps	9600 bps	Opt.; to 1200 bps
Protocols supported	UDLC/SDLC, bisync	UDLC, SDLC, bisync	UDLC/SDLC, bisync	Bisync
Network architecture supported	Univac DCA	Univac DCA	Univac DCA	—
RJE terminals emulated	HASP + 1004	HASP + 1004	HASP + 1004	2780/3780
IBM 3270 emulation	SDLC/BISYNC	SDLC/BISYNC	SDLC/BISYNC	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	13,950 (16K words)	36,100 (128K words)	38,500 (128K words)	34,900
Purchase price of memory module, \$	2,900 (16K words)	9,450 (128K words)	9,450 (128K words)	3,500 (32K)
Monthly maint. price of basic system, \$	—	—	—	345
Discounts available	—	—	—	NA
Date of first U.S. delivery	December 1976	December 1980	July 1979	1973
Number installed to date	NA	NA	NA	125
COMMENTS		Price includes CRT console terminal; field-upgradeable to a V77-800		System price includes all hardware, software, installation, training, and maintenance (1 year on software, 90 days on hardware)

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MANUFACTURER & MODEL	STC Systems Inc. System 5000	Stratmar Business Solutions STRAT TEXT	Stratmar Business Solutions SUPERVISOR II	Tandem Computers T16/1403
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	64K/512K bytes 40 Unlimited Opt.; to 9600 bps Opt.; to 1200 bps Bisync — 2780/3780 Yes 51,000 3,500 (32K) 435 NA 1974 125 System price includes all hardware, software, installation, training, and maintenance (1 year on software, 90 days on hardware)	64K/256K 16 16 Optional Standard Async, bisync X.25 2780/3780 No 22,375 2,310 (32K) 198 Quantity June 1980 1 Software maint. provided by Stratmar; hardware maint. provided by Data General	64K/256K 16 16 Optional Standard Async, bisync X.25 2780/3780 No 28,375 2,310 (32K) 198 Quantity January 1980 2 Software maint. provided by Stratmar; hardware maint. provided by Data General	384K/2M 256 256 Opt.; to 80K bps Opt.; 50-19.2K bps — NCP 2780/3780, 360/370 — 22,000 7,200 136 — May 1976 250 + (processors) Multiprocessor system containing from 2 to 16 CPU's for fault-tolerance; all system components are dual-ported; CPU's have dual buses

MANUFACTURER & MODEL	Technico T.I. 32-8H	Technico T.I. 32-14H	Texas Instruments DS990 Series Model 2	Texas Instruments DS990 Series Model 4
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	192K/256K bytes 18 18 Opt.; to 19,200 bps Opt.; to 19,200 bps Opt.; 2780/3780 Optional Optional Optional Optional 16,999 1,000 (32K) 1 percent of purchase OEM, distrib. September 1980 30 Multiprocessor design uses two 16-bit microprocessors; CRT models (IBM, DEC, ADM3A, Beehive, Datamedia) may be intermixed within the same system	192K/256K bytes 18 18 Opt.; to 19,200 bps Opt.; to 19,200 bps Opt.; 2780/3780 Optional Optional Optional Optional 19,999 1,000 (32K) 1 percent of purchase OEM, distrib. December 1980 10 Multiprocessor design uses two 16-bit microprocessors; CRT models (IBM, DEC, ADM3A, Beehive, Datamedia) may be intermixed within the same system	64K bytes 2 Std.; 3/Opt.; 16+ Std.; 9600 bps Std.; 9600 bps Bisync — No IBM 2780/3780 No 12,995 — 143 Contact vendor June 1979 NA NA	128K/2048K bytes 39 Varies Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Bisync — 2780/3780 3270 IDC 26,500 (H/W only) 2,000 (64K) 285 Quantity NA NA

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MANUFACTURER & MODEL	Texas Instruments DS990 Series Model 6	Texas Instruments DS990 Series Model 8	Texas Instrument DS990 Series Model 20	Texas Instrument DS990 Series Model 30
MAIN STORAGE Min./Max. capacity, words or bytes	128K/2048K bytes	128K/2048K bytes	256K/2048K bytes	256K/2048K bytes
NO. WORKSTATIONS CONNECTABLE	39	39	39	39
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	Varies Opt.: 75 to 9600 bps Asynchronous Bisync — 2780/3780 3270 IDC	Varies Opt.: 75 to 9600 bps Opt.: 75 to 9600 bps Async, bisync NA 2780/3780 Yes	Varies Opt.: 75 to 9600 bps Opt.: 75 to 9600 bps Async, bisync NA 2780/3780 Yes	Varies Opt.: 75 to 9600 bps Opt.: 75 to 9600 bps Async, bisync NA 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	44,250 (H/W only) 3,250 (128K) 333 Quantity	52,750 (H/W only) 2,000 (64K) 500 Quantity	75,750 (H/W only) 3,500 (128K) 625 Quantity	86,000 (H/W only) 3,500 (128K) 645 Quantity
Date of first U.S. delivery Number installed to date	NA NA	NA NA	NA NA	NA NA
COMMENTS			Additional worksta- tion includes dual controller	Additional worksta- tion includes dual controller

MANUFACTURER & MODEL	Ultimate 5303E	Ultimate 4303B	Ultimate 4303C	Ultimate 4303D
MAIN STORAGE Min./Max. capacity, words or bytes	32K/1024K words	32K/1024K words	32K/1024K words	32K/1024K words
NO. WORKSTATIONS CONNECTABLE	64	64	64	64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	64 Opt.: 9600 bps Std.: 9600 bps Bisync, 2780/3780 — 2780/3780 No	64 Opt.: 9600 bps Std.: 9600 bps Bisync, 2780/3780 — 2780/3780 No	64 Opt.: 9600 bps Std.: 9600 bps Bisync, 2780/3780 — 2780/3780 No	64 Opt.: 9600 bps Std.: 9600 bps Bisync, 2780/3780 — 2780/3780 No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	98,000 6,500 (64K) 740 —	39,400 6,500 (64K) 465 —	60,400 6,500 (64K) 555 —	79,000 6,500 (64K) 640 —
Date of first U.S. delivery Number installed to date	April 1979 235 (all sys.)	April 1979 235 (all sys.)	April 1979 235 (all sys.)	April 1979 235 (all sys.)
COMMENTS	Price includes OS, 288M-byte disk drive, 4 ports, 64K bytes of main memory, an 800-bpi magnetic tape drive, and cache memory	Price includes OS, 80/16MB-disk drive, 4 ports, and 64K bytes of main memory	Price includes OS, 80/16MB-disk drive, 4 ports, 64K bytes of main memory, and an 800-bpi magnetic tape drive	Price includes OS, 288M-byte disk drive, 4 ports, 64K bytes of main memory, and an 800-bpi magnetic tape drive

Communications Capabilities of Minicomputers and Small Business Computers

Manufacturers of minicomputers and small business computers constitute a prominent group of suppliers who are actively pursuing the communications processor market. Virtually every currently marketed small computer system is now equipped with some sort of data communications capability, ranging from simple batch terminal emulation to sophisticated communication software and hardware packages that permit it to serve effectively as a complete communications processing product. Interfacing with mainframe equipment and/or other small computers permits these systems to perform an endless variety of communication processing functions, including front-end processing, remote concentration, message switching, network processing, and terminal control. The small computer system's internal processing and storage capabilities enable it to do some data processing locally as well as handling code translation, editing and control functions in connection with the data communications activities. Whether utilized as a dedicated communications processor or as an applications processor that performs some communications functions, a minicomputer or small business computer can be used to form a basic building block of a data communication network.

In general, the level of sophistication of the data communications capabilities of a particular system can be assessed by the variety and number of communications features—both hardware and software—it supports. Naturally, not every small system is supported for all types of functions to the same extent.

Support may be provided only for basic batch terminal communications. Remote job entry products and procedures established in the 1960's by IBM, Burroughs, Control Data, Honeywell, and Univac have become de facto standards for batch data communications and it is not uncommon on small computer systems for a vendor to provide a variety of interchangeable software packages with which the user can emulate IBM's 2780 or 3780 Data Communications Terminal or its 360/20 HASP Multileaving workstation, Burroughs' TC Series terminals, Control Data's 200 User Terminal, Honeywell's GERTS, or Univac's 1004 or DCT 2000.

More extensive communications capabilities are represented by those systems that can support multiple workstations, enabling the system's processor to function as an intelligent clustered terminal controller. Some systems provide emulation packages for popular interactive mainframer-produced terminals, such as the IBM 3270 Information Display System, while others leave the management of the interaction between the workstations and a remote host to be programmed by the user.

Systems that can handle multiple communication lines, support a variety of communications protocols, and serve in any of several communications capacities are available from a number of minicomputer and small business computer vendors. For example, Data General's Nova

A concise description of the communications capabilities currently available on small computer systems. Included are comparison charts featuring 167 models offered by 52 different manufacturers that have been selected by Datapro as having substantial communications processing capabilities.

and Eclipse minicomputers have been continuously enhanced with communications hardware and software to provide for a wide range of communications applications, and can be configured as channel-attached front-end processors, remote communications concentrators, or distributed processing systems. And Digital Equipment's PDP-11 family supports virtually all modes and types of data communications protocols, and facilities, and provides over twenty different line controller and interface sets to handle local, remote and interprocessor communications.

When not available directly through the manufacturer, communications features are often added by OEMs, distributors, and similar third party organizations. And, of course, because the equipment is essentially a computer, the user can program whatever special requirements are not supported by the vendor.

The Comparison Charts

The comparison chart data presented in this report was gathered as a part of Datapro's preparation of the 1980 versions of "All About Minicomputers" and "All About Small Business Computers", which appear in DATAPRO 70, and "Minicomputer Specifications", and "Small Business Computer Specifications", which appear in DATAPRO REPORTS ON MINICOMPUTERS. As the title of the present report suggests, the broad-based information presented in the "All About..." reports has been condensed and edited, to enable us to zero in on those products which provide significant data communications features and to concentrate on just those capabilities. All models selected for inclusion in this report were judged to have substantial communications capabilities using several criteria. For example, systems to which at least 16 communications lines can be attached or that provide interprocessor communications functions under major network architectures have been included.

The resulting comparison charts can be effectively used to conduct a first-level search of minicomputers and small business computers that meet your communications requirements. For example, if you are looking for a system that can support high speed data transmission to a remote host, quickly scan the charts and jot down those vendors/models which provide the range of speeds you require. Or, if you know that your applications require a certain minimum main memory capacity for off-line processing, and you are looking for a system that can also provide support for interactive IBM 3270-type data communica- ➤

Communications Capabilities of Minicomputers and Small Business Computers

➤ tions, a complete list of those systems that satisfy both requirements can easily be made.

Once your search has narrowed down the manufacturers and model numbers of equipment that satisfies your needs, you may wish to know full details about the computers you've selected. If so, simply turn to the Index of this service and locate each system's detailed report, which contains complete information on the communications capabilities of the system, including our analysis of how it fits into data processing environment from a data communications point of view and pricing details of all communications hardware and software features offered.

Whenever you seek more information on a system that is not covered in an in-depth report in DATAPRO REPORTS ON DATA COMMUNICATIONS, please contact us directly via the Inquiry Service and get the facts you need by telephone or mail. (This service is fully described behind the Inquiry Service index tab.)

Comparison Chart Entries

The accompanying comparison charts summarize the key characteristics of the data communications functions of 167 commercially available minicomputers and small business computers from 52 vendors. The information presented in the charts was supplied by the manufacturers and suppliers during November and December 1979. The cooperation of the vendors who provided this information to the Datapro staff for these reports is gratefully acknowledged.

Main Storage

Our comparison charts show the amount of main storage available for each computer in terms of the *minimum capacity* and *maximum capacity*, expressed in words or bytes.

The amount of internal storage is one of the most significant characteristics in appraising the power of any computer. The amount of productive processing that a computer can perform during any one run is largely determined by the number of instructions and/or operands it can hold. It is important to choose the right storage capacity; for nonmultiprogramming systems, that usually means enough storage to hold your largest program and all associated subroutines and data, but not too much more than that. It's also wise to make sure that your computer's main storage capacity can be expanded if necessary, preferably by simply plugging in an additional storage module.

Number of Workstations Connectable

Another very important consideration for many users who are considering the acquisition of a minicomputer or small business computer for use in a communications processing environment is the number of workstations it can support. Workstations, in this case, can mean most any type of

device, whether remotely or locally connected, that can input and/or receive data from the minicomputer or small business computer. When the system is used in a business environment, for instance, the workstation would normally be a data processing device or terminal, but in a manufacturing or distribution environment the workstation could be a sensor or transmission unit that simply transmits signals back to the system for processing.

Communications Capabilities

Maximum no. of lines indicates how many communications lines can be physically connected to a particular system. The types of lines are specified in the next two entries. The entries in these three categories represent the raw outer limits of line number, type, and speed provided by each system.

To utilize this information properly, the reader must take into consideration two important factors. First, the line mix (the number of lines of each type and speed) and the resource mix (the number and type of workstations, peripherals, and other facilities) determine the actual practical limits of the system. For example, the number of high speed communications lines that are physically attachable to a processor is generally much less than the number of low or medium speed lines. Secondly, the throughput capabilities of the system vary radically, depending not only on the physical configuration of the hardware but also on the system's software requirements. Even if the system is configured within recommended physical bounds, a heavy processing load can reduce throughput to below an acceptable level.

Synchronous and *asynchronous* have entries of standard, optional, or no, indicating their availability, and also a notation as to the speed of each line in bits per second (bps). Most entries are of the type "to 4800 bps," indicating one or more lines supporting transmission up to a maximum of 4800 bps.

Protocols supported indicates the type of communication protocols accommodated by hardware and software for the model.

Network architecture supported indicates the communications network architecture support by this model. Entries may include, for example, Burroughs NDL, DEC's DECnet, or IBM's SNA.

RJE terminals emulated indicates whether there is software available from the vendor for this system to enable it to function as a "look-alike" for remote job entry terminals. The terminals for which support is provided are indicated.

IBM 3270 emulation is listed as a separate entry as a result of an increasing amount of interest from our users concerning the emulation of the IBM 3270 Information Display System. ➤

Communications Capabilities of Minicomputers and Small Business Computers

▷ Pricing and Availability

Purchase price of basic system shows the minimum purchase price of the system. In the case of a system in which each component is sold as a separate item, the comparison chart shows the price of the CPU, power supply, front panel, and minimum memory in the chassis. In the case of a packaged system, the price includes all standard components and facilities of the entry-level model. For many of the systems listed, itemized pricing, including all communications hardware and software features, is provided in the system's detailed report, which you can find using the Index of this service. If the system is not covered in an in-depth report, detailed pricing can be obtained through the Datapro Inquiry Service or directly from the vendor.

Purchase price of memory module stipulates the costs of various sizes (when available) of memory increments, with the actual sizes in parentheses.

Monthly maintenance price of basic system shows the maintenance costs of the basic system as described above.

If you'll need two or more systems, it's worth noting that some of the manufacturers offer sizeable discounts from their list prices on orders for multiple computers. Discounts of up to 40 percent are not unusual on large orders. *Discounts available* indicates the types of discounts offered by the vendor for each model. This entry will vary by model for many manufacturers with multiple lines of systems.

Date of first U.S. delivery tells when the first production models of each system were delivered (or are scheduled to be delivered) to customers in the United States.

Number installed to date shows how many systems of each type had been delivered to customers as of approximately November, 1979. Nearly all of the figures were supplied by the manufacturers themselves, and a number of companies chose not to release this information.

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, or applications.

Suppliers

Listed below, for your convenience in obtaining additional information, are the full names, addresses, and telephone numbers of the 52 suppliers whose products are listed in the comparison charts that follow.

Applied Digital Communications, 214 Flynn Ave., Moorestown, New Jersey 08057. Telephone (609) 234-3666.

Applied Systems Corporation, 26401 Harper Avenue, St. Clair Shores, Michigan 48081. Telephone (313) 779-8700.

Basic/Four Corporation, 14101 Myford St. Road, Tustin, California 92680. Telephone (714) 731-5100.

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

Burroughs Corporation, Burroughs Place, Detroit, Michigan 48232. Telephone (313) 972-7000.

Business Controls Corporation, 507 Boulevard, Elmwood Park, New Jersey 07407. Telephone (201) 791-7661.

Century Computer Corporation, 2339 Stanwell Circle, Concord, California 94520. Telephone (415) 798-8000.

Compal Computer Systems, 6300 Variel Avenue, Suite E, Woodland Hills, California 91367. Telephone (213) 992-4425.

Complete Computer Systems, 159 Gibraltar Road, Horsham, Pennsylvania 19044. Telephone (215) 441-4200.

CompuData Systems, Inc., 772 East State Street, Westport, Connecticut 06880. Telephone (203) 226-4791.

Computer Automation, Inc., 18651 Von Karman Avenue, Irvine, California 92713. Telephone (714) 833-8830.

Computer Data Access, Inc. (CDA), 1373 Broad Street, Clinton, New Jersey 07011. Telephone (201) 473-4700.

Computer Design Systems, Inc., 8085 Wayzata Boulevard, Minneapolis, Minnesota 55426. Telephone (612) 545-2855.

Computer Hardware, Inc., 4111 North Freeway Boulevard, Sacramento, California 95834. Telephone (916) 929-2020.

Computer Horizons Corporation, 747 Third Avenue, New York, New York 10017. Telephone (212) 371-9600.

Computer Interactions, Inc., P.O. Box 1354, Roslyn Heights, New York 11577. Telephone (516) 365-9833.

Computer Talk Inc., P.O. Box 100, Idledale, Colorado 80453. Telephone (303) 697-5485.

Data Communications Corp., Minicomputer Division, 3000 Directors Row, Memphis, Tennessee 38131. Telephone (901) 345-3544.

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

Datapoint Corporation, 9725 Datapoint Drive, San Antonio, Texas 78284. Telephone (512) 690-7000.

Digital Computer Controls, Inc., 221 Rosecrans Avenue, El Segundo, California 90245. Telephone (213) 644-9237.

Digital Equipment Corporation (DEC), Parker Street, PK 3-2, Maynard, Massachusetts 01754. Telephone (617) 897-5111.

Digital Scientific Corporation, 11455 Sorrento Valley Road, San Diego, California 92121. Telephone (714) 453-6050.

Digital Systems Corporation, P.O. Box 158, Walkersville, Maryland 21793. Telephone (301) 845-4141.

Dimis, Inc., 1060 Highway 35, Middletown, New Jersey 07748. Telephone (201) 671-1011.

Display Data Corporation, Executive Plaza IV, Hunt Valley, Maryland 21031. Telephone (301) 667-9211.

Distribution Management Systems Inc., 11 DeAngelo Drive, Bedford, Massachusetts 01730. Telephone (617) 275-2000. ▷

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▷ **Harris Corporation, Computer Systems Division**, 2101 W. Cypress Creek Road, Fort Lauderdale, Florida 33309. Telephone (305) 974-1700.

Hewlett-Packard, GSD Division, 19447 Pruneridge Avenue, Cupertino, California 95014. Telephone (408) 725-8111.

Hewlett-Packard, Data Systems Division, 11000 Wolfe Road, Cupertino, California 95014. Telephone (408) 257-7000.

Honeywell Information Systems, Inc., Small/Medium Information Systems Division, 200 Smith Street, Waltham, Massachusetts 01821. Telephone (617) 890-8400.

IBM Corporation, General Systems Division, P.O. Box 2150, Atlanta, Georgia 30301. Telephone (404) 256-7000.

IBM Corporation, Data Processing Division, 1133 West Chester Avenue, White Plains, New York 10604. Telephone (914) 696-1000.

Infomark, 9 North Bacton Hill Road, Frazer, Pennsylvania 19355. Telephone (215) 647-8685.

Jacquard Systems, 1639 11th Street, Santa Monica, California 90404. Telephone (213) 450-6784.

Melcom Business Systems, Inc., 2200 West Artesia Boulevard, Suite 101, Compton, California 90220. Telephone (213) 979-6055.

Microdata Corporation, 17481 Red Hill Avenue, Irvine, California 92705. Telephone (714) 540-8341.

Modular Computer Systems, Inc., 1650 West McNab Road, Fort Lauderdale, Florida 33310. Telephone (305) 974-1380.

Mylee Digital Sciences, Inc., 155 Weldon Parkway, Maryland Heights, Missouri 63043. Telephone (314) 567-3420.

NCR Corporation, Main and K Streets, Dayton, Ohio 45479. Telephone (513) 449-2000.

New England Digital Corporation, Main Street, Norwich, Vermont 05055. Telephone (802) 649-5183.

Northrop Data Systems, 1160 Sandhill Avenue, Carson, California 90746. Telephone (213) 637-1533.

Point 4 Computer Corporation, 2659 McCabe Way, Irvine, California 92714. Telephone (714) 556-4242.

Prime Computer Inc., 40 Walnut Street, Wellesley Hills, Massachusetts 02181. Telephone (617) 237-6990.

Q1 Corporation, 751 Second Avenue, New York, New York 10017. Telephone (212) 751-8410.

Quodata Corporation, 196 Trumbull Street, Hartford, Connecticut 06103. Telephone (203) 728-6777.

Rolm Corporation, 4900 Old Ironsides Drive, Santa Clara, California 95050. Telephone (408) 988-2900.

Sperry Univac Minicomputer Operations, P.O. Box C-19504, 2722 Michelson Drive, Irvine, California 92713. Telephone (714) 833-2400.

STC Systems, Inc., Nine Brook Avenue, Maywood, New Jersey 07607. Telephone (201) 845-0500.

Systems Engineering Laboratories, Inc., 6901 West Sunrise Boulevard, Fort Lauderdale, Florida 33313. Telephone (305) 587-2900.

Tal-Star Computer Systems, Inc., P.O. Box T-1000, Princeton Junction, New Jersey 08550. Telephone (609) 799-1111.

Tandem Computers, Inc., 19333 Vallco Parkway, Cupertino, California 95014. Telephone (408) 996-6000.

Texas Instruments, Incorporated, P.O. Box 2909, Austin, Texas 78769. Telephone (512) 250-7309.

Wang Laboratories, Inc., 836 North Street, Tewksbury, Massachusetts 08176. Telephone (617) 851-4111. ▷

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Applied Digital Communications 103	Applied Digital Communications 202	Applied Digital Communications 401	Applied Systems Corporation ASC/80	Basic Four Corporation Model 610
MAIN STORAGE Min./Max. capacity, words or bytes	64K bytes	64K/256K bytes	64K/256K bytes	4K/128K words	64K/192K bytes
NO. WORKSTATIONS CONNECTABLE	—	—	—	—	16
COMMUNICATIONS Maximum no. of lines	256	64	256	16, 32	16
Synchronous	Optional	No	Optional	Opt.; to 50K bps	Opt.; 9600 bps
Asynchronous	Optional	No	Optional	Opt.; to 9600 bps	Std.; 9600 bps
Protocols supported	Bisync	None	Bisync	IBM-Bisync	Bisync
Network architecture supported	None	None	—	DECnet (RPO)	Business Info. Net.
RJE terminals emulated	None	None	—	—	2780/3780
IBM 3270 emulation	No	No	—	—	No
PRICING & AVAILABILITY Purchase price of basic system, \$	22,645	31,500	49,300	1,900	51,400
Purchase price of memory module, \$	—	—	—	250 (8K bytes)	2,240 (32K bytes)
Monthly maint. price of basic system, \$	—	—	—	—	424
Discounts available	—	—	—	—	—
Date of first U.S. delivery	1978	1978	1978	1977	1978
Number installed to date	NA	NA	NA	NA	9000 (all models)
COMMENTS	Accounting system	Accounting system	Acctg. software and NC tape verification system, NC tape generation, NC tape translation, inc. plotter	Modular computer system designed for general applications and special business, communications, and real-time/control operations	Price includes 64KB memory, 35MB disc drive & pack w/op. sys., 160 cps printer, and one VDT (desk/worktable)

MANUFACTURER & MODEL	Basic Four Corporation Model 730	BTI 5000/ES	BTI 5000	BTI 8000	Burroughs B720/B730
MAIN STORAGE Min./Max. capacity, words or bytes	96K/256K bytes	64K bytes	64K bytes	256K/8M bytes	32K/96K bytes
NO. WORKSTATIONS CONNECTABLE	32	32	32	128 (recommended maximum)	9
COMMUNICATIONS Maximum no. of lines	32	4 std.; 32 opt.	8 std.; 32 opt.	8 std.; 128 opt.	22
Synchronous	Opt.; 9600 bps	No	No	No	To 9600 bps
Asynchronous	Std.; 9600 bps	9600 bps	9600 bps	19.2 bps	To 9600 bps
Protocols supported	Bisync	User-programmable	User-programmable	User-programmable	—
Network architecture supported	Business Info. Net.	NA	NA	NA	—
RJE terminals emulated	2780/3780	NA	NA	NA	IBM 3780
IBM 3270 emulation	No	No	No	No	No
PRICING & AVAILABILITY Purchase price of basic system, \$	95,100	29,950	38,950	86,750	Contact vendor
Purchase price of memory module, \$	2,240 (32K bytes)	—	—	9,000 (128K bytes)	—
Monthly maint. price of basic system, \$	766	345	345	650	—
Discounts available	—	Quantity	Quantity	Quantity	—
Date of first U.S. delivery	1978	9/79	3/78	4/80	3/73
Number installed to date	9000 (all models)	750 (all models)	750 (all models)	—	Over 3000
COMMENTS	Price includes 96KB memory, two 75MB disk drives & packs w/op. sys., 300 lpm printer and four VDT's (four desk/worktables)	Handles up to 32 user terminals concurrently	Handles up to 32 user terminals concurrently	Packaged system for interactive and multi-stream batch workload; variable resource bus architecture accommodates up to 8 processors, together with multiple memory modules and peripheral processors	

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Burroughs B1860 CMS	Burroughs B1885	Burroughs B1900	Business Controls System 80/8	Business Controls System 8/11
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	64K/512K bytes 16	524K/1,048K bytes 16	128K/2M bytes 32	32K/256K bytes —	64K/1M bytes —
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	8 std.; 24 opt. Opt.; 50,000 bps Opt.; 9600 bps Bisync, BDLC BNA HASP —	32 Opt.; 50,000 bps Opt.; 9600 bps Bisync, BDLC BNA HASP —	32 Opt.; to 50,000 bps Opt.; to 9600 bps BDLC, bisync BNS HASP No	16 Opt.; to 4800 bps Opt.; to 9600 bps IBM 2780 — —	64 Opt.; to 50K bps Opt.; to 9600 bps Bisync; SDLC DECnet — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	90,000 7,000 (262K bytes) 485 — Second qtr. 1977 NA	133,000 7,000 (262K bytes) 600 — June 1978 NA	71,500 5,750 (262K bytes) 410 — First qtr. 1980 NA	29,990 — — — 1971 NA	40,000 — — — 1976 120
COMMENTS	150 cpm card punch, 300-1400 cpm card readers opt.				Supports all DEC operating systems, sorts, etc.

MANUFACTURER & MODEL	Century Computer 700	Century Computer 900	Compal 9000	Complete Computer Systems # 10	Complete Computer Systems # 11
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	96K/256K bytes 20	160K/512K bytes 32	64K/128K bytes 16	64K/256K bytes 16	64K/256K bytes 16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	20 Opt.; to 9600 bps 19,200 bps Bisync No IBM 3780 No	32 Opt.; to 9600 bps 19,200 bps Bisync No IBM 3780 No	16 Opt.; 1200-9600 bps Std.; 110-9600 bps Async, bisync 2780/3780 No	16 Opt.; to 9600 bps Opt.; to 9600 bps Async, bisync IBM 360/370 Yes —	16 Opt.; to 9600 bps Opt.; to 9600 bps Async, bisync IBM 360/370 RJE 80 (2780/3780) Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	34,000 Contact vendor — OEM 6/75 NA	42,500 Contact vendor — OEM 6/75 NA	19,995 1,850 (32K bytes) 167 — 12/79 NA	30,940 4,000 (64K bytes) 280 Govt., 10% 1974 (Nova 2/10) NA	33,605 4,000 (64K bytes) 310 Govt., 10% 1974 (Nova 2/10) NA
COMMENTS	Additional work- stations available	Additional work- stations available.	Price includes turnkey computer systems with one application software package	Property manage- ment, rent and maintenance control, multi-entity financials	CREATE operates in shared-logic mode with business appli- cation; word proc- essing with variable text fill-in and

**Communications Capabilities of
Minicomputers and Small Business Computers**

MANUFACTURER & MODEL	Complete Computer Systems # 12	Complete Computer Systems # 14	Complete Computer Systems # 26	Complete Computer Systems # 22	Computata Systems (DEC 300 Series)
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	64K/256K bytes 16 16 Opt.; to 9600 bps Opt.; to 9600 bps Async, bisync IBM 360/370 RJE 80 (2780/3780) Yes 33,825 4,000 (64K bytes) 325 Govt., 10% 1974 (Nova 2/10) NA Inventory control incl. LIFO, FIFO, avg. lot ctrl., serial no. ctrl., bulk qty.	64K/256K bytes 16 Opt.; to 9600 bps Opt.; to 9600 bps Bisync IBM 360/370 RJE 80 (2780/3780) Yes 42,275 4,000 (64K bytes) 375 1976 NA HMO membership control, mail-order prospect control; CREATE report generator	128K/256K bytes 16 Opt.; to 9600 bps Opt.; to 9600 bps Bisync IBM 360/370 RJE 80 (2780/3780) Yes 77,495 4,000 (64K bytes) — Govt., 10% 1976 NA Mfg. and construction systems oriented to job costing estimating, projected completion cost, labor, cost ctr efficiency	96K/256K bytes 16 Opt.; to 9600 bps Opt.; to 9600 bps Bisync IBM 360/370 RJE 80 (2780/3780) Yes 63,605 4,000 (64K bytes) — Govt., 10% 1976 NA CREATE operates in shared-logic mode with business appli- cation, word proc- essing with variable text fill-in and preprinted forms fill-in	128K/256K bytes 8 32 Opt.; 2400 bps Std.; 9600 bps Bisync None 2780 No 26,000 — — Quantity 1975 200+ —

MANUFACTURER & MODEL	Computata Systems (DEC 500 Series)	Computata Systems (IBM Series/1)	Computer Automation Syfa System 1000	CDA, Inc. The Parts Handler DG MP/100 Series	CDA, Inc. The Parts Handler DG Nova Series
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date COMMENTS	128K/512K bytes 32 64 Opt.; 2400 bps Std.; 9600 bps Bisync DECnet 2780 Yes 60,000 — — Quantity 1976 30+ —	64K/256K bytes 32 256 Opt.; 2400 bps Std.; 9600 bps — None None No 23,000 — — — 1977 30+ —	64K/304K bytes 32 34 Opt.; 9600 bps Std.; 9600 bps Bisync, SDLC SNA IBM 3780, 3790 Optional 102,500 — 840 — 1976 250 Basic configuration includes 128K bytes, 8 port multiplexer, nine slot chassis, power supply, eight CRT's, two 32MB disk, 600 lpm printer, 3780 communications	64K bytes 16 16 Optional (6) Optional (16) Bisync X.25 2780/3780 Yes 26,900 — 175 Quantity 4/79 5 Turnkey systems for automotive parts distribution using Data General package hardware featuring MP/100 CPU; expandable	128K/256K bytes 16 16 Optional (16) Optional (16) Bisync X.25 2780/3780 Yes 54,860 6,000 (128K bytes) 350 Quantity 10/79 1 Turnkey systems for automotive parts distribution using Data General package hardware featuring Nova CPU; expandable

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Computer Design Systems Adviser IV/700	Computer Design Systems Adviser IV/800	Computer Design Systems Adviser IV/900	Computer Design Systems Adviser IV-3160	Computer Design Systems Adviser IV-4240
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	16K/512K words 32	16K/512K words 32	32K/1024K words 128	64K/192K bytes 16	64K/256K bytes 24
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 Opt.: 9600 bps Opt.: 9600 bps 2780, 3780, SDLC SNA-opt. 2780/3780 Optional	32 Opt.: 9600 bps Opt.: 9600 bps 2780, 3780, SDLC SNA-opt. 2780/3780 Optional	128 Opt.: 9600 bps Opt.: 9600 bps 2780, 3780, SDLC SNA-opt. 2780/3780 Optional	16 Opt.: 9600 bps Opt.: 9600 bps Bisync SNA/SDLC 2780/3780 Yes	24 Opt.: 9600 bps Opt.: 9600 bps Bisync SNA/SDLC 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	59,000 (64K) 18,000 (64K) 5,400 Quantity 10/77 NA	82,000 (64K) 18,000 (64K) 5,400 Quantity 10/77 NA	100,000 (64K) 18,000 (64K) 5,400 Quantity 11/78 NA	39,700 Varies 290 Quantity (5) 1976 NA	48,900 Varies 380 Quantity (5) 1977 NA
COMMENTS	Single source responsibility, field upgradable, virtual mem., min. terminal degradation under load, turnkey systems avail., interactive, direct processing system	Single source responsibility, upgradable, virtual degradation, turnkey avail., interactive, direct processing system	Single source responsibility, virtual mem., turnkey, interactive, direct processing system	Single source responsibility for hardware, software, service; pre-processors avail.	Single source responsibility for hardware, software, service; pre-processors avail.

MANUFACTURER & MODEL	Computer Design Systems Adviser IV-5320	Computer Hardware Inc. 2130	Computer Hardware Inc. 3230	Computer Hardware Inc. 4250	Computer Horizons CHC Distribution System
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	64K/320K bytes 32	16K/4M bytes 32	16K/128K bytes 32	8K/2048K bytes 16	16K/248K bytes —
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 Opt.: 9600 bps Opt.: 9600 bps Bisync SNA/SDLC 2780/3780 Yes	32 async.; 4 sync. Opt.: to 9600 bps Opt.: to 9600 bps Bisync NA 2780/3780, 3741 No	32 async.; 4 sync. Opt.: to 9600 bps Opt.: to 9600 bps Bisync NA 2780/3780 No	16 Opt.: 50-9600 bps Opt.: 50-9600 bps Bisync None IBM 2780/3780 Yes	64 Opt.: to 9600 bps Opt.: to 9600 bps ADDCP, DDCMP — — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	59,900 Varies 535 Quantity (5) 1977 NA	32,000 (16K bytes) 1,500 (16K bytes) Contact vendor Contact vendor 6/74 NA	15,000 (16K bytes) 1,500 (16K bytes) Contact vendor Contact vendor 4/76 NA	37,800 2,160 (16K bytes) Contact vendor Contact vendor 1/78 NA	150,000 to 200,000 — — NA NA
COMMENTS	Single source responsible for hardware, software, service; pre-processors avail., field upgradable	Hardware floating-point available	Hardware floating-point available	Price includes 96K bytes of ECC memory, a 10M byte disk cartridge, cassette, CRT, 60 cps printer, DX10 operating system, FORTRAN compiler, sort/merge, and time system application	

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MANUFACTURER & MODEL	Computer Interactions Compro II	Computer Talk Model 400	Computer Talk Model 407	Computer Talk Model 408	Data Communications Corp. DCS
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	32K/64K bytes 16	4K/512K words 256	4K/512K words 256	4K/512K words 256	8K/32K bytes 64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 Opt.; to 9600 bps Opt.; to 2400 bps None Std.; RS232 None No	256 Opt.; 50-9600 bps Opt.; 50-9600 bps Async, bisync, SDLC None Most RJE terminals Yes	256 Opt.; 50-9600 bps Opt.; 50-9600 bps Async, bisync, SDLC None Most RJE terminals Yes	256 Opt.; 50-9600 bps Opt.; 50-9600 bps Async, bisync, SDLC None Most RJE terminals Yes	256 Opt.; to 9600 bps Opt.; to 9600 bps ALL TNA, SNA 2780/3780 Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	35,000 Contact vendor 150 Quantity 2nd qtr. 1972 98	24,950 (4K MOS) 1,100 (4K bytes) 168 Volume 5/75 NA	31,500 (4K MOS) 1,100 (4K bytes) — Volume 1/78 NA	30,500 (4K MOS) 1,100 (4K bytes) — Volume 1/78 NA	50,000 8,000 (256K bytes) — Quantity 3/77 NA
COMMENTS	System has paged memory; can also add word processing OS to convert to WORDPRO II system; introduced in 1977	Storage protection std. by memory partition and opt. by page; price includes CRT, light pen, modem, 1.2M-byte disk, arith. & I/O processors, & battery pack operation	Expanded Model 400 with additional features; disk expanded to 2.5M bytes, 300-lpm x 132 printer and mini-floppy disk for I/O	Expanded Model 400 with additional features; disk expanded to 2.5M bytes, 300-lpm x 132 printer and mini-cassette for I/O	

MANUFACTURER & MODEL	Data Communications Corp. DPS	Data Communications Corp. RTS	Data Communications Corp. TPS	Data General Nova 4C	Data General Nova 4S
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	32K/256K bytes 39	8K/32K bytes 39	96K/256K bytes 39	16K/32K words 64	16K/32K words 64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	256 Opt.; to 50K bps Opt.; to 9600 bps ALL TNA, SNA, X.25 2780/3780 Yes	256 Opt.; to 9600 bps Opt.; to 9600 bps ALL TNA, SNA, X.25 2780/3780 Yes	256 Opt.; to 9600 bps Opt.; to 9600 bps ALL TNA, SNA, X.25 2780/3780 Yes	128 Opt.; (32) 56K bps Opt.; (128) 19,200 bps Bisync, X.25 XODIAC, IBM BSC 2780/3780, HASP II No	128 Opt.; (32) 56K bps Opt.; (128) 19,200 bps Bisync, X.25 XODIAC, IBM BSC 2780/3780, HASP II No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	Contact vendor 8,000 (256K bytes) — Quantity 9/76 NA	25,000 8,000 (256K bytes) — Quantity 3/77 NA	85,000 8,000 (256K bytes) — Quantity NA NA	2,800 (32K bytes) — 45 — NA NA	5,800 (32K bytes) 2,200 (32K bytes) 56 — NA NA
COMMENTS	CPU's include DG Nova 3/D, DG Eclipse S130/S230/S330		CPU's include DG Nova 3/D, DG Eclipse S130/S230/S330		

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Data General Nova 4X	Data General Eclipse C/150	Data General Eclipse C/350	Data General Eclipse M/600	Data General Eclipse S/130
MAIN STORAGE Min./Max. capacity, words or bytes	64K/128K words	64K/512K words	32K/1024K words	32K/1024K words	16K/512K words
NO. WORKSTATIONS CONNECTABLE	64	64	64	64	64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	128 Opt.; (32) 56K bps Opt.; (128) 19,200 bps Bisync, X.25 XODIAC, IBM BSC 2780/3780, HASP II No	— Opt.; 56,000 bps Opt.; 9600 bps Bisync, X.25 X.25 2780/3780, HASP Yes	— Opt.; 56,000 bps Opt.; 9600 bps Bisync, X.25 X.25 2780/3780, HASP Yes	— Opt.; 56,000 bps Opt.; 9600 bps Bisync, X.25 X.25 2780/3780, HASP Yes	— Opt.; 56,000 bps Opt.; 9600 bps Bisync, X.25 X.25 2780/3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	10,400 (128K bytes) 5,000 (128, bytes) 78 —	28,500 (128K bytes) 6,000 (64K bytes) 225 Various types	49,500 (128K bytes) 6,000 (64K MOS) 330 Various types	80,000 (256K bytes) 8,000 (256K bytes) 470 Various types	16,500 (128K bytes) 4,500 (32K core) 105 Various types
Date of first U.S. delivery Number installed to date	NA NA	2/79 100+	10/78 300	4/78 250	2/75 1000+ (all models)
COMMENTS		Includes X.25 Net- working, AZ-text, word processing, ANSI '74, virtual COBOL	Includes virtual COBOL ANSI '74 highest Level 2 im- plementation; std. features include ex- tended floating-point functions, plus a commercial instruc- tion set	Includes virtual COBOL ANSI '74, highest Level 2 im- plementation; I/O processor with 64KB for handling low- speed character- oriented data move- ment	256 56-bit words of writable control store optionally available

MANUFACTURER & MODEL	Data General Eclipse S/140	Datapoint 5500	Datapoint 6000	Datapoint 6600	Digital Computer Controls Synergist Model 3700
MAIN STORAGE Min./Max. capacity, words or bytes	64K/512K words	48K bytes	120K/256K(user)bytes	120K (user) bytes	128K/256K bytes
NO. WORKSTATIONS CONNECTABLE	64	16	24	24	—
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	— Opt.; 56,000 bps Opt.; 9600 bps Bisync, X.25 X.25 2780/3780, HASP Yes	16 Opt.; to 9600 bps Opt.; to 9600 bps Bisync — See Comments Yes	25 Opt.; to 9600 bps Opt.; to 9600 bps Async, bisync — See 5500 Comments Yes	25 Opt.; to 9600 bps Opt.; to 9600 bps Async, bisync — See 5500 Comments Yes	17 No Standard Async — — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	16,500 (128K bytes) 5,000 (128K bytes) 105 Various types	Contact vendor — OEM	Contact vendor — OEM	Contact vendor — OEM	Contact vendor — — —
Date of first U.S. delivery Number installed to date	NA NA	1975 NA	1978 NA	7/77 NA	1/78 NA
COMMENTS	X.25 Networking, AZ-text, word processing	Dataform, Datashare, and RPG II program languages are also supported; extensive communications to RJE interface	See 5500 Comments	See 5500 Comments	

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MANUFACTURER & MODEL	Digital Equipment Datasystem 540	Digital Equipment PDP-8/A	Digital Equipment PDP-11/03	Digital Equipment PDP-11/04	Digital Equipment PDP-11/34A
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	256K/1M byte —	8K/128K words —	4K/32K words —	16K/32K words —	16K/124K words —
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 EIA Opt.; to 50K bps NA IBM 2780/3780 Yes	20 No To 9600 bps — Any RS-232C —	— Up to 1M bps Up to 9600 bps DDCMP, DNA DECnet Control Data, Univac —	— Up to 1M bps Up to 9600 bps DDCMP, DNA DECnet Control Data, Univac —	— Up to 1M bps Up to 9600 bps DDCMP, DNA DECnet Control Data, Univac —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	54,900 — — Yes 6/80 NA	3,960 to 11,000 (8K) 1,850 (8K bytes) 44 to 99 — 9/74 Over 40,000	1,995 (8K MOS) 625 (8K bytes) 37 — NA Over 29,000	3,995 (16K MOS) 1,700 (16K bytes) 54 — 7/75 Over 9100	9,050 (32K MOS) 2,200 (32K bytes) 87 — 3/76 Over 750
COMMENTS		Also available in packaged version called Datasystem 310	Packaged version of LSI-11 micro-computer; instruction set equivalent to PDP-11/40	Successor to PDP-11/05 and 11/10; upgradable to PDP-11/34 status	Uses similar technology to PDP-11/04; includes memory management for greater addressing capability; packaged version called Datasystem 530 is also available

MANUFACTURER & MODEL	Digital Equipment PDP-11/35 & 11/40	Digital Equipment PDP-11/44	Digital Equipment PDP-11/60	Digital Equipment PDP-11/70	Digital Scientific Corporation Meta 4/1130
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	8K/124K words —	256K/1M bytes —	32K/128K words —	64K/1024K words —	16K/128K bytes —
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	— Up to 1M bps Up to 9600 bps DDCMP, DNA DECnet Control Data, Univac —	— Up to 1M bps Up to 9600 bps DDCMP, DNA DECnet Control Data, Univac —	— Up to 1M bps Up to 9600 bps DDCMP, DNA DECnet Control Data, Univac —	— Up to 1M bps Up to 9600 bps DDCMP, DNA DECnet Control Data, Univac —	32 Opt.; to 9600 bps Opt.; 50-19.2K bps Async, bisync — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	19,800 2,200 (32K core) — — NA NA	23,900 (256K bytes) 6,000 (256K bytes) — — 6/80 NA	35,700 (32K core) 6,650 (64K core) — — 6/77 NA	63,000 (128K core) 18,950 (128K core) — — NA NA	60,000 — — — 1970 Over 200
COMMENTS	PDP-11/35 is an OEM version of the PDP-11/40; packaged version is called Datasystem 350 based on PDP-11/40	Optional CIS processor & 1M byte memory increment (\$20,000) available; enhanced main-table features and an intelligent console subsystem	Includes user-accessible microprogramming; error-correcting memory	Uses same technology as PDP-11/45 and includes 2048 bytes of cache memory for increased performance; disk storage & mag. tape peripherals avail. in packaged system called Datasystem 570	Can run most IBM 1130/1180 programs; firmware arithmetic unit is optional

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MANUFACTURER & MODEL	Digital Scientific Corporation Meta 4/5020	Digital Scientific Corporation Meta 4/5030	Digital Systems Galaxy/3	Digital Systems Galaxy/5	Dimis, Inc. Total 100 (30)
MAIN STORAGE Min./Max. capacity, words or bytes	16K/128K bytes	64K/1M words	96K/128K bytes	128K/1M bytes	128K/512K bytes
NO. WORKSTATIONS CONNECTABLE	16	32	15	60	27
COMMUNICATIONS Maximum no. of lines	32	—	120	480	32
Synchronous	Opt.; to 9600	2	Std.; to 15,000 bps	Std.; to 15,000 bps	Optional
Asynchronous	Opt.; 19.2K bps	32	Std.; to 9600 bps	Std.; to 9600 bps	Std.; to 9600 bps
Protocols supported	Async, bisync	3780, bisync, HASP	Programmable	Programmable	Programmable
Network architecture supported	No	No	None	None	—
RJE terminals emulated	2780/3780/3740	2780/3780/3740	None	None	No
IBM 3270 emulation	No	No	No	No	No
PRICING & AVAILABILITY Purchase price of basic system, \$	21,250	39,600	49,500	89,900	98,000
Purchase price of memory module, \$	1,840 (16K bytes)	1,800 to 2,000 (8KB)	3,400 (32K bytes)	6,200 (64K bytes)	10,500 (128K bytes)
Monthly maint. price of basic system, \$	600	433	345	678	—
Discounts available	Quantity	Quantity	On request	On request	—
Date of first U.S. delivery	1978	NA	6/79	8/79	6/74
Number installed to date	NA	NA	5	30	18*
COMMENTS	Can run most IBM 1130/1800 programs; digital/analog I/O; up to 8 concurrent users in a mixed batch and conversation mode; expandable to Model 5030	Up to 32 concurrent users in a mixed conversation and batch mode	Sys. includes CPU, 5 comm. ports, 27 meg. drive, 300 lpm printer	Sys. includes CPU, 15 comm. ports, two 80 meg. drives, one CRT, one 600 lpm printer	3 CRT's std., pkg. includes staff and mgmt. training and conversion support. *Includes compatible Modcomp II

MANUFACTURER & MODEL	Dimis, Inc. Total 100 (70)	Display Data Corporation In* Sight	Distribution Management Systems BS11-70-03	Distribution Management Systems BS11-780-03	Distribution Management Systems BS11-44-07
MAIN STORAGE Min./Max. capacity, words or bytes	512K/4M bytes	32K/128K bytes	512K/2M bytes	512K/2M bytes	512K/1M bytes
NO. WORKSTATIONS CONNECTABLE	50	32	64	64	64
COMMUNICATIONS Maximum no. of lines	32	32	64	64	64
Synchronous	Optional	No	No	No	No
Asynchronous	Std.; to 9600 bps	Std.; to 9600 bps	No	No	No
Protocols supported	Programmable	ANSI Std., async., X3.25	—	—	—
Network architecture supported	—	None	None	None	None
RJE terminals emulated	No	None	2780/3780	2780/3780	2780/3780
IBM 3270 emulation	No	No	Yes	Yes	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	153,000	29,600	95,000	159,000	44,000
Purchase price of memory module, \$	36,000 (512KB)	3,500 (8K)	20,000 (512K bytes)	18,500 (1M bytes)	20,000 (512K bytes)
Monthly maint. price of basic system, \$	—	297	717	948	515
Discounts available	—	Quantity	—	—	—
Date of first U.S. delivery	12/78	1/74	4/79	1/80	1/80
Number installed to date	15	1000	8	—	—
COMMENTS	3 CRT's std., pkg. includes staff and mgmt. training and conversion support	Specialists in complete turnkey systems, support, forms, & maintenance for selected businesses			

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MANUFACTURER & MODEL	Harris 100	Harris 500	Harris 800	Hewlett-Packard General Sys. Div. 300 Model A	Hewlett-Packard General Sys. Div. 300 Model B
MAIN STORAGE Min./Max. capacity, words or bytes	192K/768K bytes	192K/3072K bytes	384K/3072K bytes	256K/1M byte	256K/1M byte
NO. WORKSTATIONS CONNECTABLE	32	64	128	16	16
COMMUNICATIONS Maximum no. of lines	32	64	128	16	16
Synchronous	Opt.; 56K bps	Opt.; 56K bps	Opt.; 56K bps	No	No
Asynchronous	Opt.; 19.2K bps	Opt.; 19.2K bps	Opt.; 19.2K bps	Opt.; to 9600 bps	Opt.; to 9600 bps
Protocols supported	Async, bisync	Async, bisync	Async, bisync	None	None
Network architecture supported	None	None	None	—	—
RJE terminals emulated	See Comments	See Comments	See Comments	—	—
IBM 3270 emulation	Yes	Yes	Yes	—	—
PRICING & AVAILABILITY Purchase price of basic system, \$	45,000	99,500	155,200	35,000	45,000
Purchase price of memory module, \$	2,400 (48K bytes)	28,800 (1.9M bytes)	28,800 (1.9M bytes)	2,500 (128K bytes)	2,500 (128K bytes)
Monthly maint. price of basic system, \$	500	605	1,095	160	225
Discounts available	Quantity, dollar volume	Quantity, dollar volume	Quantity, dollar volume	OEM, volume	OEM, volume
Date of first U.S. delivery	First qtr. 1977	First qtr. 1979	First qtr. 1980	12/78	12/78
Number installed to date	NA	NA	NA	NA	NA
COMMENTS	RJE terminals emulated; 2780/3780, HASP workstation, UT-200, U-1004	RJE terminals emulated; 2780/3780, HASP workstation, UT-200, U-1004	RJE terminals emulated; 2780/3780, HASP workstation UT-200, U-1004		

MANUFACTURER & MODEL	Hewlett-Packard HP 1000 M Series	Hewlett-Packard HP 1000 E Series	Hewlett-Packard HP 1000 F Series	Honeywell Level 6 Model 33	Honeywell Level 6 Model 43
MAIN STORAGE Min./Max. capacity, words or bytes	32K/1024K bytes	32K/1024K bytes	32K/2048K bytes	32K/128K bytes	32K/2048K bytes
NO. WORKSTATIONS CONNECTABLE	56	57	56	160	160
COMMUNICATIONS Maximum no. of lines	56	56	56	160	160
Synchronous	Opt.; to 500K bps	Opt.; to 500K bps	Opt.; to 500K bps	Opt.; 50-7200 bps	Opt.; 50-7200 bps
Asynchronous	Opt.; to 2.5M bps	Opt.; to 2.5M bps	Opt.; to 2.5M bps	Opt.; 50-19,200 bps	Opt.; 50-19,200 bps
Protocols supported	Bisync, WASP	Bisync, WASP	Bisync, WASP	Async, bisync, HDLC	Async, bisync, HDLC
Network architecture supported	DS/1000-3000	DS/1000-3000	DS/1000-3000	—	—
RJE terminals emulated	IBM 2780	IBM 2780	IBM 2780	HASP, 2780/3780	HAPS, 2780/3780
IBM 3270 emulation	No	No	No	—	—
PRICING & AVAILABILITY Purchase price of basic system, \$	6,950 (64K bytes)	8,700 (64K bytes)	11,750 (64K bytes)	7,275	10,325
Purchase price of memory module, \$	1,400 (32K bytes)	1,400 (32K bytes)	1,700 (16K bytes)	875 (16K bytes)	2,240 (64K bytes)
Monthly maint. price of basic system, \$	71	74	102	77	114
Discounts available	OEM & end-user qty.	OEM & end-user qty.	OEM & end-user qty.	Qty., vol., educ.	Qty., vol., educ.
Date of first U.S. delivery	5/74	11/76	7/78	1976	1977
Number installed to date	NA	NA	NA	NA	NA
COMMENTS	M-Series processor supports DS/1000 high-level networking software & DATACAP/1000 factory data capture software; M-Series also available as a board computer	HP1000 Model 20 & Model 40 packaged systems include E-Series; DS/1000 & DATACAP/1000 support; E-Series also available as board computer	HP1000 Model 25 & Model 45 packaged systems include F-Series; DS/1000 & DATACAP/100 support; F-Series scientific instruction set provides high-performance transcendental	Field upgradable to all higher models; replaces models 34 and 36, which are no longer actively marketed	Field upgradable to all higher models; writable control store optional

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MANUFACTURER & MODEL	Honeywell Level 6 Model 47	Honeywell Level 6 Model 53	Honeywell Level 6 Model 57	Honeywell Series 60 Level 62	IBM Series/1
MAIN STORAGE Min./Max. capacity, words or bytes	32K/2048K bytes	32K/2048K bytes	32K/2048K bytes	96K/992K bytes	16K/256K bytes
NO. WORKSTATIONS CONNECTABLE	152	152	144	744 (24 lines x 31 dev.)	Variable
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	160 Opt.; 50-7200 bps Opt.; 50-19,200 bps Async, bisync, HDLC — HASP, 2780/3780 —	160 Opt.; 50-7200 bps Opt.; 50-19,200 bps Async, bisync, HDLC — HASP, 2780/3780 —	160 Opt.; 50-7200 bps Opt.; 50-19,200 bps Async, bisync, HDLC — HASP, 2780/3780 Yes	25 Opt.; 19,200 bps Opt.; 9600 bps Bisync IIY, ISO, BSC, VIP 360/370, 2780 Yes	— Up to 56,000 bps Up to 9600 bps Async, bisync SNA 2780, 3780, HASP Yes
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	22,275 2,250 (64K bytes) 227 Qty., vol., educ.	22,175 2,250 (64K bytes) 174 Qty., vol., educ.	46,975 2,250 (64K bytes) 334 Qty., vol., educ.	33,192 3,315 (32K) 160 (processor) Quantity	4360 (CPU only) 1,170 (16K bytes) 76 Contact vendor
Date of first U.S. delivery Number installed to date	1978 NA	1978 NA	1978 NA	August 1974 Over 1,000	NA NA
COMMENTS	Field upgradable to model 57; includes high-speed commercial instructions (decimal arithmetic, etc.); writable control store optional	Field upgradable to model 57; includes 8K bytes high-speed cache memory; writable control store optional	Includes 8K byte high-speed cache memory and high-speed commercial instructions	Performance increase packages of 33, 78 or 90 percent optional	Prices shown are for Model 4953 offered on a purchase-only basis; eleven different CPU models

MANUFACTURER & MODEL	IBM System/3	IBM System/38	IBM 8100	Infomark, Inc. S/6000	Infomark, Inc. S/8000
MAIN STORAGE Min./Max. capacity, words or bytes	8K/512K bytes	512K/1536K bytes	256K/512K bytes	128K/256K bytes	256K bytes
NO. WORKSTATIONS CONNECTABLE	Variable	40	24	—	—
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	8 Opt.; to 50K bps No SDLC — System/370 Yes	4 Opt.; to 9600 bps Opt.; to 1200 bps Bisync Most IBM systems — —	24 Std.; 600 to 9600 bps No Bisync SNA Most IBM systems Yes	16 No Standard Async — — —	24 No Standard Async — — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	13,790 (Mdl. 4 cpu) 2,950 (4K bytes) 176 (Mdl. 4 cpu) Contact vendor	70,210 (Mdl. 0321 5,000 (256K bytes) 314 (Mdl. 0321 CPU) Contact vendor	24,000 (Mdl. A21 CPU) 2,250 (128K bytes) 122 (Mdl. A21 CPU) —	130,000 (bundled) — — —	143,000 (bundled) — — —
Date of first U.S. delivery Number installed to date	12/70 Over 54,000	7/80 —	8/79 NA	1976 NA	1976 14
COMMENTS	Six different models currently in line	There are 48 packaged models of the System/38			

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MANUFACTURER & MODEL	Jacquard Systems J100	Melcom Business Systems Inc. Mitsubishi 8038	Microdata Reality Series 4000	Microdata Reality Series 6000	Microdata Reality Series 8000
MAIN STORAGE Min./Max. capacity, words or bytes	96K/128K bytes	128K/512K bytes	16K/64K bytes	32K/128K bytes	128K/512K bytes
NO. WORKSTATIONS CONNECTABLE	16	27	32	32	32
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	19 Opt.; to 4800 bps Opt.; to 4800 bps See Comments No 2780/3780 Yes	32 Opt.; 1200 to 19,200 Opt.; 300 to 9600 BC-1, BSC NA NA No	32 Opt.; to 9600 bps No Bisync — HASP, 360/370 No	32 Opt.; to 9600 bps Opt.; to 9600 bps Bisync IBM 360/370 2780, HASP No	32 Opt.; to 9600 bps Opt.; to 9600 bps Bisync IBM 360/370 2780, HASP No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	19,900 2,400 (32K bytes) 172 Qty., dollar vol., educ.	43,000 5,000 (128K bytes) 287 —	38,550 3,500 (16K bytes) 280 —	61,250 3,500 (16K bytes) 420 —	84,975 6,900 (64K bytes) 580 —
Date of first U.S. delivery Number installed to date	8/75 NA	11/79 12,000+ (all models)	11/73 NA	11/73 2,000+ (all systems)	10/79 2,000+ (all systems)
COMMENTS	Optional 150 cps printer available	Includes CPU (128K bytes), serial printer, keyboard/CRT, 10M byte cartridge disk	Packaged system in- cludes 16KB core memory, magnetic tape, 20MB disk drive, 165 cps printer, and 1 CRT	Packaged system includes 32KB core memory, magnetic tape, 50MB disk drive, 165 cps printer, and 1 CRT	Packaged system includes 256KB MOS memory, magnetic tape, 128MB disk drive, 165 cps printer, and 2 CRT

MANUFACTURER & MODEL	Modular Computer Systems Inc. Classic 7810/3140	Modular Computer Systems Inc. Classic 7830/7835	Modular Computer Systems Inc. Classic 7860	Modular Computer Systems Inc. Classic 7870	Mylee Digital Sciences System 3000
MAIN STORAGE Min./Max. capacity, words or bytes	64K/128K bytes	128K/2048K bytes	128K/2048K bytes	512K/4096K bytes	88K/286K bytes
NO. WORKSTATIONS CONNECTABLE	32	96	128	128	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	256 FDX Opt.; 48-230.4K bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 —	256 FDX Opt.; 48-230.4K bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 —	256 FDX Opt.; 48-230.4K bps Opt.; 50-19.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 —	256 FDX Opt.; 48-230.4K bps Opt.; 50-10.2K bps SDLC/HDLC, Bisync MAXNET HASP, 2780/3780 —	16 Opt.; to 9600 bps Opt.; to 1200 bps Bisync — IBM 2780/3780 No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	8,150 1,000 (32K bytes) 85 —	23,800/29,500 7,500 (128K bytes) 155/192 —	38,100 7,500 (128K bytes) 242 —	61,500 25,900 (512K bytes) 382 —	28,995 2,000 (32K bytes) 9% —
Date of first U.S. delivery Number installed to date	5/79 NA	9/79 NA	4/78 NA	10/78 NA	5/76 175
COMMENTS					Total turnkey system from design to in- stallation

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MANUFACTURER & MODEL	NCR Century 50 and 50 Mod 1	NCR Century 100	NCR Century 101	NCR Century 151	NCR 8250
MAIN STORAGE Min./Max. capacity, words or bytes	16K/32K bytes	16K/32K bytes	16K/128K bytes	32K/131K bytes	48K/128K bytes
NO. WORKSTATIONS CONNECTABLE	—	—	—	—	—
COMMUNICATIONS Maximum no. of lines	16	16	255	255	24
Synchronous	600-50,000 bps	600-50,000 bps	600-50,000 bps	600-50,000 bps	Opt.; to 9600 bps
Asynchronous	45-2400 bps	45-2400 bps	45-24,000 bps	45-2400 bps	Std.; 2400 bps
Protocols supported	Bisync	Bisync	Bisync	Bisync	Bisync, async
Network architecture supported	—	—	—	—	—
RJE terminals emulated	—	—	—	—	—
IBM 3270 emulation	—	—	—	—	—
PRICING & AVAILABILITY Purchase price of basic system, \$	47,000 (16K bytes)	71,500 (16K bytes)	69,520 (16K bytes)	119,925 (64K bytes)	34,420
Purchase price of memory module, \$	3,500 (16K bytes)	3,500 (16K bytes)	5,000 (8K bytes)	20,000 (64K bytes)	1,000 (16K bytes)
Monthly maint. price of basic system, \$	347	458	—	521	163
Discounts available	—	—	—	—	—
Date of first U.S. delivery	12/70	3/63	8/72	2/75	3/77
Number installed to date	NA	NA	Over 1,200	NA	NA
COMMENTS	System price also includes line printer, 8.4-MB disk drive, and card reader; no longer manufactured; available only in used or used-refurbished units	System price also includes line printer, 8.4-MB disk drive, and card reader; no longer manufactured; available only in used or used-refurbished units	System price also includes line printer, 8.4-MB disk drive, and card reader		

MANUFACTURER & MODEL	New England Digital Able/40	New England Digital Able/60	Northrop Data Systems BDS Series 4000	Point 4 Computer Corp. Point 4	Prime 450
MAIN STORAGE Min./Max. capacity, words or bytes	16K/64K words	16K/64K words	64K/512K bytes	32K/64K words	256/1024K bytes
NO. WORKSTATIONS CONNECTABLE	—	—	32	128 (32 recom.)	32
COMMUNICATIONS Maximum no. of lines	64	64	32	128 (32 recom.)	32
Synchronous	Optional 300-38.4K bps	Optional 300-38.4K bps	Opt.; to 9,600 bps	Std.; 56,000 bps	Std.; 56KBS
Asynchronous	Bisync	Bisync	Opt.; to 9,000 bps	Std.; 19,200 bps	Std.; 9600 bps
Protocols supported	NEDWORK	NEDWORK	Bisync	SDLC	Bisync
Network architecture supported	IBM 2780	IBM 2780	—	None	PRIMENET, X.25
RJE terminals emulated	Yes	No	IBM 2780	IBM 2780/3780	HASP, 2780/3780
IBM 3270 emulation	No	No	No	No	Yes
PRICING & AVAILABILITY Purchase price of basic system, \$	7,950	9,650	52,295	5,540	73,000 (450 HBM)
Purchase price of memory module, \$	1,000 (8K words)	1,000 (8K words)	3,900/6,900	—	—
Monthly maint. price of basic system, \$	—	—	355	1,760 (32K bytes)	500
Discounts available	Educ., qty.	Educ., qty.	—	—	Volume
Date of first U.S. delivery	6/77	4/78	1975	3/79	First qtr. 1979
Number installed to date	NA	NA	Over 200 (all models)	250-300	77
COMMENTS	Includes minifloppy drives, RTC, APL, and serial port	Includes 8-inch floppy drives, RTC, APL, and serial port	Price includes CRT and printer; memory increment price is for 32K and 64K, respectively	Point 4 formerly known as Educational Data Systems	Virtual memory management system permits addressing up to 32M bytes per user; 2K-byte cache memory std.; 2 to 1 memory interleaving std.

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MANUFACTURER & MODEL	Prime 550	Prime 650	Prime 750	Q1 Corporation Microlite	Q1 Corporation Q1/LITE
MAIN STORAGE Min./Max. capacity, words or bytes	512K/2048K bytes	512K/4096K bytes	512K/8192K bytes	16K/64K bytes	16K/64K bytes
NO. WORKSTATIONS CONNECTABLE	63	63	63	16	16
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	63 async.; 8 sync. Std.; 56KBS Std.; 9600 bps Async, bisync PRIMENET X.25 HASP, 2780/3780 Yes	63 async.; 8 sync. Std.; 56KBS Std.; 9600 bps Async, bisync PRIMENET X.25 HASP, 2780/3780 Yes	63 async.; 8 sync. Std. 56KBS Std.; 9600 bps Async, bisync PRIMENET X.25 HASP, 2780/3780 Yes	16 Std.; to 4800 bps Std.; to 1200 bps Bisync No 2780 No	16 Std.; to 4800 bps Std.; to 1200 bps Bisync No 2780 No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	80,000 (550 HMB) 40,000 (1M byte) 578 (550 HMB) Volume	105,000 (650 HMB) 400,000 (1M byte) 685 (650 HMB) Volume	130,000 (750 HMB) 40,000 (1M byte) 785 (750 HMB) Volume	7,625 800 (16K bytes) 12% per year GSA, quantity	21,000 800 (16K bytes) 10% per year GSA, quantity
Date of first U.S. delivery Number installed to date	First qtr. 1979 201	First qtr. 1979 11	Third qtr. 1979 55	7/78 NA	7/77 NA
COMMENTS	Virtual memory management system permits addressing up to 32M bytes per user; 2K-byte cache memory std.; 2 to 1 memory interleaving std.	Virtual memory management system permits addressing up to 32M bytes per user; 2K-byte cache memory std.; 2 to 1 memory interleaving std.	Virtual memory management system permits addressing up to 32M bytes per user; 16K-byte cache memory std.; 2 to 1 memory interleaving std.		

MANUFACTURER & MODEL	Quodata E-500	Quodata E-660	Quodata E-770	Quodata E-930	Roim 1602B (AN/UYK-19)
MAIN STORAGE Min./Max. capacity, words or bytes	64K/256K bytes	128K/256K bytes	256K bytes	512K/2048K bytes	16K/64K words
NO. WORKSTATIONS CONNECTABLE	64	64	64	64	2
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	32 Optional Std.; to 19.2K bps Bisync DECnet 3780, HASP Yes	32 Optional Standard Bisync, SDLC DECnet 3780, HASP Yes	63 Optional Std.; to 9600 bps Bisync, SDLC DECnet 3780, HASP Yes	63 Optional Std.; to 9600 bps Bisync, SDLC DECnet 3780, HASP Yes	56 — 19.2K baud — — —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	33,000 — — —	47,000 — — —	77,500 — — —	131,000 — — —	25,250 7,000 (16K words) — GSA, OEM, qty.
Date of first U.S. delivery Number installed to date	1974 Over 100	1972 Over 50	1973 Over 50	1975 Over 50	1977 Approx. 500
COMMENTS		See E-930	See E-930	Data management software for gen. business appl. and software systems specifically designed for educational institutions and government entities	Qualified to Mil-E 5400 & Mil E-16400 specif.; ATR chassis; micro-programmed militarized CPU

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MANUFACTURER & MODEL	Rolm 1603A (AN/UYP-12)	Rolm 1606 (AN/UYP-19)	Rolm 1664 (AN/UYP-19)	Rolm 1666 (AN/UYP-19)	Sperry Univac V77-200
MAIN STORAGE Min./Max. capacity, words or bytes	16K/32K words	16K/1024K words	16K/64K words	16K/1024K words	8K/32K words
NO. WORKSTATIONS CONNECTABLE	2	10	2	10	—
COMMUNICATIONS					
Maximum no. of lines	56	56	56	56	32
Synchronous	—	—	—	—	50KB
Asynchronous	19.2K baud	19.2K baud	19.2K baud	19.2K baud	9600 bps
Protocols supported	—	—	—	—	—
Network architecture supported	—	—	None	None	—
RJE terminals emulated	—	—	None	None	HASP + 1004
IBM 3270 emulation	—	—	No	No	—
PRICING & AVAILABILITY					
Purchase price of basic system, \$	13,400	43,900	39,450	48,900	5,350
Purchase price of memory module, \$	6,000 (16K words)	7,000 (16K words)	7,000 (16K words)	7,000 (16K words)	1,350 (8K words)
Monthly maint. price of basic system, \$	—	—	—	—	—
Discounts available	GSA, OEM, qty.	GSA, OEM, qty.	GSA, OEM, qty.	GSA, OEM, qty.	—
Date of first U.S. delivery	1976	1978	1976	1977	NA
Number installed to date	90	100	100	40	NA
COMMENTS	Qualified to Mil-E-5400 & Mil-E-16400 specif.; ATR chassis; low-priced, faster version of previously offered Model 1603. Model compatible with DG Nova	Qualified to Mil-E-16400; system used on Navy DPEWS (AN/SLO-32); same as 1666 except for floating-point capability	Designed to meet Mil-E-5400 & Mil-E-16400 specif., ATR chassis, tri-processor militarized computer, upward-compatible with other Rolm computers	Qualified to Mil-E-5400 & Mil-E-16400; Std. 64K-bit floating-point arithmetic; std. memory mgmt. for up to 1024K words; complete protection and security features	

MANUFACTURER & MODEL	Sperry Univac V77-400	Sperry Univac V77-600	Sperry Univac V77-800	STC Systems Personna-Data	STC Systems Ultimacc 2000
MAIN STORAGE Min./Max. capacity, words or bytes	8K/1024K words	16K/1024K words	64K/1024K words	64K/512K bytes	64K/128K bytes
NO. WORKSTATIONS CONNECTABLE	—	—	—	20	3
COMMUNICATIONS					
Maximum no. of lines	32	256	256	Unlimited	Unlimited
Synchronous	50KB	50KB	50KB	Opt.; to 9600	Opt.; to 9600
Asynchronous	9600 bps	9600 bps	9600 bps	Opt.; to 1200	Opt.; to 1200
Protocols supported	—	UDLC/SDLC	UDLC/SDLC	Bisync	Bisync
Network architecture supported	—	Univac DCA	Univac DCA	—	—
RJE terminals emulated	HASP + 1004	HASP + 1004	HASP + 1004	IBM 2780/3780	IBM 2780/3780
IBM 3270 emulation	—	SDLC/BISYNC	SDLC/BISYNC	Yes	Yes
PRICING & AVAILABILITY					
Purchase price of basic system, \$	7,850	13,950	33,000 (128K words)	34,900	34,900
Purchase price of memory module, \$	1,350 (8K words)	2,900 (16K words)	5,000 to 9,000	3,500 (32K bytes)	3,500 (32K bytes)
Monthly maint. price of basic system, \$	—	—	—	—	345
Discounts available	—	—	—	—	—
Date of first U.S. delivery	NA	12/76	7/79	1976	1973
Number installed to date	NA	NA	NA	10	100
COMMENTS		Price includes cabinet; power supply and memory at lower prices than chassis level components	See V77-600; memory increment prices for 64K words and 128K words, respectively	Turnkey only including software	Turnkey only including software

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MANUFACTURER & MODEL	STC Systems Ultimacc 3000	STC Systems Ultimacc 4000	Systems Engineering Laboratories 32/30A	Systems Engineering Laboratories 32/55	Systems Engineering Laboratories 32/57
MAIN STORAGE Min./Max. capacity, words or bytes	64K/512K bytes	64K/512K bytes	32K/256K words	8K/256K words	64K/256K words
NO. WORKSTATIONS CONNECTABLE	20	20	16	16	64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	Unlimited Opt.; to 9600 Opt.; to 1200 Bisync — IBM 2780/3780 Yes	Unlimited Opt.; to 9600 Opt.; to 1200 Bisync — IBM 2780/3780 Yes	16 Opt.; to 9600 bps Opt.; 38.4 bps Bisync — HASP terminals —	16 Opt.; to 40.8K bps Opt.; 38.4K bps — — HASP terminals —	64 Opt.; to 9600 bps Opt.; 38.4 bps Bisync — HASP terminals —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	51,000 3,500 (32K bytes) 435 —	Contact vendor 4,500 (32K bytes) — —	25,100 (128K bytes) 9,300 (128K bytes) 200 See 32/57 Comments	53,900 (128K bytes) 6,300 (8K words) 375 See 32/57 Comments	39,500 (256K bytes) 12,500 (256K bytes) 295 See Comments
Date of first U.S. delivery Number installed to date	1975 100	1979 40	9/79 10	10/75 425	4/79 10
COMMENTS	Turnkey only including software	Turnkey only including software	Single Chassis System, memory map, 16MB addressing capability, multi-processor configurations. Total DBMS, instrumenter I/II, scientific accelerator, plotters and graphics	Single or double cabinet systems; multiprocessor configurations; total DBMS; instrumenter I/II, plotters/graphics	Discounts are based on projected point values for equipment purchased during the term of the agreement; OEM, volume end-user, and educational discounts are available

MANUFACTURER & MODEL	Systems Engineering Laboratories 32/75	Systems Engineering Laboratories 32/77	Systems Engineering Laboratories VPS 3200	Systems Engineering Laboratories VPS 3300	Systems Engineering Laboratories VPS 6400
MAIN STORAGE Min./Max. capacity, words or bytes	32K/2048K words	64K/4096K words	64K/4096K words	64K/4096K words	64K/4096K words
NO. WORKSTATIONS CONNECTABLE	64	64	64	64	64
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	64 Opt.; to 9600 bps Opt.; 38.4 bps Bisync — HASP terminals —	64 Opt.; to 9600 bps Opt.; 38.4 bps Bisync — HASP terminals —	64 Opt.; to 40/8K bps Opt.; 38.4 bps — HASP terminals —	64 Opt.; to 40.8K bps Opt.; 38.4K bps — HASP terminals —	64 Opt.; to 40.8K bps Opt.; 38.4K bps — HASP terminals —
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available	72,300 (128K bytes) 6,300 (32K bytes) 470 See 32/57 Comments	46,300 (256K bytes) 13,500 (256K bytes) 330 See 32/57 Comments	79,000 13,500 (256K bytes) 710 See 32/57 Comments	85,000 13,500 (256K bytes) 765 See 32/57 Comments	137,500 17,000 (16K x 64-bit) 1,240 See 32/57 Comments
Date of first U.S. delivery Number installed to date	1/78 325	6/78 275	NA NA	NA NA	NA NA
COMMENTS	Double cabinet system, memory map, 16MB addressing capability, multi-processor configs., TOTAL DBMS, instrumenter I/II, scientific accelerator, internal processing unit, plotters and graphics	4MB memory in double cabinet, memory map, 16MB addressing capability, multi-processor configs., TOTAL DBMS, instrumenter I/II, scientific accelerator, internal processing unit, plotters and graphics	Includes a 32/77 CPU for scalar arithmetic & a VPU for vector arithmetic; VPU performs two 32-bit floating-pt. adds & one floating-pt. multiplication in 420 nanoseconds; incl. SNAP II vector proc. exec. & array proc. routines	Includes a 32/77 CPU for scalar arithmetic & a VPU for vector arithmetic; VPU performs two 32-bit floating-pt. adds & one floating-pt. multiplication in 420 nanoseconds; incl. SNAP II vector proc. exec. & array proc. routines	Includes a 32/77 CPU for scalar arithmetic & a VPU for vector arithmetic; VPU performs two 64-bit floating-pt. adds and one floating-pt. multiply in 1 microsecond; incl. SNAP II vector processing exec. & array processing routines

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Tal-Star Computer Systems TSO	Tandem T16/212-1	Tandem T16/240-1	Tandem T16/244-1	Tandem T16/1102
MAIN STORAGE Min./Max. capacity, words or bytes	128K/256K bytes	192K/448K bytes	96K/480K bytes	192K/512K bytes	32K/256K words
NO. WORKSTATIONS CONNECTABLE	32	—	—	—	256
COMMUNICATIONS Maximum no. of lines	32	2048	64	2048	256
Synchronous	Std.; to 9600 bps	Opt.; 5600 bps	Opt.; 5600 bps	Opt.; 5600 bps	Opt.; to 80K bps
Asynchronous	Opt.; to 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 9600 bps	Opt.; 50-19.2K bps
Protocols supported	Bisync	Bisync, TINET	Bisync, TINET	Bisync, TINET	—
Network architecture supported	No	—	—	—	NCP
RJE terminals emulated	2780/3780	—	—	—	2780/3780, 360/370
IBM 3270 emulation	No	—	—	—	—
PRICING & AVAILABILITY Purchase price of basic system, \$	70,000	92,800	59,750	87,100	20,400
Purchase price of memory module, \$	3,250 (16K bytes)	—	—	—	8,000 (64K bytes)
Monthly maint. price of basic system, \$	375	—	—	—	106
Discounts available	Contact vendor	—	—	—	—
Date of first U.S. delivery	1977	5/76	10/76	5/76	5/76
Number installed to date	8	10	5	30	250+ (processors)
COMMENTS	Designed as stand-alone or interactive with Tal-Star text processing and composition systems	Multiprocessor, fault-tolerant, "non-stop" system for on-line, transaction-oriented applications	Multiprocessor, fault-tolerant, "non-stop" system for on-line, transaction-oriented applications	Multiprocessor, fault-tolerant, "non-stop" system for on-line, transaction-oriented applications	Multiprocessor system containing from 2 to 16 CPU's for fault-tolerance; all system components are dual-ported; CPU's have dual buses.

MANUFACTURER & MODEL	Tandem T16/1403	Texas Instruments DS990 Series Model 2	Texas Instruments DS990 Series Model 4	Texas Instruments DS990 Series Model 6
MAIN STORAGE Min./Max. capacity, words or bytes	32K/256K words	64K bytes	128K/2048K bytes	128K/2048K bytes
NO. WORKSTATIONS CONNECTABLE	256	2	39	39
COMMUNICATIONS Maximum no. of lines	256	3 std., 16+ opt.	Appl. dependent	Appl. dependent
Synchronous	Opt.; to 80K bps	Std.; 9600 bps	Opt.; 75 to 9600 bps	Opt.; 75 to 9600 bps
Asynchronous	Opt.; 50-19.2K bps	Std.; 9600 bps	Opt.; 75 to 9600 bps	Opt.; 75 to 9600 bps
Protocols supported	—	Bisync	Bisync	Bisync
Network architecture supported	NCP	No	—	—
RJE terminals emulated	2780/3780, 360/370	IBM 2780/3780	2780/3780	2780/3780
IBM 3270 emulation	—	No	3270 IDC	3270 IDC
PRICING & AVAILABILITY Purchase price of basic system, \$	22,000	12,995	34,500 (H/W only)	44,250 (H/W only)
Purchase price of memory module, \$	7,200	—	1,750 (64K bytes)	3,250 (128K bytes)
Monthly maint. price of basic system, \$	136	143	225	333
Discounts available	—	Contact vendor	Quantity	Quantity
Date of first U.S. delivery	5/76	6/79	3/76	NA
Number installed to date	250+ (processors)	NA	NA	NA
COMMENTS	Multiprocessor system containing from 2 to 16 CPU's for fault-tolerance; all system components are dual-ported; CPU's have dual buses	Packaged small business system based on TI's 990/5 microcomputer	Packaged small business system based on TI's 990/10 minicomputer	Packaged small business system based on TI's 990/10 minicomputer

Communications Capabilities of Minicomputers and Small Business Computers

MANUFACTURER & MODEL	Texas Instruments DS990 Series Model 8	Texas Instruments DS990 Series Model 20	Texas Instruments DS990 Series Model 30	Texas Instruments 990/5
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	128K/2048K bytes 39	256K/2048K bytes 39	256K/2048K bytes 39	16K/32K words Appl. dependent
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	Appl. dependent Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Async, bisync NA 2780/3780 Yes	Appl. dependent Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Async, bisync NA 2780/3780 Yes	Appl. dependent Opt.; 75 to 9600 bps Opt.; 75 to 9600 bps Async, bisync NA 2780/3780 Yes	Appl. dependent Std., to 9600 bps Standard Bisync NA 2780/3780 No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	49,250 (H/W only) 1,750 (64K bytes) 378 Quantity NA NA	68,500 (H/W only) 3,250 (128K bytes) 549 Quantity NA NA	78,900 (H/W only) 3,250 (128K bytes) 581 Quantity NA NA	3,400 (16K words) 750 (16K words) 55 — 4/79 NA
COMMENTS	Packaged small business system based on TI's 990/10 minicomputer	Packaged small business system based on TI's 990/12 minicomputer	Packaged small business system based on TI's 990/12 minicomputer	Based on TI's TMS 990 microprocessor

MANUFACTURER & MODEL	Texas Instruments 990/10	Texas Instruments 990/12	Texas Instruments 980B	Wang 2200 VS
MAIN STORAGE Min./Max. capacity, words or bytes NO. WORKSTATIONS CONNECTABLE	64K/1048K words Appl. dependent	128K/1048K words Appl. dependent	8K/64K words —	128K/2048K bytes 32
COMMUNICATIONS Maximum no. of lines Synchronous Asynchronous Protocols supported Network architecture supported RJE terminals emulated IBM 3270 emulation	Appl. dependent Std.; to 9600 bps Standard Bisync NA 2780/3780 Yes	Appl. dependent Std.; to 9600 bps Standard Bisync NA 2780/3780 Yes	1 to 256 Up to 9600 bps No — None Any RS-232C/20mA No	16 No Up to 9600 bps Bisync — 2780/3780, HASP No
PRICING & AVAILABILITY Purchase price of basic system, \$ Purchase price of memory module, \$ Monthly maint. price of basic system, \$ Discounts available Date of first U.S. delivery Number installed to date	14,675 (64K words) 6,250 (128K words) 103 — 3/76 NA	29,050 (128K words) 6,250 (128K words) 261 — 9/79 NA	4,850 (8K words) 1,400 (8K MOS) 75 — 4/74 Over 4,100	19,000 7,000 (128K bytes) 240 — 12/77 NA
COMMENTS	MSI implementation of 990 instruction set; Disk Operating System	SCHOTTKY implementation of 990 instruction set	Heavily supported for process control applications	Packaged systems includes 128KB memory, one 308KB floppy disk, 7-slot chassis, cabinets, operating system, resource management software, and choice of one language

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Many of today's minicomputers are available with communications interfaces and operating systems. When equipped with appropriate peripherals, such as diskette drives, and appropriate additional software, these systems can perform communications related processing functions, such as serving as distributed processing workstations, IBM 3270 or HASP emulation, and message switching.

Dynamism and proliferation continue in the world of the minicomputer. We hear daily of a continual stream of new products entering the marketplace, with hardware and software that take on many names. We hear of minicomputers, microcomputers, programmable controllers, micro-programmable data entry units, intelligent terminals, accounting machines, large-scale programmable calculators, etc. We also regularly hear of old-line peripheral device and terminal manufacturers announcing their entry into the "minicomputer business" as they add programmable logic and memory to their formerly unintelligent, hard-wired devices.

The net result of all these happenings is, more often than not, confusion—at least when one tries to grasp the meaning or direction of the industry in any overall sense. The confusion may well be compounded when one sets out to satisfy a known in-house need and wonders where to begin looking for a specific minicomputer that will satisfy that need at the best available price.



Honeywell's powerful new Level 6 Model 47 minicomputer can provide up to 2 million bytes of main memory and can process COBOL programs seven times faster than the earlier Model 33. The configuration shown includes (left to right) a 900-lpm printer, VIP 7200 console display/keyboard, 500-cpm card reader, CPU with 320K bytes of memory, two diskette units above the processor, two magnetic tape units, and two 256-megabyte disk units. Prices for the Model 47 begin at \$28,050.

This report presents the salient characteristics of 251 minicomputers from 74 vendors. Prices and capabilities of these machines span a wide range, so prospective users should carefully check the details of this report and the accompanying comparison charts.

This report on Minicomputer Characteristics can cut through a lot of this confusion by providing a convenient way to scan quickly a comprehensive list of available minicomputers, together with their primary specifications and prices.

The comparison charts that follow can be effectively used to complete a comprehensive, first-level search of the minicomputer universe in just a few minutes. For example, if you want a minicomputer but know you can't pay more than \$5,000 for the basic CPU and memory, then you can quickly scan across the charts noting the entry "Price of CPU, power supply, front panel, and minimum memory in chassis" and jotting down the name and model number of each minicomputer that applies. Or, your requirements may be for a minicomputer that has a BASIC programming language in addition to removable disk pack storage. A similar quick scan across the entries called "Disk pack/cartridge drives" and "Compilers" will produce a complete list of those minicomputers that satisfy both requirements.

A significant aspect of any evaluation and procurement cycle is to gather information about how well the product has worked out for other customers. True, you are not likely to find someone with exactly your processing requirements or company/information set-up, but there will be similar elements.

THE COMPARISON CHARTS

The key functional characteristics of 251 commercially available minicomputers from 74 manufacturers are presented in the accompanying comparison charts. Nearly all of the information in the charts was supplied and/or verified by the manufacturers during the months of August and September 1978; their close cooperation with the Datapro Research staff in the preparation of these charts is greatly appreciated.

The chart entries and their significance to potential minicomputer users are explained in the following paragraphs, together with some useful guidelines for selecting the most suitable minicomputer for your application.

Minicomputers — Basic Characteristics

▷ Data Formats

Probably the single most important distinguishing characteristic of a minicomputer is its *word length, bits*; i.e., 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 length, the greater the efficiency and accuracy of a computer's internal operations—and the higher its price tag. Most of the minicomputers currently on the market have a 16-bit word length; this size neatly accommodates two 8-bit bytes (characters) and has been shown to yield an attractive balance between economy and performance for many applications. Other widely used models have word lengths of 8, 12, 18, 24, or 32 bits. The 8-bit minicomputers are suitable for many functions where low cost is more important than high precision or sophisticated instruction repertoires—and they can be particularly effective when extensive manipulation of 8-bit bytes must be performed. Entries also indicate parity and error correction bits when applicable.

For most minicomputers, the *fixed-point operand length, bits* is the same as the word length. Some machines, however, have "extended precision" facilities which enable them to handle arithmetic operands two or more words in length. For many applications, extended precision arithmetic is a valuable feature that helps to overcome the limitations upon number range and accuracy which are otherwise imposed by the short word lengths used in most minicomputers. Some of the 8-bit minicomputers are really byte-oriented machines, designed for efficient processing of variable-length operands composed of one or more 8-bit bytes.

Instruction length, bits is one word in most computers, but some are capable of using instructions which are two or more words in length. In most two-word instruction formats, the first word defines the operation to be performed and the second word contains the address of the required operand. The use of two-word instructions greatly increases the number of storage locations that can be directly addressed. This in turn simplifies programming—but the simplification is usually gained at the expense of two words of storage space to hold each instruction and two memory cycles for each instruction retrieved for processing.

Main Storage

The *storage type* generally falls into one of two basic categories, magnetic core or semiconductor memory. Magnetic core storage has been widely used for more than a decade, and has proved to be fast, flexible, and reliable. Semiconductor memories began to appear in commercially available minicomputers late in 1970, and most minicomputer makers are now using semiconductor

memory in their new products. It is clear that the demand for higher performance at lower cost, together with continuing improvements in semiconductor technology, have accelerated the trend toward the use of semiconductor memories.

Two types of semiconductor memories appear in the charts, MOS (metal oxide semiconductor) and bipolar (bipolar transistor). MOS is decidedly more popular because of its compactness and price. However, bipolar technology, a type of transistor-transistor logic, offers a classic trade-off—higher speed at the expense of more space and greater power consumed, as well as greater cost.

The *cycle time, microseconds/word* for a storage device is the 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, it is definitely *not* safe to 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 minicomputer's performance include the flexibility and power of its instruction repertoire, the number of storage cycles it requires to execute each instruction, its input/output capabilities, etc.

Access time, microseconds/word is the actual elapsed time between the CPU's request for data and the time when that data is received (read). In core memory, the access time is usually one-half the cycle time; semiconductor memories do not display a similar relationship.

Our comparison charts show the amount of main storage available for each computer in terms of the *minimum capacity* and *maximum capacity*, expressed in words. In the great majority of cases, storage is available in all the usual binary increments of capacity. Thus, if a computer has minimum and maximum storage capabilities of 4,096 and 32,768 words, respectively, it's safe to assume that capacities of 8,192 and 16,384 words are also available.

It is important to choose the right storage capacity; for nonmultiprogramming systems, that usually means enough storage to hold your largest program and all associated subroutines and data, but not too much more than that. It's also wise to make sure that your computer's main storage capacity can be expanded if necessary, preferably by simply plugging in an additional storage module.

Parity checking is a standard feature of some minicomputers and an extra-cost option for others. In still other cases, the manufacturers maintain—with some justification—that the reliability of modern magnetic core and semiconductor memories is so high that parity checking is an unnecessary luxury unless absolute accuracy is a must. Parity checking requires the addition of one more bit to each main storage location. This added bit is set to the

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This representative Data General Eclipse M/600 host network system includes the CPU and 512K bytes of main storage, magnetic tape drives, fixed- and moving-head disk drives, a 600-lpm printer, card reader, Dasher master display and printer consoles, and a communications subsystem with 48 local and remote time-sharing terminals. Its price tag is about \$325,000. The M/600 is designed specifically to perform in a multiprogramming operating system environment. It features a three-level Input/Output Management System (IOMS) and a demand-paged one-megabyte main memory facility supported by DG's Advanced Operating System, which extends the system's capabilities to up to 64 users.

▷ appropriate value (0 or 1) whenever a word is written into main storage and checked each time the word is read out; the technique permits detection of most, though not all, read and write errors.

Error correction is a rather new feature which is beginning to appear in some of the recent minicomputer offerings.

This feature involves appending five or six check bits to each word of memory. The check bits, called a Hamming code, and special algorithms allow a system to detect and correct single-bit errors, and also to detect a fair proportion of the multiple-bit errors that occur.

Storage protection is a feature that prevents unauthorized writing in certain areas of main storage. The protection can be accomplished by hardware means, software means, 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.

Central Processor

Although there are many variations in their internal architecture, the great majority of currently available minicomputers are parallel, binary processors with single-address instructions and fixed word lengths of 8, 12, 16, 18, 24, or 32 bits.

In single-address computers, the *number of accumulators* can have a significant effect upon internal flexibility and processing power. An accumulator is a register that holds one operand and permits various arithmetic and logical operations to be performed upon it (e.g., a second operand might be added to the operand contained in the accumulator, with the sum replacing the first operand in the accumulator). In computers with multiple accumulators, instructions involving operands in two of the

accumulators can often be executed more rapidly than instructions which require the retrieval of an operand from main storage.

Indexing is an important form of address modification in which the contents of a special register called an index register are added to the machine address contained in an instruction prior to its execution. An effective indexing scheme is particularly desirable in minicomputers, since it can help to compensate for their limited direct addressing capabilities. The *number of index registers* serves as an indication of a computer's programming flexibility and efficiency. Prospective buyers should note, however, that there are wide variations in the indexing schemes used in current minicomputers. It is important to determine whether the index registers are separate hardware registers or simply reserved locations in main storage, whether special instructions are provided for loading, incrementing, and testing the index registers, and how much additional time (if any) indexing adds to the instruction execution times. It should also be noted that many of the current computers use "general registers" which can serve as either accumulators or index registers.

The *number of directly addressable words* of main storage is an important characteristic that may require some explanation if you're investigating minicomputers for the first time. The problem is that the short word lengths 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 ▷

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▷ 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 multi-word instructions, indexing, and/or indirect addressing.

Number of addressing modes refers to the number of different types of additional addressing modes (other than direct) available to the user. There are many addressing modes being offered today: program-relative, base-relative, indexed, base plus displacement, auto increment/decrement, and many others. Many of these modes can also be combined with indirect addressing, the most popular of all non-direct addressing modes, to create an almost unlimited list of addressing schemes.

Since indirect addressing is so prominent, it deserves a short explanation. Indirect addressing is an address modification technique in which the address part of an instruction specifies a storage location that contains another address rather than the desired operand itself. This second address may in turn be either the address of the desired operand or another indirect address; the latter case is called multi-level indirect addressing. Indirect addressing permits the use of an entire word to hold an operand address. It can also simplify programming and speed up execution times in some applications by making it possible to change the effective address of numerous instructions by altering the indirect address in a single storage location. Each level of indirect addressing, however, usually requires one additional storage cycle of execution time.

Control storage is an indication of the microprogrammability of the minicomputer. Microprogrammability is a trait that enables the vendor and/or the user to tailor a minicomputer's internal processing capabilities to suit his particular needs. In place of conventional hard-wired logic, a microprogrammed computer uses sequences of microinstructions, usually stored in a special read-only memory (ROM), programmable read-only memory (PROM), or bipolar read-only memory (BROM) unit, to define the effects of each instruction in its repertoire. In some cases the microprograms can be altered by the user himself, while in others they are accessible only to the vendor. Microprogrammability can greatly increase the flexibility of a minicomputer, but its presence may involve a trade-off in terms of reduced performance or increased price. Entries here indicate both the type and the size of central storage.

Although it is undeniably dangerous to make inferences about a computer's overall performance capability on the basis of instruction execution times, our charts show the basic *add time, microseconds* to give a first-level indication of fixed-point arithmetic speeds. In general, the indicated add times are the times required to retrieve a one-word operand from main storage and add it to another operand already contained in an accumulator, with no indexing or indirect addressing. Comparisons based on add times can easily be misleading, however, because of differences in word lengths and instruction repertoires.

Hardware multiply/divide facilities are standard in some minicomputers and optional in others. When no hardware facilities are present, multiplication and division must be performed by means of programmed subroutines at a significant reduction in execution speeds. Many minicomputer applications, however, impose little or no need for multiplication or division operations, and in these cases the hardware facilities would be superfluous.

Hardware floating-point facilities are not included in the standard instruction repertoires of most of the currently available minicomputers, despite the fact that floating-point arithmetic is highly desirable, if not essential, in many scientific applications. Where available, these facilities can dramatically reduce the execution times for certain programs by eliminating the need for time-consuming floating-point subroutines.

Hardware byte manipulation is the ability to conveniently process information expressed in the 8-bit character codes which are rapidly becoming an industry standard. Obviously, most of the 8-bit minicomputers are effective byte manipulators, and many of the 16-bit machines offer special instructions that permit either half of a word to be addressed and processed as an 8-bit byte.

Battery backup is a feature unique to minicomputers with semiconductor memory, which is volatile and requires refreshing at regular intervals to retain the data that has been written into it. In the event of a power failure, the contents of memory would be lost if the regulator power supply were not backed up by the battery pack.

An interesting solution to this problem with semiconductor memories is furnished by Computer Talk, Inc., whose battery backup feature causes the contents of memory to be recorded on the system disk if a power failure occurs. When power is restored, memory can be recreated by copying from the disk.

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.

Input/Output Control

A direct memory access channel (DMA) permits direct transfer of I/O data between main storage and a peripheral controller. When a DMA channel is used, the I/O data bypasses the computer's main hardware registers, and the I/O operation proceeds independently of program control once it has been initiated by the program. In minicomputers that lack a DMA channel, I/O data transfers are generally carried out under direct program control, with each word being transferred by way of the processor's registers. Generally speaking, the DMA channel has two significant advantages over program-controlled I/O: it can accommodate higher I/O data rates, ▷

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▷ and it causes far less interference with internal processing operations. Regardless of the type of I/O control they employ, most minicomputers can accommodate multiple I/O devices and include appropriate facilities for addressing the desired device.

Maximum I/O rate, words/sec is a measure of each computer's potential ability to transfer data to and from peripheral devices or other external sources. In machines equipped with a DMA channel, the maximum I/O rate frequently equals the cycling rate of the main storage unit. These maximum I/O rates, however, can be quite deceptive in the case of minicomputers. In general, their storage capacities are limited, their capabilities for simultaneous input/output operations are restricted, and fairly complex programming is associated with I/O operations. For all these reasons, I/O data rates approaching the indicated maximum rates can usually be handled only in short bursts, if at all.

An effective *program interrupt* facility is a requirement for virtually all applications of a real-time nature. An interrupt is a signal that causes a temporary suspension of normal program execution so that the particular condition that caused the interrupt can be dealt with. Interrupts fall into two basic categories: internal and external. Internal interrupts are usually triggered by conditions such as a memory parity error, an illegal instruction, or a power failure. External interrupts usually indicate that a particular peripheral device requires attention or has completed an I/O operation. An interrupt usually results in automatic storage of the current contents of the instruction counter, followed by a transfer of control to a software routine that determines the cause of the interrupt and initiates the appropriate action.

The *number of external interrupt levels* provides a reasonable indication of the power of a minicomputer's interrupt system. It shows the number of different external devices whose interrupt signals can be identified by the processor—though it should be noted that this identification process may require a fairly complex and time-consuming sequence of instructions. Many of the minicomputers offer additional external interrupt levels as extra-cost options, and in these cases our charts show the available range, from minimum to maximum.

Peripheral Equipment

The comparison charts summarize the standard peripheral devices that are available for each minicomputer. (Full details on the specifications and prices of more than 900 peripheral and memory products can be found in the Peripherals section of *DATAPRO REPORTS ON MINI-COMPUTERS*. In addition, the individual minicomputer system reports in the Computers section include coverage of all the important peripheral devices offered with each minicomputer.)

Users who are accustomed to larger general-purpose computer systems will find that the term "standard peripheral device" often has a somewhat different

meaning when used by a minicomputer manufacturer. Since comparatively few of the minicomputer makers produce their own peripheral equipment, the indicated availability of a given type of device may simply mean that an appropriate interface is available to couple the computer with a peripheral unit supplied by some other manufacturer. In many instances the minicomputer manufacturer buys the peripheral device from the peripheral manufacturer and supplies an appropriate interface for his minicomputer. Datapro has made every effort to include *only* the peripheral devices that are physically supplied by the minicomputer vendors; therefore, prospective buyers should ask these questions about each item of peripheral equipment they will need:

- Has it actually been installed and used with the computer of interest?
- If so, what has the users' experience been?
- What software support is available?
- Who will provide service for the device, and under what conditions?

The inclusion of mass storage devices (magnetic disk units) can greatly increase the data storage and processing capabilities of a minicomputer system. Disk units enable millions of characters of information to be constantly accessible to the computer. Moreover, any desired record can be retrieved, updated, and re-recorded on the disk, usually within a fraction of a second.

By replacing or augmenting slower, less flexible file storage media such as punched cards, paper tape, or magnetic ledger cards, disk units can enable small computers to handle applications and processing volumes that would otherwise be impossible. The principal disadvantages of disk units are their comparatively high costs and the software complexities that are encountered by users who attempt to harness their full potential. One or both of these considerations will make disk units impractical for many small computer buyers, despite the obvious appeal of disk-oriented data processing.

The diskette, or "floppy disk," is an innovation that can significantly reduce the cost of disk-oriented data processing. The diskette itself consists of a flexible Mylar disk, about 8 inches in diameter, that is permanently housed in a plastic envelope. It can serve as an input/output and/or random-access storage medium that is considerably smaller in capability and slower in performance than conventional disk units—but also far lower in cost. Introduced by IBM in 1972, diskettes and diskette drive units are now being produced by dozens of vendors and are finding their way into numerous small computer systems, such as the IBM System/32 and Burroughs B 80. Recent enhancements to the floppy disk concept include more concentrated data storage and "flippies" (floppy disks that utilize both sides of the diskette), allowing more data to be stored on-line. ▷

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The Meta 4/5020 is one model of the Meta 4 family of micro-programmed computers from Digital Scientific Corporation. This family offers a broad range of capabilities to accommodate a variety of high-throughput time-sharing applications. The 5020 is a midrange member of this family, which extends from a small OEM package to a large-scale system. The purchase price of a basic Meta 4/5020 is \$24,500.

▷ The other, more conventional types of mass storage devices, cartridge and disk pack drives, provide access to far more data and at significantly faster rates. Unfortunately, they also carry price tags several times higher than their floppy counterparts. Most of these units employ cartridges or disk packs that can easily be removed from the drive units and interchanged in much the same manner as magnetic tape reels.

Some cartridge-type units either use nonremovable media or use two cartridges, one fixed and the other removable. Nonremovable disks impose two important limitations. First, the system's file storage capacity is effectively limited to the amount of information that can be stored on-line. Second, disk dumps to create backup files for efficient restart procedures in case of catastrophe are not available to the user.

Interchangeable disks, conversely, provide great flexibility and make it practical to use small computers effectively for both sequential and random data processing applications. In sequential applications, files of virtually unlimited size can be handled through the use of multiple disk packs or cartridges.

Fixed-head (head-per-track) disk and drum units can provide much faster access to on-line data than any other type of mass storage device. The reason is that there is no loss of time due to head positioning because a head is provided for each track. The only delay is rotational delay (latency), or the time required for the desired data to move under the read/write head. But the price of this type of equipment is higher than that of the preceding varieties, and less data can be stored on-line. Fixed-head devices are used when data bases are relatively small and very rapid access to the information is required.

Floppy disk (diskette) drives indicates whether floppies are available for a particular minicomputer and the minimum and maximum on-line capacities that are offered.

Disk pack/cartridge drives signifies whether one or the other, or both, types of devices can be interfaced to the system and the minimum and maximum on-line capacities available.

Drum/fixed-head disk storage informs the reader as to the availability of a drum or head-per-track (fixed-head) disk drive and the minimum and maximum on-line capacities offered.

The indicated maximum storage capacities are shown in thousands (K) or millions (M) of bytes and may be the capacity of a single disk or the total capacity of two or more (typically, four to eight) drives that can be connected to one controller. It is difficult to imagine minicomputer users wanting more disk storage, but if an I/O slot is open, theoretically, another controller and its associated drives can be added to most systems.

Magnetic tape cassettes and cartridges offer increased convenience in that they can be transported and stored with little fear of damaging the data that has been recorded. What's more, price tags for cassette and cartridge drives are significantly lower than those of the more conventional reel-to-reel variety, but once again the trade-off of slower transfer rates and reduced on-line storage must be accepted. The charts indicate the availability of *magnetic tape cassettes/cartridges* and *magnetic tape*, $\frac{1}{2}$ -inch drives and their associated transfer rates in characters per second (cps) or thousands of bytes per second (KBS).

Punched card input informs the reader if a punched card reader is offered and its speed in cards per minute (cpm).

Serial (character-at-a-time) printers are enjoying increased popularity with the prolific growth of the minicomputer marketplace. The main reason is price; serial printers can provide excellent-quality hard-copy reports for far less money than the line-at-a-time printers used with larger computers. However, for users who require faster printing capabilities, *line printers* are also available for many systems. Serial printers generally range in speed from about 30 to 600 or more characters per second (cps), while line printers operate at speeds of 100 to 2000 or more lines per minute (lpm). The user who needs faster printed output can obviously get it, but he must be willing to pay the higher price tag associated with the line printers.

Data communications interface describes the minicomputer's capabilities, if any, to send and receive data over a common-carrier communications link. Depending on the configuration, a minicomputer can be programmed to function as an intelligent terminal communicating with a larger host computer, or the mini can act as the host

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computer communicating with other terminals in a network. The chart entry indicates whether an interface is available and gives the range of data rates or the maximum data rate in bits per second (bps).

CRT indicates the availability of a CRT display unit and describes its standard screen size in characters per line and number of lines per screen (e.g., 80 char. x 24 lines).

Other standard peripheral units lists the additional peripheral devices that are available for each system. Typical entries include analog/digital (A/D) converters, paper tape readers, paper tape punches, plotters, etc.

Software

A critically important area to be evaluated is *software*—the programming packages and languages used to program the computer and thereby direct its operations. It is important that you carefully investigate the available software. This investigation should include the operating systems, programming languages, preprogrammed utility packages such as sorts and file maintenance, and application packages such as payroll, inventory control, general ledger, etc. Prospective buyers should carefully note whether the software they will require is included in the cost of the system or offered at extra cost.

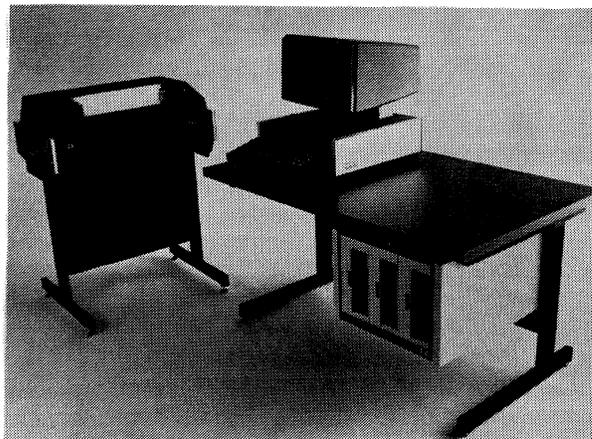
Vendors' claims and promises concerning the availability and capability of software should be carefully checked. This is particularly true of software that has been announced but not yet released. Vendors have frequently failed to live up to their marketing publicity.

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 own program 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 or, in some cases, a macro assembler.

A macro assembler is another software tool to aid the programmer and make his job a little easier. Macro routines can be called by the programmer and copied right into his 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: the use of macros usually wastes memory space.

Entries in this section of the charts indicate whether an assembler, a macro assembler, or both are available.

A *compiler* is a software tool designed to 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



The Cado System 40/IV is a multi-terminal, multi-tasking system that uses AT&T's Dataspeed 40 CRT terminals and printers. The 40/IV system includes a CPU with up to 54K bytes of main memory and up to 19 megabytes of disk storage. The Bell System's Dataspeed 40 display units and printers can be connected directly to the 40/IV in a variety of configurations. The CRTs can be separated from the printer, terminals can be connected remotely by the use of modems, and host computers can address the Cado system. Included with the system are a monitor, compiler-editor, and disk utilities.

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 minicomputers. This trend is possible because of the more powerful central processors now being used, since compilation is an intricate process that requires more storage space and processing power than the earlier minicomputers provided. Where compilers are offered, however, they frequently limit the programmer to restricted subsets of the standard programming languages and/or require the use of a larger computer to perform the compilation process.

Entries in this section of the charts may include *COBOL* (COmmon Business Oriented Language), *RPG* (Report Program Generator), *FORTTRAN* (FORmula TRANslator), *BASIC* (Beginners All-purpose Symbolic Instruction Code), *ALGOL* (ALGOrithmic Language), or proprietary languages that are available from a vendor for use on a particular system, and indicate the availability of those compilers for each minicomputer. The key word of warning here is that if you use a language that is unique to a vendor, you will be faced with a big problem if someday you decide to change vendors. Your investment in software will be lost, since the programs will not operate on any other system.

An *operating system* facilitates the operation of a computer by handling functions such as: (1) scheduling, loading, and supervising the execution of programs; (2) allocating storage and I/O devices; (3) initiating and controlling I/O operations; (4) analyzing interrupt signals and dealing with errors; (5) handling communications between the system and its human operator; and (6) controlling multiprogramming or time-sharing operations. ▷

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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 (communication between operator and system is not permitted once the job has begun); "interactive," which means that the system allows data, parameters, etc., 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.

Language implemented in firmware and operating system implemented in firmware tell the reader whether or not the language processor and/or the operating system are contained in microcode. The entries stipulate "Fully," "partially," or "no" to indicate the extent of firmware implementation. An advantage to the user is that a language and/or operating system implemented in firmware frees up more memory space for the user's programs and data. Also, the microcode is usually inaccessible to the user (generally contained in read-only memory), eliminating any possible tampering with the language processor or operating system and reducing chances for error. A third advantage derived from firmware implementation is the ability to create more sophisticated and complex system functions at the hardware level. Microcode routines can be substituted for often-used subroutines, thereby increasing system performance.

Pricing and Availability

The comparison charts show the *price of CPU, power supply, front panel, and minimum memory in chassis* along with the memory size in parentheses. *Price of memory increment* stipulates the costs of various sizes (when available) of memory increments, with the actual sizes in parentheses.

(Completely detailed pricing data is provided with each minicomputer system report in the Computers section of this service. Detailed pricing on any minicomputer which is not covered in the in-depth report format can be obtained directly from the Datapro analysts by using the Datapro Inquiry Service.)

If you'll need two or more minicomputers, it's also worth noting that most of the manufacturers offer sizeable discounts from their list prices on orders for multiple computers. Discounts of up to 40 percent are not unusual on large orders.

Date of first delivery indicates when the first production model of each minicomputer 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 approximately August 31, 1978. All figures were supplied by the manufacturers themselves.

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, or applications.

MINICOMPUTER MANUFACTURERS

Listed below, for your convenience in obtaining additional information, are the full names, addresses, and telephone numbers of the 74 suppliers whose products are listed in the comparison charts that follow.

Advanced Information Design, Inc., 1240 Elko Drive, Sunnyvale, California 94086. Telephone (408) 744-0900.

Anderson-Jacobson, Inc., 521 Charcot Avenue, San Jose, California 95131. Telephone (408) 263-8520.

Applied Systems Corporation, 26401 Harper Avenue, St. Clair Shores, Michigan 48081. Telephone (313) 779-8700.

Bainbridge Research & Development, Inc., 12715 Miller Road, N.E., Bainbridge Island, Washington 98110. Telephone (800) 426-0070.

Basic/Four Corporation, 14101 Myford Road, Tustin, California 92680. Telephone (714) 731-5100.

BTI Computer Systems, Inc., 870 West Maude Avenue, Sunnyvale, California 94086. Telephone (408) 733-1122.

Burroughs Corporation, Burroughs Place, Detroit, Michigan 48232. Telephone (313) 972-7525.

Cado Systems Corporation, 2730 Monterey Street, Torrance, California 90503. Telephone (213) 320-9660.

Cascade Data, Inc., 6300 28th Street, S.E., Grand Rapids, Michigan 49506. Telephone (616) 942-1420.

Century Computer Corporation, 4410 Spring Valley Road, Dallas, Texas 75240. Telephone (214) 233-3238.

Cincinnati Milacron, Inc., Mason Road and S.R. 48, Lebanon, Ohio 45036. Telephone (513) 494-1200.

Computer Automation, Inc., 18651 Von Karman Avenue, Irvine, California 92664. Telephone (714) 835-8830.

Computer Hardware, Inc., 411 North Freeway Boulevard, P.O. Box 255000, Sacramento, California 95834. Telephone (916) 929-2020.

Computer Talk, Inc., P.O. Box 100, Idledale, Colorado 80453. Telephone (303) 697-4315.

Computervision Corporation, 201 Burlington Road, Route 62, Bedford, Massachusetts 01730. Telephone (617) 275-1800.

Control Data Corporation, P.O. Box 0, Minneapolis, Minnesota 55440. Telephone (612) 853-4656.

Data General Corporation, 15 Turnpike Road, Westboro, Massachusetts 01581. Telephone (617) 366-8911.

Datapoint Corporation, 9725 Datapoint Drive, San Antonio, Texas 78284. Telephone (512) 690-7000.

Dataram Corporation, Princeton-Hightstown Road, Cranbury, New Jersey 08512. Telephone (609) 799-0071.

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The BTI 8000, from BTI Computer Systems (formerly Basic Timesharing, Inc.), is a 32-bit multiprocessor system designed for OEM applications, service bureaus, and in-house time-sharing. The basic configuration includes the CPU with 256K bytes of core memory, 33 megabytes of disk storage, a magnetic tape cartridge drive, and an asynchronous communications controller. The BTI 8000 can support up to 100 megabytes of main memory, over 2 billion bytes of disk storage, and a practical maximum of 512 users. Deliveries of the new BTI system are scheduled to begin in March 1979.

▷ *Datsaab Systems Inc.*, 437 Madison Avenue, New York, New York 10022. Telephone (212) 754-0680.

Decision Data Computer Corporation, 100 Witmer Road, Horsham, Pennsylvania 19044. Telephone (215) 674-3300.

Diablo Systems, Inc., 1270 East Arques Avenue, Sunnyvale, California 94086. Telephone (408) 733-2300.

Digital Equipment Corporation, 146 Main Street, Maynard, Massachusetts 01754. Telephone (617) 897-5111.

The Digital Group, P.O. Box 6528, Denver, Colorado 80206. Telephone (303) 777-7133.

Digital Scientific Corporation, 11455 Sorrento Valley Road, San Diego, California 92121. Telephone (714) 453-6050.

Digital Systems Corporation, P.O. Box 396, Walkersville, Maryland 21793. Telephone (301) 845-4141.

Display Data Corporation, Executive Plaza IV, Hunt Valley, Maryland 21031. Telephone (301) 667-9211.

Durango Systems, Inc., 10101 Bubb Road, Cupertino, California 95014. Telephone (408) 996-1001.

Financial Computer Corporation, 412 West Redwood Street, Baltimore, Maryland 21201. Telephone (301) 837-9510.

Four-Phase Systems, Inc., 10700 North DeAnza Boulevard, Cupertino, California 95014. Telephone (408) 255-0900.

Functional Automation, Inc., 118 Northeastern Boulevard, Nashua, New Hampshire 03060. Telephone (603) 882-1580.

General Automation, Inc., 1055 South East Street, Anaheim, California 92805. Telephone (714) 778-4800.

General Robotics Corporation, 55-57 North Main Street, Hartford, Wisconsin 53027. Telephone (414) 673-6800.

GRI Computer Corporation, 320 Needham Street, Newton, Massachusetts 02164. Telephone (617) 969-0800.

Harris Corporation, Computer Systems Division, 1200 Gateway Drive, Fort Lauderdale, Florida 33309. Telephone (305) 974-1700.

Hewlett-Packard, Data Systems Division, 11000 Wolfe Road, Cupertino, California 95014. Telephone (408) 257-7000.

Hewlett-Packard, Fort Collins Division, 3400 East Harmony Road, Fort Collins, Colorado 80521. Telephone (303) 226-3800.

Hewlett-Packard, Desktop Computer Division, 3725 Canal Drive, Fort Collins, Colorado 80521. Telephone (303) 221-5000.

Hewlett-Packard, GSD Division, 5303 Stevens Creek Road, Santa Clara, California 95050. Telephone (408) 249-7020.

Honeywell Information Systems, Inc., 200 Smith Street, Waltham, Massachusetts 02154. Telephone (617) 890-8400.

IBM Corporation, General Systems Division, 875 Johnson Ferry Road, N.E., Atlanta, Georgia 30342. Telephone (404) 231-3000.

ICL, Inc., Turnpike Plaza, 197 Highway 18, East Brunswick, New Jersey 08816. Telephone (201) 246-3400.

Intelligent Systems Corporation, 5965 Peachtree Corners East, Norcross, Georgia 30071. Telephone (404) 449-5961.

Interdata, Inc., 2 Crescent Place, Oceanport, New Jersey 07757. Telephone (201) 229-4040.

Jacquard Systems, 1639 11th Street, Santa Monica, California 90404. Telephone (213) 393-9784.

Katcard Systems Ltd., 250 Don Park Road, Unit 14, Markham (Toronto), Ontario, Canada L3R 2V1. Telephone (416) 495-9590.

Keronix Data Systems, Inc., 250 East Emerson Avenue, Orange, California 92665. Telephone (714) 974-0800.

Lockheed Electronics Company, Data Products Division, U.S. Highway 22, Plainfield, New Jersey 07061. Telephone (201) 575-8100.

MCM Computers Ltd., P.O. Box 310, 133 Dalton Street, Kingston, Ontario, Canada K7L 4W2. Telephone (613) 544-9860.

Melcom Business Systems, Inc., 2200 West Artesia Boulevard, Suite 101, Compton, California 90220. Telephone (213) 979-6055.

Microdata Corporation, 17481 Red Hill Avenue, Irvine, California 92705. Telephone (714) 540-8341.

Modular Computer Systems, Inc., 1650 West McNab Road, Fort Lauderdale, Florida 33309. Telephone (305) 974-1380.

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▷ *Mylee Digital Sciences, Inc.*, 155 Weldon Parkway, Maryland Heights, Missouri 63043. Telephone (314) 567-3420.

Nanodata Corporation, 2457 Wehrle Drive, Williamsville, New York 14221. Telephone (716) 631-5880.

NCR Corporation, Main and K Streets, Dayton, Ohio 45409. Telephone (513) 449-2000.

New England Digital Corporation, P.O. Box 305, Norwich, Vermont 05055. Telephone (802) 649-5183.

Olivetti Corporation of America, 500 Park Avenue, New York, New York 10022. Telephone (212) 371-5500.

Philips Business Systems, Inc., 175 Froehlich Farm Boulevard, Woodbury, New York 11797. Telephone (516) 921-9310.

Plessey Peripheral Systems, Inc., 17466 Daimler Street, Irvine, California 92714. Telephone (714) 540-9945.

Prime Computer, Inc., 40 Walnut Street, Wellesley, Massachusetts 02181. Telephone (617) 879-2960.

Qantel Corporation, 3525 Breakwater Avenue, Hayward, California 94545. Telephone (415) 783-3410.

Randal Data Systems, Inc., 365 Maple Avenue, Torrance, California 90503. Telephone (213) 320-8550.

Raytheon Data Systems Company, 1415 Boston-Providence Turnpike, Norwood, Massachusetts 02062. Telephone (617) 762-6700.

Rolm Corporation, 4900 Old Ironsides Drive, Santa Clara, California 95050. Telephone (408) 988-2900.

Systems Approach Ltd., 1257 Algoma Road, Ottawa, Ontario, Canada K1B 3W7. Telephone (613) 741-9500.

Systems Engineering Laboratories, Inc., 6901 West Sunrise Boulevard, Fort Lauderdale, Florida 33313. Telephone (305) 587-2900.

Tandem Computers, Inc., 19333 Vallco Parkway, Cupertino, California 95014. Telephone (408) 996-6000.

Tektronix, Inc., P.O. Box 500, Beaverton, Oregon 97077. Telephone (503) 644-0161.

Texas Instruments, Inc., P.O. Box 2909, Austin, Texas 78769. Telephone (512) 258-7111.

Univac (Sperry Univac Division), Sperry Rand Corporation, P.O. Box 500, Blue Bell, Pennsylvania 19422. Telephone (215) 542-4011.

Univac Minicomputer Operations, 2722 Michelson Drive, Irvine, California 94662. Telephone (714) 833-2400.

Wang Laboratories, Inc., One Industrial Avenue, Lowell, Massachusetts 01851. Telephone (617) 851-4111.

Warrex Computer Corporation, 2505 North Central Expressway, Dallas, Texas 75243. Telephone (214) 233-8400.

Westinghouse Electric Corporation, Digital Products Department, 1200 West Colonial Drive, Orlando, Florida 32804. Telephone (305) 843-7030.□

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MANUFACTURER & MODEL	Advanced Information Design System 2000	Anderson Jacobsen 1500	Applied Systems Corporation ASC/80	Basic Four 200	Basic Four 400
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 16 16, 32	8-bit byte 8, 16 8, 24	8, 16 8, 32 8, 32	8-bit byte 16, 32 8, 16, 24, 32	8-bit byte 16, 32 8, 16, 24, 32
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS or core 0.6 0.3 4K 32K Optional No Optional	Core, MOS 1.0; 0.8 0.8; 0.5 32K bytes 64K bytes No No No	MOS 1.0 0.5 4K 128K Optional Optional Optional	MOS 0.60 0.40 32K bytes 40K bytes Standard No No	MOS 0.60 0.40 32K bytes 64K bytes Standard No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	16 15 32K 4 ROM; 4K bytes 1.2 Standard Optional Standard Optional Standard	128 3 64K 2 ROM; 4K bytes 4 No No Standard No Standard	2 7 64K 3 PROM; 64K max. 1.0 Optional Optional Standard Optional Standard	2 1 64K 8 ROM; 1K x 16 bits 7.4 No No Standard Standard Standard	2 1 64K 8 ROM; 1K x 16 bits 7.4 No No Standard Standard Standard
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 1 million 4-256	Standard 606K 15	Optional 50K 8 optional	Standard 1M 8	Standard 1M 8
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	640-2,400KB Pack & Cartridge; 10-1200M bytes No Cassette; 500 bps 4 units; 45-120 KBS 300-1000 cpm 30-165 cps 300-1200 lpm 50-9600 bps 24 char. x 80 lines Paper tape, A/D converters	640K-2.56M bytes Cartridge; 10-40M bytes No No No 45, 120 cps 125 lpm, 300 lpm 1200 bps; asynch. 80 char. x 24 lines	250KB to 2MB Optional 10 to 100MB (optional) A/R optional Optional 300 cpm 30/180 cps A/R optional To 19.2KB 64 x 16 std.; 80 x 24 Plotters, graphic CRT, A/D-D/A I/O	No Cartridge; 10-20M bytes No Std.; 2.3M bytes 10 KBS No 120 cps No 1200 bps 80 char. x 24 lines	No Cartridge; 10-40M bytes No No 10 KBS No 160 cps 300, 600 lpm 1200 bps 80 char. x 24 lines
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Assembler & macro assembler FORTRAN, BUSI- NESS, BASIC, COBOL, RPG II Multi-user, time- sharing, real-time No No	Assembler BASIC ESP Multi-user Partially Partially	Yes, macro assem- bler optional BASIC, FORTRAN, PASCAL, PL/M Optional Optional Optional	No Business BASIC Single-user inter- active No Partially	No Business BASIC Multi-user No Partially
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$2,800 (8K bytes) \$800 (8K words) June 1975 50+	\$18,150 (32K bytes) \$3,000 (32K bytes) July 1977 200+	\$900 (basic system) \$250 (8K bytes) 1977 NA	\$29,000 (32K bytes) \$2,000 (8K bytes) 1978 5000 (all models)	\$36,900 (32K bytes) \$2,000 (8K bytes) \$2,500 (16K bytes) 1971 5000 (all models)
COMMENTS	System operates either under a com- mercially oriented time-sharing sys- tem with Business BASIC or a real- time OS with back- ground batch for FORTRAN, COBOL, etc.; also has inter- active control sys- tem; instruction set is similar to that of IBM 370	Multiprogramming operating system, up to four partitions; client accounting software—Payroll, A/R, G/L, A/P, sales acctg., word proc., time cost bill- ing, inventory con- trol	Modular computer system designed for general applica- tions and special business, commu- nications, and real- time/control opera- tions	Available as pack- aged systems only; system price also includes fixed disk subsystem, serial printer, and CRT ter- minal	

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MANUFACTURER & MODEL	Basic Four 610	Basic Four 730	BRD Dolphin	BRD Porpoise	BTI 5000
DATA FORMATS					
Word length, bits	8-bit byte	8-bit byte	8-bit byte	8-bit byte	16
Fixed-point operand length, bits	16, 32	16, 32	8	8	16
Instruction length, bits	8, 16, 24, 32	8, 16, 24, 32	16	16	16
MAIN STORAGE					
Storage type	MOS	MOS	MOS	MOS	MOS and core
Cycle time, microseconds/word	0.60	0.60	0.60	0.60	0.60
Access time, microseconds/word	0.40	0.40	1.00	1.00	0.3
Minimum capacity, words	40K bytes	96K bytes	4K bytes	4K bytes	32K bytes
Maximum capacity, words	128K bytes	256K bytes	32K bytes	32K bytes	32K bytes
Parity checking	Standard	Standard	Standard	Standard	Standard
Error correction	No	No	No	No	Yes, with MOS
Storage protection	No	No	No	No	Standard
CENTRAL PROCESSOR					
No. of accumulators	2	2	480	480	2; not user-accessible
No. of index registers	1	1	480	480	NA
No. of directly addressable words	64K	64K	4K to 8K	4K to 8K	NA
No. of addressing modes	8	8	2	2	NA
Control storage	ROM; 1K x 16 bits	ROM; 1K x 16 bits	EPROM; 14K	EPROM; 12K	PROM; 98K bits
Add time, microseconds	7.4	7.4	5.0	5.0	20
Hardware multiply/divide	No	No	Standard	Standard	Standard
Hardware floating point	No	No	No	No	Standard
Hardware byte manipulation	Standard	Standard	Standard	Standard	Standard
Battery backup	Standard	Standard	No	No	Standard
Real-time clock or timer	Standard	Standard	No	No	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	1M	1M	1M	1M	616K
No. of external interrupt levels	8	8	None	None	NA
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	No	No	1.2MB; dual dr. std.	622KB; dual dr. std.	No
Disk pack/cartridge drives	Cartridge; 35M-105M	Cartridge; 75M-300M bytes	No	No	Non-remov. pack, 29MB to 392MB
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	Opt.; 9.2 bytes	No	No	No	No
Magnetic tape, 1/2-inch	10 KBS	10 KBS	No	No	Cart; 24KB/sec.
Punched card input	No	No	No	No	No
Serial printer	160 cps	160 cps	45-200 cps	30-55 cps	No
Line printer	300, 600 lpm	300, 600 lpm	No	No	300, 600, 900 lpm
Data communications interface	1200 bps	1200 bps	300-1200 bps	300 bps	2400 bps; asynch.
CRT	80 char. x 24 lines	80 char. x 24 lines	24 x 80	24 x 80	No
Other standard peripheral units	—	—	No	No	None
SOFTWARE					
Assembler	No	No	No	No	No
Compilers	Business BASIC	Business BASIC	BASIC	BASIC	BASIC
Operating system	Multi-user	Multi-user	Real-time	Real-time	Time-sharing
Language implemented in firmware	No	No	B.A.L./fully	B.A.L./fully	Partially
Operating system implemented in firmware	Partially	Partially	Fully	Fully	Partially
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$51,400 (40K bytes)	\$110,000 (96K bytes)	\$18,000 to \$25,000	\$10,000 to \$15,000	\$38,950
Price of memory increment	\$2,000 (8K bytes) \$2,500 (16K bytes)	\$3,900 (32K bytes)	\$400 (4K bytes)	\$400 (4K bytes)	None
Date of first delivery	1978	1978	July 1977	January 1978	August 1978
Number installed to date	5000 (all models)	5000 (all models)	125	25	650 (all models)
COMMENTS			Entry-level small business system; price also includes dual floppy disk drives, workstation, cabinet, and desk as standard; software packages available for most business applications	Entry-level small business system; price also includes dual floppy disk drives, workstation, cabinet, and desk as standard; software packages available for most business applications	Packaged system includes non-removable and/or pack disk drives, cartridge magnetic tape drives; reel-to-reel tape drives and line printers are standard options; up to 32 users supported; price is for minimum system configuration

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	BTI 8000	Burroughs L 9000 Series	Burroughs B 80	Burroughs B 730/B 720	Burroughs B 770 Series
DATA FORMATS					
Word length, bits	32	64	8-bit byte	64	16
Fixed-point operand length, bits	32 and 64	—	—	—	—
Instruction length, bits	32	Variable	Variable	Variable	Variable
MAIN STORAGE					
Storage type	Core	MOS	MOS	MOS	Core, MOS
Cycle time, microseconds/word	0.67	1.5	1.0	1.0	1
Access time, microseconds/word	0.4	1.2	0.5	0.5	0.4; 0.63
Minimum capacity, words	64K bytes	4K bytes	32K bytes	32K bytes	16K bytes
Maximum capacity, words	32M bytes	48K bytes	128K bytes	80K bytes	48K; 96K bytes
Parity checking	Standard	Standard	Standard	Standard	Standard
Error correction	No	No	No	No	No
Storage protection	Standard	Standard	Standard	Standard	Standard
CENTRAL PROCESSOR					
No. of accumulators	—	None to user	None to user	None to user	None to user
No. of index registers	8 gen.-purpose reg.	4	None to user	None to user	None to user
No. of directly addressable words	—	—	—	—	—
No. of addressing modes	—	—	—	—	—
Control storage	PROM	RAM; 8K bytes	ROM; 4K bytes	ROM; 3584 bytes	RAM; 32K bytes
Add time, microseconds	3.5	—	—	0.43	—
Hardware multiply/divide	Standard	—	—	No	—
Hardware floating point	Standard	No	No	No	No
Hardware byte manipulation	Standard	Standard	Standard	Standard	—
Battery backup	Standard	—	—	—	—
Real-time clock or timer	Standard	—	—	—	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	6 std., 32 opt.	—	—	—	Standard
Maximum I/O rate, words/sec.	10M	—	—	—	—
No. of external interrupt levels	NA	—	—	—	—
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	No	No	243K-6M bytes	243K-1.5 bytes	243K bytes
Disk pack/cartridge drives	Pack; 33 MB to 46,368 MB	No	Cartridge; 4.6-27.6M bytes	Cartridge; 4.6-36.8M bytes	Cartridge; 4.6-36.8M bytes
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	No	Cassette; 1 KBS	Cassette; 1 KBS	Cassette; 1 KBS	Cassette; 1 KBS
Magnetic tape, 1/2-inch	Cart.; 24 KBS	10 KBS	No	10 KBS	10 KBS
Punched card input	No	480 cpm	No	600 cpm	300-800 cpm
Serial printer	No	60, 90, 120, 150 cps	60, 180 cps	60 cps	No
Line printer	300, 600, 900 lpm	90-250 lpm	160, 250 lpm	85-400 lpm	85-750 lpm
Data communications interface	19.2 bps; asynch.	9600 bps	9600 bps	9600 bps	9600 bps
CRT	No	32 char. x 8 lines	80 char. x 24 lines	80 char. x 24 lines	No
Other standard peripheral units	None	Mag. ledger card reader	—	Card punch, card reader/punch	Up to 2 data communications processors; reader/punch/data record
SOFTWARE					
Assembler	No	Assembler	No	No	Assembler
Compilers	BASIC, FORTRAN, COBOL, PASCAL, RPG II	COBOL	COBOL, RPG, NDL, MPL	COBOL, RPG, AEL	COBOL, RPG, NDL, MPL
Operating system	Time-sharing and batch	—	Interactive	Real-time	Batch, real-time
Language implemented in firmware	No	Fully	Fully	Fully	Fully
Operating system implemented in firmware	No	—	Fully	Fully	Fully
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$86,850	\$16,490 (4K bytes)	\$19,510 (32K bytes)	\$20,900 (32K bytes)	\$16,200 (32K bytes)
Price of memory increment	\$9,000 (128K bytes)	\$800 (2K bytes); \$1,400 (4K bytes)	\$900 (4K bytes); \$1,500 (16K bytes)	\$2,280 (8K bytes)	\$990 (8K bytes)
Date of first delivery	March 1979	June 1975	April 1976	March 1973	1974
Number installed to date	None	Thousands	NA	NA	NA
COMMENTS					
	Packaged system for interactive and multistream batch workload; variable resource bus architecture accommodates up to 8 processors, together with multiple memory modules and peripheral processor	Six models: L 9300, L 9400, and L 9500 with 60-cps printer, L 9700, L 9800, and L 9900 with 90-cps printer; L 9500 and L 9900 have mag. ledger capability	Offers the technology of Burroughs' larger computers	System price includes console printer; AEL and COBOL or RPG programs can run concurrently	Systems and communications processors; not all models allow all features presented

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Burroughs B 800 Series	Burroughs B 1700 Series	Burroughs B 1720 Series	Burroughs B 1800 Series	Cado Systems Corporation System 20
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	64, 16 — Variable	8-bit byte — Variable	64 — Variable	8-bit byte — Variable	8-bit byte 48 8
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS, bipolar 1 0.5 32K bytes 144K bytes Standard No Standard	MOS 1.5 1.0 24K bytes 128K bytes Standard No Standard	MOS 1.0 0.67 48K bytes 378K bytes Standard No Standard	MOS 1.7-2.0 — 96K bytes 1M bytes Standard No Standard	MOS 2.5 0.75 6K 10K No No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	None to user None to user — — RAM; to 48K — — No — — Standard	None to user None to user — — No — — No — —	None to user None to user — — ROM; to 8K bytes — — No — —	None to user None to user — — ROM; 4K bytes — — No — Standard	1 0 10K NA PROM; 1-2K, 1-1K 6.0 (5 digits) No No Standard No No
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 2M bytes —	— — —	— — —	— — —	Standard 1 MB/sec None
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	2M bytes Pack/cartridge; 4.6-130.4M bytes Fixed-head; 9.4- 65.6M bytes Cassette; 3 KBS 10 KBS 300-600 cpm 120 cps 160-750 lpm 9600 bps 80 char. x 24 lines Card punch; card reader/punch; DDES	No Pack & cartridge; 2.3-697.6M bytes Fixed-head disk; 1.9M bytes Cassette; 1 KBS 10-120 KBS 300-1400 cpm No 85-1040 lpm 9600 bps 80 char. x 24 lines Card punch; card reader/punch	No Pack & cartridge; 2.3-697.6M bytes Fixed-head disk; 1.9-70M bytes Cassette; 1 KBS 10-120 KBS 300-1400 cpm No 85-1040 lpm 9600 bps 80 char. x 24 lines Card punch; card reader/punch	486K bytes Pack & cartridge; 4.6-697M bytes No Cassette; 1 KBS 10-120 KBS 300-1400 cps No 400-1500 lpm 9600 bps 80 char. x 24 lines Card punch; card reader/punch	1.2 to 3.6M bytes Cart.; 9.5 to 19M bytes Fixed media ; 15M bytes No NA No 150 cps No 9600 bps 80 char. x 24 lines None
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	No COBOL, RPG, NDL, MPL Batch, real-time Fully Fully	No COBOL, FORTRAN, RPG, BASIC, UPL, NDL Batch, real-time, time-sharing Fully Fully	No COBOL, FORTRAN, RPG, BASIC, UPL, NDL Batch, real-time, time-sharing Fully Fully	No COBOL, RPG, MPL, NDL Batch, real-time Fully Fully	No Basic (CADOL) Real-time Partially Partially
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$32,400 (32K bytes) \$990 (8K MOS)	\$25,780 (24K bytes) \$2,500 (16K bytes)	\$64,800 (48K bytes) \$2,500 (16K bytes)	\$48,500-\$140,090 \$3,000 (16K bytes)	\$5,000 January 1978 200+
COMMENTS					

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Cado Systems Corporation System 20/IV	Cado Systems Corporation System 40	Cado Systems Corporation System 40/IV	Cascade Data Concept II	Cascade Data Concept III
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8-bit byte 48 8	8-bit byte 48 8	8-bit byte 48 8	16 16-32 16-40	16 16-32 16-40
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 1.3 0.4 20K 52K Standard No No	MOS 2.5 0.75 5K 9K No No No	MOS 1.3 0.4 20K 48K Standard No No	Core 1.0 0.35 16K 64K Standard No No	Core 1.0 0.35 16K 64K Standard No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	1 0 52K NA PROM; 2—2K 3.9 (5 digits) No No Standard No Standard	1 0 9K NA ROM; 2K 6.0 (5 digits) No No Standard No No	1 0 52K NA PROM; 2—2K 3.9 (5 digits) No No Standard No Standard	16 3 32K 2 No 8.8 Standard No Standard Optional Optional	16 3 32K 2 No 7.5 (word) Standard No Standard Optional Optional
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 1MB/sec 3	Standard 1MB/sec None	Standard 1MB/sec 3	Standard 413K 0	Standard 413K 0
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	1.2 to 3.6M bytes Cart.: 9.5 to 19M bytes Fixed media; 15M bytes No NA No 150 cps 300 lpm 9600 bps 80 char. x 24 lines None	1.2 to 3.6M bytes Cart.: 9.5 to 19M bytes Fixed media; 15M bytes No NA No 45 cps 300 lpm 9600 bps 80 char. x 24 lines None	1.2 to 3.6M bytes Cart.: 9.5 to 19M bytes Fixed media; 15M bytes No NA No 45 cps 300 lpm 9600 bps 80 char. x 24 lines None	No Cartridge; 40M bytes No No 30, 60 KBS 300 cpm 55 cps 125-600 lpm 9600 bps 80 char. x 24 lines Paper tape reader, paper tape punch	1.2M bytes Cartridge; 40M bytes No No 30-60 KBS 300 cpm 55 cps 125-600 lpm 9600 bps 80 char. x 24 lines Paper tape reader, paper tape punch, card reader
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	No Basic (CADOL) Real-time, multi-task Partially Partially	No Basic (CADOL) Real-time Partially Partially	No Basic (CADOL) Real-time, multi-task Partially Partially	Macro assembler RPG Batch, real time, time-sharing No No	Macro assembler RPG Batch, real time, time-sharing No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$7,000 — June 1978 60+	\$5,000 — April 1976 600+	\$7,000 — June 1978 60+	\$22,200 (16K bytes) \$1,200 (16K bytes), \$2,700 (32K bytes) January 1970 260	\$26,900 (16K bytes) \$1,200 (16K bytes), \$2,700 (32K bytes) November 1977 15
COMMENTS				Operating system provides 2 partitions; system price includes CRT and cartridge disk	Operating system provides 4 partitions; system price includes CRT and cartridge disk

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Cascade Data Concept IV	Century Computer 300	Century Computer 400	Century Computer 700	Century Computer 900
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8 16-32 8-24	8-bit byte 8 8, 16, 24	16 + 5 16 8, 16, 24	8 16 8, 16, 24, 32	8 16 8, 16, 24, 32
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 0.6 0.5 32K 64K No No No	MOS 0.6 0.2 16K, 32K bytes 60K No No No	MOS 0.6 0.2 32K bytes 512K bytes Optional Optional Optional	MOS 0.6 0.2 32K bytes 512K bytes Optional Optional Optional	MOS 0.6 0.2 96K bytes 512K bytes Optional Optional Optional
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	12 6 64 7 No 2.0 (byte) No No Standard Optional Standard	16 16 64K bytes 17 PROM; to 2K bytes 2.6 Optional Standard Standard No No	16 16 64K bytes 17 PROM; to 2K bytes 2.6 Optional Standard Standard Optional Optional	16 16 64K bytes 17 PROM; to 2K bytes 2.6 Optional Optional Standard Optional Optional	16 16 64K bytes 17 PROM; to 2K bytes 2.6 Optional Optional Standard Optional Optional
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 750K 0	Optional 1M 15; 120	Standard 1M 120	Standard 1M 120	Standard 1M 120
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	4.8M bytes No No No No 60 cps 125-600 lpm 19.2K bps 80 char. x 24 lines Paper tape reader, paper tape punch	376K bytes Pack & cartridge; 20-100M bytes No Cassette; 300 cps 120 KBS 300, 600 lpm 165 cps 300, 600 lpm Up to 9600 bps 80 char. x 24 lines Paper tape reader	384K bytes Pack & cartridge; 10-1200M bytes No Cassette; 300 cps 120 KBS 300, 600 cpm 165 cps 300, 600 lpm Up to 9600 bps 80 char. x 24 lines Paper tape reader	No Pack & cartridge; 10-120M bytes Fixed-head; 74- 296M bytes No 36 KBS 300 cpm 165 cps 600 lpm Up to 9600 bps 80 char. x 24 lines Paper tape reader	No Pack & cartridge; 10-120M bytes Fixed-head; 74- 296M bytes No 36 KBS 300 cpm 165 cps 600 lpm Up to 9600 bps 80 char. x 24 lines Paper tape reader
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Macro assembler, BASIC No Batch, real-time Partially Partially	Yes BASIC, CPL Batch, real-time No No	Yes BASIC, CPL Batch, real-time No Partially	Yes BASIC, CPL Batch, real-time No Partially	Yes BASIC, CPL Batch, real-time No Partially
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$14,000 (32K bytes) \$1,500 (16K bytes) September 1978 —	\$17,000 (32K bytes) \$3,200 (32K bytes) February, 1971 Over 600	\$21,000 (32K bytes) \$3,200 (32K bytes) March 1975 117	\$21,000 (32K bytes) \$3,200 (32K bytes) April 1976 154	\$27,000 (32K bytes) \$3,200 (32K bytes) June 1976 12
COMMENTS	Applications compatible with concept II and III; system price includes two application software packages	System price also includes RS-232C interface; system is intended primarily for system turnkey houses and dealers; volume discounts available	System price also includes RS-232C interface; system is intended primarily for system turnkey houses and dealers; volume discounts available	System price also includes RS-232C interface; system is intended primarily for system turnkey houses and dealers; volume discounts available	System price also includes RS-232C interface; system is intended primarily for system turnkey houses and dealers; volume discounts available

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Century Computer 1000	Cincinnati Milacron CIP/2200B	Cincinnati Milacron CIP/4400	Computer Automation Naked Milli LSI-3/05	Computer Automation Naked Mini LSI-2 Series
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8, 16, 24 16 8	16 8-32 8-64	16 8-32 8-64	16 8, 16, 32 16, 32, 48	16 + 2 8, 16, 32 16, 32, 48
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 1.2 0.5 128K bytes 512K bytes Optional Optional Optional	MOS 1.1 0.66 32K bytes 64K bytes Optional No No	MOS 0.9 0.6 64K bytes 256K bytes Standard No No	Core MOS 0.98-1.6 0.5-0.8 512 8K No No No	Core MOS 0.85-1.2 0.4-0.6 8K 512K Optional No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	16 16 64K bytes 17 PROM; to 2K bytes 2.6 Optional Standard Standard Optional Optional	3 1 32K 9 ROM; 16 x 2K bytes 10.3 Standard No Standard No Standard	3 1 32K 9 ROM; 24 x 2K bits 2.1 Standard No Standard Optional Standard	2 1 128 8 ROM; 512 x 24 bits 6.25 (2 digits) No No Standard Optional Optional	2 1 32K 8 ROM; 512 x 56 bits 4.12.2.06 Standard No Standard Optional Optional
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 1M 120	Standard 909K 32-64	Standard 1.2M 32-64	Standard 250K 1	Standard 1M 3
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	630K bytes Cartridge; 46 4M bytes No No 120 KBS 300 cpm 300 cps 1200 lpm Up to 9600 bps 80 char x 24 lines Paper tape reader	630K-2.52M bytes Cartridge; 5-4M bytes No No 20 KBS 600 cpm 60 cps 60-600 lpm 9600 bps 80 char x 12 lines Remote printer; keyboard printer, data entry station	630K-1.26M bytes Both; 10-320M bytes No No 15 & 20 KBS 600 cpm 60 cps 60-600 lpm 9600 bps 80 char x 12 lines Remote printer, keyboard printer data entry station	243-972K bytes Cartridge; 4.92-19.68M bytes No No 20 KBS 285 cpm 100, 165 cps No To 9600 bps 80 char x 24 lines Paper tape reader, paper tape reader punch	243-972K bytes Cartridge; 4.92-19.68M bytes No No 20 KBS 285 cpm 100, 165 cps No 110 50K bps 80 char x 24 lines Paper tape reader, paper tape reader punch
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Yes BASIC, CPL, ALGOL Batch, real-time Partially Partially	Assembler & macro assembler RPG II Batch, interactive Fully No	Assembler & macro assembler RPG II Multi-user interactive, batch Fully No	Macro assembler FORTRAN Real-time No No	Macro assembler FORTRAN, BASIC Batch, real-time, multi-tasking No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$40,000 (32K bytes) \$3,200 (32K bytes) June 1977 6	\$16,100 (32K bytes) \$3,200 (32K bytes) June 1973 590 (all models)	\$45,900 (64K bytes) \$3,200 (32K bytes) July 1976 590 (all models)	\$725 (4K MOS) \$550 (4K MOS) January 1975 NA	\$1,750 (2 10) \$985 (4K core) July 1973 NA
COMMENTS		Packaged system including CPU with 32K bytes, 960-character VDT 60-cps printer dual floppy disk drives; accounting software available	Packaged system including CPU with 64K bytes printer, 60-lpm dual floppy disk drives, 960-character VDT, accounting software available	ROM EPROM & RAM ROM PROM are available in combination, ROM, PROM, EROM available in max capacities of 8K, 2K, & 4K words, respectively	ROM EPROM & RAM ROM PROM are available in combination, ROM, PROM, EROM available in max capacities of 8K, 2K, & 4K words respectively

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Computer Automation Naked Mini 4 Family	Computer Hardware Inc. 2130	Computer Hardware Inc. 3230	Computer Hardware Inc. 4210	Computer Hardware Inc. 4250
DATA FORMATS					
Word length, bits	16	16	16	16	16
Fixed-point operand length, bits	16	16	16	—	—
Instruction length, bits	16, 32	16-64	16-64	16	16
MAIN STORAGE					
Storage type	Core or MOS	MOS, core	MOS	MOS	MOS
Cycle time, microseconds/word	0.55-0.85	0.8	1.6	0.47	0.47
Access time, microseconds/word	0.3-0.4	0.25	0.25	0.3	0.3
Minimum capacity, words	4K	8K	8K	4K	4K
Maximum capacity, words	64K	2,000K	64K	26K	1024K
Parity checking	Optional	Standard	Standard	Standard	Standard
Error correction	No	Optional	No	No	Optional
Storage protection	No	Standard	Standard	Optional	Optional
CENTRAL PROCESSOR					
No. of accumulators	2	8	8	0	0
No. of index registers	8	6	6	16	16
No. of directly addressable words	64K	64K	64K	32K	64K
No. of addressing modes	12	—	—	8	8
Control storage	None	—	—	No	PROM; 256 x 45 bits
Add time, microseconds	1.5-3.0	1.6	2.7	4.662	3.5
Hardware multiply/divide	Standard	Standard	Standard	Standard	Standard
Hardware floating point	Optional	Optional	Optional	No	No
Hardware byte manipulation	Standard	No	No	Standard	Standard
Battery backup	Optional	No	No	No	No
Real-time clock or timer	Standard	Optional	Optional	Standard	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	Optional	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	115K	1.25M	1.25M	—	—
No. of external interrupt levels	4	8	8	8	16
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	4: 243K-972K bytes	No	No	Yes	Yes
Disk pack/cartridge drives	Cartridge & pack; 5-1200M bytes	Pack; 1600M bytes	Pack; 1600M bytes	No	Cartridge; 3M or 10M bytes
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges					
Magnetic tape, 1/2-inch	20 KBS	Yes	Yes	No	No
Punched card input	285 cps	300-1000 cpm	300-1000 cpm	No	No
Serial printer	No	No	No	30-180 cps	30-180 cps
Line printer	60-165 lpm	300, 600 lpm	300, 600 lpm	300 lpm	300 lpm
Data communications interface	50K bps	To 4800 bps; synch.	To 4800 bps; synch.	9600 bps	9600 bps
CRT	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines
Other standard peripheral units	Paper tape units, A/D-D/A converters	Card reader/punch, paper tape reader, paper tape punch, plotter	Card reader/punch, paper tape reader, paper tape punch, plotter	None	None
SOFTWARE					
Assembler	Assembler, macro assembler	Assembler & macro assembler	Assembler & macro assembler	Assembler	Macro assembler
Compilers	BASIC, FORTRAN	RPG, COBOL, FORTRAN	RPG, COBOL, FORTRAN	FORTRAN	FORTRAN, BASIC, COBOL
Operating system	Batch, real-time	Batch, time-sharing	Batch, time-sharing	Real-time	Real-time
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$995 (4K words)	\$32,000	\$15,000	\$13,000 (32K bytes)	\$24,950 (96K bytes)
Price of memory increment	\$995 (16K words)	\$1,500	\$1,500	\$1,550	\$1,625
Date of first delivery	June 1977	June 1974	April 1976	October 1977	January 1978
Number installed to date	800	NA	NA	NA	NA
COMMENTS	All processors include power-fail, auto restart, auto load, and real-time clock capabilities as standard features	Asynchronous communications to 9600 bps	Asynchronous communications to 9600 bps	Software and hardware supports CHI 4111 Time Clock—standard feature for T/A and Labor Distribution Control	Software and hardware supports CHI 4111 Time Clock—standard feature for T/A and Labor Distribution Control

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Computer Talk Model 400	Computer Talk Model 407	Computer Talk Model 408	Computervision Corporation CGP-100	Control Data Cyber 18-17
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 8, 16, 32-128 16, 32, 48	16 8, 16, 32-128 16, 32, 48	16 8, 16, 32-128 16, 32, 48	16 16 16, 32, 48	16 + 1 16 16, 32
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 0.5; 0.3 0.3; 0.15 4K 512K Optional Optional See comments	MOST 0.5; 0.3 0.3; 0.15 4K 512K Optional Optional See comments	MOS 0.5; 0.3 0.3; 0.15 4K 512K Optional Optional See comments	MOS 0.7 0.4 32K 512K Standard None Optional	0.6, 0.9 — 4K 64K Standard No Standard
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	12 (4 more opt.) 2 32K; 512K 10 PROM; 768 words 1 Standard Standard Standard Standard Standard with date	12 (4 more opt.) 2 32K; 512K 10 PROM; 768 words 1 Standard Standard Standard Standard Standard with date	12 (4 more opt.) 2 32K; 512K 10 PROM; 768 words 1 Standard Standard Standard Standard Standard with date	4 2 32K 6 PROM, 60 x 512 words 0.9 Standard Optional No No Standard	2 2 (1 in memory) 256 7 No 1.8 Standard Optional Optional Optional Optional
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 1M 1-256	Standard 1M 1-256	Standard 1M 1-256	Standard 0.7M words/sec 16	Standard 1.6M 2-16
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	110K-10M bytes Both; 1.2M-1 billion bytes Moving-head; 2.5M bytes 30-800 cps; 4 KBS 5-120 KBS 10-100 cpm 10-200 cps 220-600 lpm 50-9600; 56K 96 char. x 32 lines Digitizers, plotters, factory automation equipment	110K bytes Both; 1.2M-1 billion bytes Moving-head; 2.5M bytes 30-800 cps; 4 KBS 5-120 KBS 10-1000 cpm 10-200 cps 300 lpm 50-9600; 56K 96 char. x 32 lines Digitizers, plotters, factory automation equipment	110K-10M bytes Both; 1.2M-1 billion bytes Moving-head; 2.5M bytes 100 cps; 50 KBS 5-120 KBS 10-1000 cpm 10-200 cps 300 lpm 50-9600; 56K 96 char. x 32 lines Digitizers, plotters, factory automation equipment	256K-4M bytes Pack; 1.2 billion bytes No No 30-75 KBS 150-1000 cpm 165 cps 340 lpm 9600 bps 80 char. x 24 lines Graphic displays, plotters, digitizers,	None Cartridge; 4-36M bytes No No 40 KBS 300 cpm No 300, 600 lpm Up to 9600 bps 80 char. x 24 lines A/D & D/A converters
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Assembler & macro assembler BASIC, FORTRAN, APL Batch, real-time, time-sharing Partially Partially	Assembler & macro assembler BASIC, FORTRAN, APL Batch, real-time, time-sharing Partially Partially	Assembler & macro assembler BASIC, FORTRAN, APL Batch, real-time, time-sharing Partially Partially	Assembler FORTRAN, TPL, PEP Multi-sharing, multi-tasking No No	Assembler & macro assembler FORTRAN, BASIC, AUTRAN Batch, real-time No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$24,950 (4K MOS) \$1,100 (4K) May 1975 NA	\$31,500 (4K MOS) \$1,100 (4K) January 1978 NA	\$30,500 (4K MOS) \$1,100 (4K) January 1978 NA	Contact manufacturer Contact manufacturer November 1977 100+	\$11,160 \$2,360 (8KB) July 1973 NA
COMMENTS	Storage protection std. by memory partition and opt. by page; mapping to 512K opt.; 4K PROM opt.; on low power, memory is stored on disk; price includes CRT, light pen, modem, 1.2M-byte disk, arith. & I/O processors, & battery pack operation	Expanded Model 400 with additional features: disk expanded to 2.5M bytes, 300-lpm x 132 printer and mini-floppy disk for I/O	Expanded Model 400 with additional features: disk expanded to 2.5M bytes, 300-lpm x 132 printer and mini-cassette for I/O	Extensive 3-D interactive CAD/CAM design application software; 24-slot high-resolution chassis; micro-diagnostic and bootstrap diagnostic facilities; 100-amp power supply; desk console	

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Control Data Cyber 18 Series	Data General Eclipse C/330	Data General Eclipse C/350	Data General Eclipse M/600	Data General Eclipse S/130
DATA FORMATS					
Word length, bits	16 + 5 or + 1	16 + 5	16 + 5	16 + 5	16 + 5
Fixed-point operand length, bits	16	16	16	16	16
Instruction length, bits	16, 32	16, 32	16, 32	16, 32	16, 32
MAIN STORAGE					
Storage type	MOS	Core, MOS	Core, MOS	Core, MOS	Core, MOS
Cycle time, microseconds/word	0.75	0.8, 0.7	0.8, 0.7	0.8	0.8, 0.5-0.7
Access time, microseconds/word	0.3	0.4, 0.5	0.5	0.5	0.4
Minimum capacity, words	16K	16K	32K	32K	16K
Maximum capacity, words	128K	256K	512K	512K	128K
Parity checking	Standard	No	No	No	No
Error correction	Optional	Optional	Standard	Standard	Standard
Storage protection	Standard	Optional	Standard	Standard	Optional
CENTRAL PROCESSOR					
No. of accumulators	6	4	4	4	4 + 4
No. of index registers	6	2	2	2	2 + 16
No. of directly addressable words	64K	32K	32K	32K	64K
No. of addressing modes	8	7	7	7	7
Control storage	ROM/RAM; 8K instructions	ROM; 2K x 56 bits	ROM; 2K x 56 bits	ROM; 2K x 56 bits	PROM/RAM; 4 x 56 bits
Add time, microseconds	1.76	0.6	0.6	0.6	0.6
Hardware multiply/divide	Standard	Standard	Standard	Standard	Standard
Hardware floating point	No	Standard	Standard	Standard	No
Hardware byte manipulation	Standard	Standard	Standard	Standard	Optional
Battery backup	Optional	No	No	No	Optional
Real-time clock or timer	Standard	Optional	Standard	Standard	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	1.2M	1.25M	1.25M/5.0M	1.25M/5.0M	1.25M
No. of external interrupt levels	2-16	16	16	16	16
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	560K bytes	315K-2.5M bytes	315K-2.5M bytes	315K-2.5M bytes	315K-2.5M bytes
Disk pack/cartridge drives	Pack/cartridge; 4-400M bytes	Pack & cartridge; 10-1520M bytes	Pack & cartridge; 10-1520M bytes	Pack & cartridge; 10-6080M bytes	Pack & cartridge; 10-1520M bytes
Drum/Fixed-head disk storage	No	Fixed-head; 1-16M bytes	Fixed-head; 1-16M bytes	Fixed-head; 1-16M bytes	Fixed-head; 1-16M bytes
Magnetic tape cassettes/cartridges	No	Cassette, 1.6 KBS	Cassette, 1.6 KBS	Cassette, 1.6 KBS	Cassette, 1.6 KBS
Magnetic tape, 1/2-inch	80 KBS	10-72 KBS	10-72 KBS	10-72 KBS	10-72 KBS
Punched card input	300, 600 cpm	150-1000 cpm	150-1000 cpm	150-1000 cpm	150-1000 cpm
Serial printer	70 lpm	10-165 cps	10-165 cps	10-165 cps	10-165 cps
Line printer	300, 600 lpm	240-600 lpm	240-900 lpm	240-900 lpm	240-600 lpm
Data communications interface	Up to 9600 bps	56,000 bps	56,000 bps max.	56,000 bps max.	56,000 bps
CRT	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines
Other standard peripheral units	None	Modular digital & analog data control & acquisition sub-system optional	Modular digital & analog data control & acquisition sub-system optional	Modular digital & analog data control & acquisition sub-system optional	Modular digital & analog data control & acquisition sub-system optional
SOFTWARE					
Assembler	Macro assembler	Assembler & macro assembler	Assembler & macro assembler	Assembler & macro assembler	Assembler & macro assembler
Compilers	FORTRAN, BASIC, RPG, COBOL	FORTRAN, BASIC, BASIC, ALGOL	COBOL, IDEA, FORTRAN, PL/1, DG/L, ALGOL	COBOL, IDEA, FORTRAN, PL/1, DG/L	FORTRAN, BASIC, ALGOL
Operating system	Batch, real-time, time-sharing	Batch, real-time, time-sharing	Batch, real-time, time-sharing	Batch, real-time, time-sharing	Batch, real-time, time-sharing
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$15,300	\$30,000 (32K core)	\$53,500 (32K MOS)	\$80,000 (128K)	\$9,200 (8K core)
Price of memory increment	\$3,000 (16KW)	\$4,500 (16K core); \$8,500 (32K MOS)	\$6,000 (32K MOS); \$8,500 (32K MOS)	\$6,000 (32K MOS); \$4,500 (16K core)	\$4,500 (16K core); \$8,500 (32K MOS)
Date of first delivery	May 1976	October 1976	NA	April 1978	February 1975
Number installed to date	NA	1000+ (all models)	NA	14	1000+ (all models)
COMMENTS		Extended arithmetic processor standard; extended memory allocation and protection unit optional; error correction std. on MOS; opt. on core; IDEA software	Includes COBOL ANSI '74, highest Level 2 implementation; 128KB ERCC-MOS, \$10,000; 256KB ERCC MOS, \$18,000; std. features include extended floating-point functions, plus a commercial instruction set	Includes COBOL ANSI '74, highest Level 2 implementation; I/O processor with 64 KB for handling low-speed character-oriented data movement	256 56-bit words of writable control store optionally available

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Data General Eclipse S/230	Data General Eclipse S/250	Data General Nova 3/4	Data General Nova 3/12, 3-D	Datapoint 1100
DATA FORMATS					
Word length, bits	16 + 5	16 + 5	16 + 1	16 + 1	8-bit byte
Fixed-point operand length, bits	16	16	16	16	8
Instruction length, bits	16, 32	16, 32	16	16	8-24
MAIN STORAGE					
Storage type	Core, MOS	Core, MOS	Core, MOS	Core, MOS	MOS
Cycle time, microseconds/word	0.8, 0.7	0.8, 0.7	0.7	0.7	1.6
Access time, microseconds/word	0.4, 0.5	0.5	0.35	0.35	0.6
Minimum capacity, words	16K	32K	4K	4K	4K bytes
Maximum capacity, words	256K	512K	32K	32K	16K bytes
Parity checking	No	No	Optional	Optional	No
Error correction	Optional	Standard	No	No	No
Storage protection	Optional	Standard	No	No; see comments	No
CENTRAL PROCESSOR					
No. of accumulators	4	4	4	4	2
No. of index registers	2	2	2	2	12
No. of directly addressable words	32K	32K	256	256	16K bytes
No. of addressing modes	7	7	6	6	2
Control storage	ROM; 256 x 56 bits	ROM, 1.5K; RAM, 1K; PROM, 2K	No	No	No
Add time, microseconds	0.6	0.6	0.7	0.7	4.8
Hardware multiply/divide	Standard	Standard	Optional	Optional	No
Hardware floating point	Optional	Optional	No	Optional	No
Hardware byte manipulation	Standard	Standard	No	No	Standard
Battery backup	No	No	Optional	Optional	No
Real-time clock or timer	Optional	Standard	Optional	Optional	Optional
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	No
Maximum I/O rate, words/sec.	1.25M	1.25M/5.0M	1.10M	1.10M	195K
No. of external interrupt levels	16	16	16	16	—
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	315K-2.5M bytes Pack & cartridge;	315K-2.5M bytes Pack & cartridge;	315K-1.25M bytes Cartridge;	315K-2.5M bytes Pack & cartridge;	256K-1M bytes No
Disk pack/cartridge drives	10-1520M bytes Fixed-head;	10-1520M bytes Fixed-head;	2.5-10M bytes Fixed-head;	2.5-736M bytes Fixed-head;	No
Drum/Fixed-head disk storage	1-16M bytes Cassette; 1.6 KBS	1-16M bytes Cassette; 1.6 KBS	256K-1M bytes Cassette; 1.6 KBS	256K-2M bytes Cassette; 1.6 KBS	Cassette; 352 cps
Magnetic tape cassettes/cartridges	10-72 KBS	10-72 KBS	10-72 KBS	10-72 KBS	9.6-20 KBS
Magnetic tape, 1/2-inch	150-1000 cpm	150-1000 cpm	150-1000 cpm	150-1000 cpm	300 cpm
Punched card input	10-165 cps	10-165 cps	10-165 cps	10-165 cps	120 cps
Serial printer	240-600 lpm	240-900 lpm	240-600 lpm	240-600 lpm	300, 600 lpm
Line printer	56,000 bps	56,000 bps max.	Up to 9600 bps	Up to 9600 bps	Up to 9600 bps
Data communications interface	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 12 lines
CRT	Modular digital & analog data control & acquisition sub- system optional	Modular digital & analog data control & acquisition sub- system optional	Modular digital & analog data control & acquisition sub- system optional	Modular digital & analog data control & acquisition sub- system optional	—
Other standard peripheral units					
SOFTWARE					
Assembler	Assembler & macro assembler FORTRAN BASIC, ALGOL	Assembler & macro assembler FORTRAN, ALGOL, PL/1, DG/L	Assembler & macro assembler FORTRAN, BASIC, ALGOL	Assembler & macro assembler FORTRAN, BASIC, ALGOL	Yes
Compilers					BASIC, RPG II, SCRIBE, DATA- BUS, DATAFORM BATCH
Operating system	Batch, real-time, time-sharing	Batch, real-time, time-sharing	Real-time	Batch, real-time, time-sharing	No
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$15,000 (16K core)	\$34,500 (64K core)	\$2,600 (4K MOS)	\$3,600 (4K MOS)	\$6,400 (4K bytes)
Price of memory increment	\$4,500 (16K core); \$8,500 (32K MOS)	\$6,000 (32K MOS); \$4,500 (16K core)	—	—	\$434 (4K bytes)
Date of first delivery	November 1976	NA	April 1976	April 1976	January 1974
Number installed to date	1000+ (all models)	NA	NA	NA	6000
COMMENTS	256 56-bit words of writable control store, extended memory allocation and protection unit optionally avail- able; error correc- tion std. on MOS, opt. on core	Optional extended floating-point functions; optional Integral Array Processor; optional character instruc- tion set; optional written and fixed control store	4-slot chassis; auto program load and power monitor/ auto restart opt.	12-slot chassis; memory manage- ment unit stand- ard; memory allo- cation and protec- tion unit standard on 3-D	System price also includes integral CRT/keyboard and dual cassette tape drives; diskette- based system also available with 16K bytes of memory for \$12,880; the 1150 is an augmented 1100 with a 5500 instruction set for \$14,480

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Datapoint 1150	Datapoint 1170	Datapoint 1500	Datapoint 1800	Datapoint 2200
DATA FORMATS					
Word length, bits	8-bit byte	8-bit byte	8-bit byte	8-bit byte	8-bit byte
Fixed-point operand length, bits	8	8	8	8	8
Instruction length, bits	8-24	8-24	8-24	8-24	8-24
MAIN STORAGE					
Storage type	MOS	MOS	MOS	MOS	MOS
Cycle time, microseconds/word	0.8	0.8	0.65	0.63	1.6
Access time, microseconds/word	0.3	0.3	0.3	NA	0.6
Minimum capacity, words	24K bytes	48K bytes	32K bytes	60K bytes	4K bytes
Maximum capacity, words	24K bytes	48K bytes	32K bytes	60K bytes	16K bytes
Parity checking	Standard	Standard	Standard	Standard	No
Error correction	Standard	Standard	Standard	Standard	No
Storage protection	Standard	Standard	No	Standard	No
CENTRAL PROCESSOR					
No. of accumulators	2	2	2	Instruction-dependent	2
No. of index registers	16	16	16	16	12
No. of directly addressable words	24K bytes	48K bytes	32K bytes	60K	16K bytes
No. of addressing modes	2	2	2	2	2
Control storage	ROM; 4K bytes	ROM; 4K bytes	ROM; 4K bytes	ROM, 4K bytes (sys.); RAM, 60K bytes (user)	No
Add time, microseconds	1.4	1.4	1.8	3.8	4.8
Hardware multiply/divide	No	No	No	No	No
Hardware floating point	No	No	No	NA	No
Hardware byte manipulation	No	Standard	—	Standard	Standard
Battery backup	No	No	No	No; auto restart	No
Real-time clock or timer	No	No	No	Standard	Optional
INPUT/OUTPUT CONTROL					
Direct memory access channel	No	No	No	Standard	No
Maximum I/O rate, words/sec.	114K	114K	250K	Instruction-dependent	195K
No. of external interrupt levels	—	—	—	4	—
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	512K-1M bytes	512K-1M bytes	512K	1MB (dual-density)	256K-1M bytes
Disk pack/cartridge drives	No	No	No	No	Pack & cartridge; 2.4-50M bytes
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	No	No	No	No	Cassette; 352 cps
Magnetic tape, ½-inch	9.6-20 KBS	9.6-20 KBS	No	560-1600 bpi; 7&9 trk	9.6-20 KBS
Punched card input	300 cpm	300 cpm	No	Yes	300 cpm
Serial printer	80-160 cps	80-160 cps	80-160 cps	80, 160 cps	120 cps
Line printer	300, 600 lpm	300, 600 lpm	No	300, 600, 900 lpm	300, 600 lpm
Data communications interface	Up to 9600 bps	Up to 9600 bps	Up to 4800 bps	Up to 9600 bps	Up to 9600 bps
CRT	80 char. x 12 lines	80 char. x 12 lines	80 char. x 24 lines	1920 char.; 50 or 60	80 char. x 12 lines
Other standard peripheral units	—	—	—	Single-density disk storage, serial print- ers, belt printers	—
SOFTWARE					
Assembler	Yes	Yes	No	Macro assembler	Yes
Compilers	DATABUS, MULTI- FORM, BASIC, RPG II	BASIC, DATA- SHARE, DATABUS, MULTIFORM, RPG II	DATABUS, DATAFORM	COBOL, BASIC, RPG II, DATABUS, DATA- SHARE	BASIC, RPG II, SCRIBE, DATA- BUS, DATAFORM
Operating system	BATCH	Batch, time-sharing	Batch, stand-alone	Batch, interactive, real-time	Batch, time-sharing
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	Partially	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$14,480 (24K bytes)	\$15,980 (48K bytes)	\$5,950 (32K bytes)	\$12,500	\$8,571 (4K bytes)
Price of memory increment	—	—	—	\$4,100 (1M-char. diskette modules)	\$1,432 (4K bytes); \$1,647 (8K bytes)
Date of first delivery	August 1976	July 1977	October 1977	August 1978	April 1972
Number installed to date	NA	NA	NA	NA	9000
COMMENTS	1152 system with 24K memory and two diskette drives	1172 system with 48K memory and two diskette drives	All user instructions are in high-level language	One, two, and three- year leases also available, at \$433, \$391, and \$377 per month, respectively; \$125 monthly main- tenance charge	System price also includes integral CRT/keyboard and dual cassette tape drives

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Datapoint 5500	Datapoint 6600	Dataram BCM-1	Datasaab Systems 5020	Datasaab Systems 5051 & 5052
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8-bit byte 8 8-24	8-bit byte 8 8-24	16 16 16, 32, 48	16 + 2 8, 16 16	16 1-255 digits 16-128
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 0.8 0.3 48K bytes 48K bytes Standard No Standard	MOS 0.6 0.2 120K bytes 120K bytes Standard Standard Standard	Core, MOS 1.2 1.2 8K 32K No No No	Core 1.2 — 4K 32K Standard No Standard	Core 0.98; 1.2 — 4K; 8K 32K No No Standard
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	2 16 48K bytes 2 ROM; 4K bytes 1.4 No No Standard No Optional	2 16 120K bytes 2 ROM; 4K bytes 1.15 Standard No Standard No No	6 6 32K 8 ROM, 1K; PROM, 1K 3.5 Optional Optional Standard No Optional	8 3 256 3 — 7.2 No No Standard No Optional	7 7 32K 8 — 3.2 Standard No Standard No Optional
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	No 114K —	No 125K —	Standard 833K Variable	Optional — —	Standard 1M 5
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	256-1M bytes Pack & cartridge; 2.4-200M bytes No Cassette, 352 cps 9.6-20 KBS 300 cpm 120 cps 300, 600 lpm Up to 9600 bps 80 char. x 12 lines —	No Pack & cartridge; 2.5-200M bytes No Cassette, 352 cps 9.6-20KBS 300 cpm 80-160 cps 300, 600 lpm Up to 9600 bps 80 char. x 12 lines —	No No No No No No 1-megabyte bulk core storage is standard	256K-1M bytes No No No No No 15-330 cps 200 lpm To 9600 bps 40 char. x 12 lines Paper tape reader, paper tape punch	No Cartridge; 5-40M bytes No Cassette; 756 cps Cassette; 756 cps 10 KBS No 15-330 cps 200 lpm To 9600 bps 64 char. x 16 lines Paper tape reader, paper tape punch, RS-232C interface
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Yes BASIC, RPG II, SCRIBE, DATA-BUS, DATAFORM Batch, time-sharing No No	Yes BASIC, RPG II, COB., DATASH, DATABUS, DATAFORM, SCRIBE Batch, time-sharing No No	Assembler, macro-assembler NA Batch, real-time No No	Yes DIL-5 Time-sharing No No	No Logic-3/MALL Time-sharing No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$26,271 (48K bytes) CPU cannot be expanded December 1974 500	Only \$31,685 July 1977 NA	\$9,800 (64 KB memory + 256KB bulk core) \$840 (32KB) November 1978 NA	— — 1971 4000	\$45,000 (8K words) \$2,000 (8K words) NA NA
COMMENTS	System price also includes integral CRT/keyboard and dual cassette tape drives	System price also includes integral CRT/keyboard, dual cassette tape drives, multipoint communications adapter, and software; a batch processing system with no comm. adapter costs \$32,500	BCM-1 is a packaged system containing DEC LSI-11 and Dataram Bulk Core as high-speed peripheral storage; has provisions for up to 10 slots for DEC-compatible quad-size peripheral controllers	Basis for Datasaab D5/20 business minicomputer system; terminal oriented system for data collection and on-line data entry; intelligent terminals can process data locally	Basis for Datasaab D15 business minicomputer system; interpreter-based system for up to 16 simultaneous users; system price also includes 10-megabyte disk drive, CRT workstation, and serial printer

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Decision Data System/4	Diablo 3200	Digital Equipment PDP-8/A	Digital Equipment PDP-11/03	Digital Equipment PDP-11/04
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8-bit bytes 8 16-32	8 + parity 8, 16 8 to 24	12 12 12	16 16 16, 32, 48	16 + 2 16 16, 32, 48
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 1 0.5 48K bytes 64K bytes Standard No No	MOS 0.488 0.3 20K 64K Standard No No	Core; MOS 1.2; 1.5; 2.4 0.6; 0.75; 2.4 1K 128K No No No	Core; MOS 1.2; 1.2 — 4K 32K No No No	Core; MOS 0.98; 0.725 0.51; 0.635 16K 32K Standard No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	6 16 64K 3 ROM; 2K — Standard No Standard No Standard	7 None 64K 4 No 23.9 (6 digits) No No Standard No No	1 8 per 4K (in mem.) 256 4 — 3.0-3.8 Optional Optional No Optional Optional	6 6 32K 8 ROM; PROM; 1K 3.5 Optional Optional Standard No Optional	6 6 32K 8 — 3.17 Optional Optional Standard Optional Standard
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 400K 8	Standard 1M 8	Standard 526-667K 1-64	Standard 833K Variable	Standard 2M Variable
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	1-3M bytes Cartridge; 10-40M bytes No No 300-1200 cpm 120 cps 600 lpm Up to 9600 bps 80 char. x 24 lines None	1-2M bytes Cartridge over fixed; 10-20M bytes None None None 45 cps/200 cps None Programmable Multiple, 1920 char. None	128-2M (6-bit) Cartridge; 3.2-12.8M (6-bit) No Cassette; 562 cps 10-36 KBS 300 cpm 180 cps 230 lpm 110-71K bps 80 char. x 24 lines DECtape, 8325 words/sec; A/D converter, paper tape reader, paper tape punch	256-512K bytes No No No 180 cps No 50-56,000 bps 80 char. x 24 lines Serial line and parallel line con- trollers	256-512K bytes Cartridge & pack; 2.5-1408M bytes Fixed-head. 512K-8M bytes Cassette; 562 cps 10-72 KBS 285-1200 cpm 30-180 cps 230-1200 lpm 50-56,000 bps 80 char. x 24 lines DECtape, 8325 words/sec.; paper tape reader; paper tape punch
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	No RPG Batch, interactive No Partially	Global assembler DACL (English-like compiler) Batch, interactive, time-sharing No No	Assembler & macro assembler BASIC, DIBOL ALGOL, FOCAL Batch, real-time, time-sharing No No	Assembler & macro assembler BASIC, FORTRAN Batch, real-time No No	Assembler & macro assembler BASIC, FORTRAN, FOCAL Batch, real-time, time-sharing No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$22,615 \$935 (16K bytes) July 1975 15	\$19,500 (20K bytes) Various December 1976 500	\$1,835-\$8,295 \$2,850 (8K core); \$1,230 (4K MOS) December 1974 Over 30,000	\$1,995 \$990 (8K core); \$625 (8K MOS) NA NA	\$3,995 (16K MOS); \$2,280 (16K core); \$1,700 (16K MOS) NA NA
COMMENTS		Sold exclusively in U.S. through Shasta General Systems with word processing software and applica- tion systems; contact Shasta at 895 Stanton Rd., Burlingame, CA, 94010; (415) 692-0722	Also available in packaged version called Datasystem 310	Packaged version of LSI-11 micro- computer; instruc- tion set equivalent to PDP-11/40	Successor to PDP-11/05 and 11/10; upgradable to PDP-11/34 status

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Digital Equipment PDP-11/34A	Digital Equipment PDP-11/35 & 11/40	Digital Equipment PDP-11/45	Digital Equipment PDP-11/55	Digital Equipment PDP-11/60
DATA FORMATS					
Word length, bits	16 + 2	16 + 2	16 + 2	16 + 2	16 + 2
Fixed-point operand length, bits	16	16	16	16	16
Instruction length, bits	16, 32, 48	16, 32, 48	16, 32, 48	16, 32, 48	16, 32, 48
MAIN STORAGE					
Storage type	Core; MOS	Core	Core; MOS; bipolar	Core; bipolar	Core; MOS
Cycle time, microseconds/word	0.98; 0.725	0.98	0.98; 0.50; 0.30	0.98; 0.30	0.98
Access time, microseconds/word	0.51; 0.635	0.36	—	—	—
Minimum capacity, words	16K	8K	32K	16K	32K
Maximum capacity, words	124K	124K	124K	124K	256K
Parity checking	Standard	Optional	Standard	Standard	Standard
Error correction	No	No	No	No	Standard (MOS)
Storage protection	Standard	Optional	Standard	Standard	Standard
CENTRAL PROCESSOR					
No. of accumulators	6	6	12	12	8
No. of index registers	6	6	12	12	8
No. of directly addressable words	32K	32K	32K	32K	32K
No. of addressing modes	8	8	8	8	8
Control storage	—	No	—	—	RAM; 1K words
Add time, microseconds	2.03	1.07	0.30-0.97	0.30-0.97	2.2
Hardware multiply/divide	Optional	Optional	Standard	Standard	Standard
Hardware floating point	Optional	Optional	Optional	Optional	Standard
Hardware byte manipulation	Standard	Standard	Standard	Standard	Standard
Battery backup	Optional	No	No	No	No
Real-time clock or timer	Standard	Optional	Standard	Standard	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	—	2M	2M (core); 4M (bi.)	2M (core); 4M (bi.)	—
No. of external interrupt levels	Variable	Variable	Variable	Variable	Variable
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	256-512K bytes	256-512K bytes	256-512K bytes	256-512K bytes	256-512K bytes
Disk pack/cartridge drives	Cartridge & pack; 2.5-1408M bytes	Cartridge & pack; 2.5-1408M bytes	Cartridge & pack; 2.5-1408M bytes	Cartridge & pack; 2.5-1408M bytes	Cartridge & pack; 2.5-1408M bytes
Drum/Fixed-head disk storage	Fixed-head; 512K-8M bytes	Fixed-head; 512K-8M bytes	Fixed-head; 512K-8M bytes	Fixed-head; 512K-8M bytes	Fixed-head; 512K-8M bytes
Magnetic tape cassettes/cartridges	Cassette; 562 cps	Cassette; 562 cps	Cassette; 562 cps	Cassette; 562 cps	Cassette; 562 cps
Magnetic tape, 1/2-inch	10-72 KBS	10-72 KBS	10-72 KBS	10-72 KBS	10-72 KBS
Punched card input	285-1200 cpm	285-1200 cpm	285-1200 cpm	285-1200 cpm	285-1200 cpm
Serial printer	30-180 cps	30-180 cps	30-180 cps	30-180 cps	30-180 cps
Line printer	230-1200 lpm	230-1200 lpm	230-1200 lpm	230-1200 lpm	230-1200 lpm
Data communications interface	50-56,000 bps	50-56,000 bps	50-56,000 bps	50-56,000 bps	50-56,000 bps
CRT	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines
Other standard peripheral units	DEctape, 8325 words/sec.; paper tape reader, paper tape punch	DEctape, 8325 words/sec.; paper tape reader, paper tape punch	DEctape, 8325 words/sec.; paper tape reader, paper tape punch	DEctape, 8325 words/sec.; paper tape reader, paper tape punch	DEctape, 8325 words/sec.; paper tape reader, paper tape punch
SOFTWARE					
Assembler	Assembler & macro assembler	Assembler & macro assembler	Assembler & macro assembler	Assembler & macro assembler	Assembler & macro assembler
Compilers	BASIC, FORTRAN, COBOL, FOCAL	BASIC, FORTRAN, COBOL, FOCAL	BASIC, FORTRAN, COBOL, FOCAL	BASIC, FORTRAN, COBOL, FOCAL	BASIC, FORTRAN, COBOL
Operating system	Batch, real-time, time-sharing	Batch, real-time, time-sharing	Batch, real-time, time-sharing	Batch, real-time, time-sharing	Real-time, interactive, time-sharing
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$9,050 (32K MOS); \$10,030 (32K core)	\$19,800	\$41,800 (64K core)	\$44,100 (64K core)	\$35,700 (32K core)
Price of memory increment	\$1,700 (16K MOS); \$2,280 (16K core)	\$2,200 (32K core)	\$2,200 (32K core)	\$2,200 (32K core)	\$6,650 (64K core); \$4,500 (64K MOS) June 1977
Date of first delivery	NA	NA	NA	NA	NA
Number installed to date	NA	NA	NA	NA	—
COMMENTS	Uses similar technology to PDP-11/04; includes memory management for greater addressing capability; packaged version called Datasystem 530 is also available	PDP-11/35 is an OEM version of the PDP-11/40; packaged version is called Datasystem 350 based on PDP-11/40	PDP-11/45 features two internal Unibuses, one normal-speed and one high-speed	PDP-11/55 is based on a PDP-11/45 with core and bipolar memory; designed for applications requiring high-speed calculations	Includes user-accessible microprogramming; error-correcting memory

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Digital Equipment PDP-11/70	Digital Group, Inc. "Systems"	Digital Group, Inc. "Bytemaster"	Digital Scientific 4030/40	Digital Scientific 5010
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 + 2 16 16, 32, 48	8-bit byte 2.5 8, 16, 24, 32	8-bit byte 8, 16 8, 16, 24, 32	16 + 2 4 16-32 16-32	16 + 2 16-32 16-32
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	Core 0.98 0.36 64K 1024K Standard No Standard	MOS 2.5 1.0 10K bytes 64K bytes No No No	MOS 2.5 1.0 18K bytes 64K bytes No No No	Core 4 0.5 8K 128K Standard No Standard	MOS 0.5 0.3 4K 32K Standard No Standard
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	12 12 32K 8 — 0.30-1.20 Standard Optional Standard No Standard	16 3 64K 11 Boot only NA No No Standard No Optional	16 3 64K 11 Boot only NA No Standard No Optional	Up to 28 3 64K 4 ROM; 4K words 2.9 Standard Standard No No Standard	1 + 1 3 16K 4 PROM 1.44 Standard No No No No
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 2.9M Variable	Standard NA 0-8	Standard NA 0-8	Standard 1M 16	Standard 2M 6
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	256-512K bytes Cartridge & pack, 2.5-1408M bytes Fixed-head, 512K-8M bytes Cassette, 562 cps 10-72 KBS 285-1200 cpm 30-180 cps 230-1200 lpm 50-56,000 bps 80 char. x 24 lines DECtape, 8325 words/sec., paper tape reader, paper tape punch	256K-1M bytes No No Cassette No No 60-200 cps 300 lpm 100-9600 bps 64 x 16 or 96 x 24 Speech synthesizers, ham radio inter- faces, real- world controllers	90K-1M bytes No No Cassette No No 60-200 cps 300 lpm 100-9600 bps 64 x 16 or 96 x 24 Speech synthesizers, ham radio inter- faces, graphics (video)	No Pack, cartridge; 1-160M bytes Fixed-head; 1-2M bytes No 30, 60 KBS 60,100 cpm 180 cps 300 to 1000 lpm Up to 19,200 bps 80 char. x 24 lines Paper tape reader/ punch, XY plotter, digital/analog I/O	No Cartridge; 1-5M bytes No Optional 600, 1000 cpm 180 cps 300, 600 lpm Up to 19,200 bps 80 char. x 24 lines —
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Assembler & macro assembler BASIC, FORTRAN, COBOL, FOCAL Real-time, interac- tive, time-sharing No No	Assembler & macro assembler BASIC, APL Batch No No	Assembler & macro assembler BASIC, APL Batch No No	Assembler & macro assembler COBOL, RPG II, FORTRAN, BASIC, APL Real-time, time- sharing Partially No	Assembler & macro assembler RPG II, FORTRAN, BASIC Batch No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$63,000 (128K core) \$18,590 (128K core) NA NA	\$1,995 \$695 (32K bytes) November 1976 3,500	\$2,495 \$695 (32K bytes) June 1978 100	\$33,850 (4030); \$42,285 (4040) \$4,000 (8K bytes) core 1970 240+ (both models)	\$18,000 \$1,000 (4K by.) MOS NA NA
COMMENTS	Uses same technol- ogy as PDP-11-45 and includes 2048 bytes of cache memory for increased perform- ance; disk storage & mag tape periph. avail. in packaged system called Data- system 570		Fully integrated desk-top system	Real-time, process- control monitoring and time-sharing/ multi-programming operating systems; IBM 1130 and 1800 compatible; user microprogram- mable	Intelligent RJE or local batch for appli- cations requiring high-speed calcula- tions; expandable to Model 5020

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Digital Scientific 5020	Digital Scientific 5030	Digital Systems Galaxy/5 Model 130	Digital Systems Galaxy/5 Model 140	Digital Systems Galaxy/5 Model 150
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 + 2 16-32 16-32	16 + 2 16-32 16-32	8 to 20 8 to 2048 16, 32, 48	8 to 20 8 to 2048 16, 32, 48	8 to 20 8 to 2048 16, 32, 48
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	Core, MOS 0.9, 0.5 0.5, 0.3 8K 64K Standard No Standard	Core, MOS 0.9, 0.5 0.5, 0.3 64K 1M Standard No Standard	MOS 0.50 0.50 64K bytes 128K bytes Standard Standard Optional	MOS 0.50 0.50 128K bytes 256K bytes Standard Standard Optional	MOS 0.50 0.50 128K bytes 256K bytes Standard Standard Optional
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	1 + 1 3 32K 4 PROM 1.44 Standard No No No Optional	1 + 1 3 64K 4 PROM 1.44 Standard Optional No Optional Standard	7 to 14 7 to 14 128K 1 PROM; 512 x 40 bits 0.30 Standard No Standard Optional Standard	14-21 14-21 256K 1 PROM; 1024 x 40 bits 0.30 Standard No Standard Optional Standard	21-28 21-28 512K 1 PROM; 1024 x 40 bits 0.30 Standard No Standard Optional Standard
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 1M-2M 6	Standard 1M-2M 6	Standard 280K 15	Standard 200K 30	Standard 200K 30
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	No Pack, cartridge; 1.24M bytes 1M-2M bytes; fixed-head/track No Optional 600, 1000 cpm 180 cps 300, 600 lpm Up to 19,300 bps 80 char. x 24 lines Paper tape reader/ punch; XY plotter	No Pack, cartridge; 1M-600M bytes Fixed-head/track; 1-2M bytes No 30, 60 KBS 600, 1000 cpm 180 cps 300, 600 lpm Up to 19,200 bps 80 char. x 24 lines Paper tape reader/ punch; XY plotter	Optional Pack, cartridge No Optional 1600 bpi Optional 120 cps 200 to 900 lpm 110-9600 bps 80 char. x 24 lines 15-port asynchro- nous multiplexer, 360/370 interface	Optional Pack, cartridge No Optional 1600 bpi Optional 120 cps 200-900 lpm 110-9600 bps 80 char. x 24 lines 15-port asynchro- nous multiplexer, 360/370 interface	Optional Pack, cartridge No Optional 1600 bpi Optional 120 cps 200-900 lpm 110-9600 bps 80 char. x 24 lines 15-port asynchro- nous multiplexer, 360/370 interface
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Assembler & macro assembler COBOL, RPG II, FORTRAN, BASIC Batch, time-sharing No No	Assembler & macro assembler COBOL, RPG II, FORTRAN, BASIC, APL Batch, time-sharing Partially No	Yes RPG II, BASIC/5, PL/G Time-sharing Partially Partially	Yes RPG II, BASIC/5, PL/G Time-sharing Partially Partially	Yes RPG II, BASIC/5, PL/G Time-sharing Partially Partially
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$24,500 \$1,800 (8KB MOS); \$2,100 (8KB core) NA NA	\$39,600 \$1,800 (8KB MOS); \$2,100 (8KB core) NA NA	\$34,700 \$4,500 (32K bytes) August 1976 30 (all models)	\$55,400 \$4,500 (32K bytes) NA NA	\$82,900 \$4,500 (32K bytes) NA NA
COMMENTS	Up to 8 concurrent users in a mixed conversational and batch mode; IBM 1130-compatible, in a time-sharing environment; expandable to model 5030	Up to 32 concurrent users in a mixed conversational and batch mode; IBM 1130-compatible plus the ability to perform multiprogramming in a time-sharing environment	In-cabinet, on-site upgrades available on all configurations; Galaxy/5 is a multiple microprocessor system; DMA channel and communications interface are both microprocessor-based	Has two CPU's and two DMA channels; each DMA supports 15 high-speed devices	Has three CPU's and three DMA channels; all CPU's execute independent instruction streams

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Digital Systems Galaxy/5 Model 170	Durango Systems, Inc. F-85	Financial Computer System III/6	Financial Computer System III/10	Four Phase IV/40
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8 to 20 8 to 2048 16, 32, 48	8-bit byte 8 8, 16, 24	8-bit byte 8 8	8-bit byte 8 8	24 15 24
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 0.50 0.50 128K bytes 256K bytes Standard Standard Optional	MOS 0.50 0.25 32K bytes 64K bytes Standard No No	MOS 0.6 0.2 4K bytes 256K bytes Optional Optional Optional	MOS 0.6 0.2 4K bytes 256K bytes Optional Optional Optional	MOS 2 — 24K bytes 96K bytes Standard No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	28 28 1M 1 PROM; 1024 x 40 bits 0.30 Standard No Standard Optional Standard	1 0 64K bytes 3 EROM; 2-8K 1.33 No No Standard Optional Standard	Software-assigned 128 64K bytes 3 PROM, 1-16K bytes 3.2 Optional Optional Standard Optional Optional	Software-assigned 128 64K bytes 3 PROM, 1-16K bytes 3.2 Optional Optional Standard Optional Optional	2 3 98,304 bytes 3 ROM; 1K x 48 bits 16 Standard Standard Standard — Standard
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 200K 30	Standard 750K 8	Standard 960K 16	Standard 960K 16	No 125K 8
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	Optional Pack, cartridge No Optional 1600 bpi Optional 120 cps 200-900 lpm 110-9600 bps 80 char. x 24 lines 15 port asynchronous multiplexer, 360/370 interface	473K-1890K bytes Cartridge; 10-20M bytes No No No 165 cps No Up to 9600 bps 80 char. x 24 lines —	266K-2M bytes Cartridge; 10-400M bytes No Cassette; 1.2 KBS 72 KBS 300, 600 lpm 30 cps 300-1250 lpm Up to 9600 bps 80 char. x 24 lines Paper tape reader, paper tape punch	266K-5M bytes Cartridge; 10-400M bytes No Cassette; 1.2 KBS 72 KBS 300, 600 cpm 165 cps 300-1250 lpm Up to 9600 bps 80 char. x 24 lines Paper tape reader, paper tape punch	354K bytes Cartridge; 2.5-10M bytes 10-20M bytes No No 300, 600 cpm 30 cps 245-1800 lpm Up to 9600 bps 80 char. x 24 lines None
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Yes RPG II, BASIC/5, PL/G Time-sharing Partially Partially	No BASIC Batch, real-time, multiprogramming No No	Yes BASIC, CPL, PL/X Batch, real-time No Partially	Yes BASIC, CPL, PL/X Batch, real-time No Partially	Yes None Batch, interactive Partially —
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$186,800 \$4,500 (32K bytes) NA NA	\$12,983 (48K bytes) \$1,030 (16K bytes) January 1979 —	\$17,950 (32K bytes) \$1,600 (16K bytes); \$3,000 (32K bytes) January 1975 250+	\$29,950 (32K bytes) \$1,600 (16K bytes); \$3,000 (32K bytes) January 1975 250+	\$37,440 (24K bytes) — June 1973 6000 (all models)
COMMENTS	Has four CPU's and four DMA channels	Totally integrated desktop small business system; emphasis on packaged applications software; system price includes two 473K-byte diskette drives, CRT, keyboard, & printer; does not include system software (\$550)	Also available as a turnkey system with applications software for manufacturers, wholesalers, accountants, hospitals, construction, insurance agencies, and trucking firms	Also available as a turnkey system with applications software for manufacturers, wholesalers, accountants, hospitals, construction, insurance agencies, and trucking firms	System price also includes 4 CRT's, 2.5-megabyte disk drive, and bisynch. communications controller

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Four Phase IV/70	Four Phase IV/90	Functional Automation F6400	General Automation 16/110	General Automation 16/220
DATA FORMATS					
Word length, bits	24	24	64	16 + 1	16 + 2
Fixed-point operand length, bits	15	15	8, 16, 32, 64, 128	16, 32	16
Instruction length, bits	24	24	32, 64	16, 32	16, 32, 48
MAIN STORAGE					
Storage type	MOS	MOS	MOS	MOS	MOS
Cycle time, microseconds/word	2	0.8	0.5	0.5	0.5
Access time, microseconds/word	—	—	1.0	0.6	0.225
Minimum capacity, words	24K bytes	96K bytes	256K bytes	2K	2K
Maximum capacity, words	96K bytes	384K bytes	30M bytes	64K	32K
Parity checking	Standard	Standard	Optional	Optional	Optional
Error correction	No	No	Optional	No	No
Storage protection	No	No	Standard	Optional	Optional
CENTRAL PROCESSOR					
No. of accumulators	5	5	256	16	16
No. of index registers	3	3	256	8	8
No. of directly addressable words	98,304 bytes	98,304 bytes	250 million	64K	64K
No. of addressing modes	—	—	16	11	11
Control storage	ROM; 1K x 48 bits	ROM; 1K x 48 bits	4K x 128 RAM	—	ROM; 320 x 34 bits
Add time, microseconds	16	12	6.0	2.4	1.9
Hardware multiply/divide	Standard	Standard	Standard	Standard	Standard
Hardware floating point	Standard	Standard	Standard	No	Optional
Hardware byte manipulation	Standard	Standard	Standard	No	Standard
Battery backup	—	—	Standard	No	No
Real-time clock or timer	Standard	Standard	Standard	Standard	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	No	No	Standard	Standard	Standard
Maximum I/O rate, words/sec.	125K	125K	5 million	120K; 2000K (DMT)	1.25M
No. of external interrupt levels	8	8	4-128	Unlimited, vectored	Unlimited, vectored
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	354K bytes	354K bytes	No	No	500K-2M bytes
Disk pack/cartridge drives	Pack & cartridge; 2.5-270M bytes	Pack & cartridge; 2.5-270M bytes	Cartridge; up to 2.4 billion bytes	Pack & cartridge; 1.02-80M bytes	Pack & cartridge; 5-2400M bytes
Drum/Fixed-head disk storage	10-20M bytes	10-20M bytes	No	No	Fixed-head; 256K-2M bytes
Magnetic tape cassettes/cartridges	No	No	3M tape	No	No
Magnetic tape, 1/2-inch	10, 60 KBS	10, 60 KBS	No	20-60 KBS	20-60 KBS
Punched card input	300, 600 cpm	300, 600 cpm	No	400, 1000 cpm	400, 1000 cpm
Serial printer	30 cps	30 cps	No	No	10, 165 cps
Line printer	245-1800 lpm	120-1800 lpm	300 lpm	300, 600 lpm	200-600 lpm
Data communications interface	Up to 9600 bps	Up to 9600 bps	Up to 9600 bps	To 9600 bps	75-9600 bps
CRT	80 char. x 24 lines	80 char. x 24 lines	96 char. x 42 lines	See Comments	80 char. x 24 lines
Other standard peripheral units	None	None	3M data cartridge	TTY, paper tape units, card punches, plotters	TTY, paper tape units, card punches, A/D converters, digital I/O plotters
SOFTWARE					
Assembler	Yes	Yes	No	Yes	Macro assembler
Compilers	COBOL, RPG	COBOL, RPG	MPL, FORTRAN	APL, BASIC, COBOL, FORTRAN IV, RPG II	FORTRAN IV, BASIC, COBOL
Operating system	Batch, interactive	Batch, interactive	Real-time	Batch, real-time, time-sharing	Batch, real-time
Language implemented in firmware	Partially	Partially	Partially	No	No
Operating system implemented in firmware	—	—	Partially	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$72,315 (48K bytes)	\$1,876/month (48-month lease)	\$68,700	\$585	\$770
Price of memory increment	—	—	\$20,100 (256 KB and I/O controller)	\$1,625 (8K words)	\$1,810 (8K words)
Date of first delivery	February 1971	July 1977	1st. qtr. 1979	September 1975	December 1975
Number installed to date	6000 (all models)	6000 (all models)	NA	800	800
COMMENTS	System price also includes 12 CRT's, 2.5-megabyte disk drive, and 9-track magnetic tape drive	System price also includes 12 CRT's, 2.5-megabyte disk drive, and 9-track magnetic tape drive			

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	General Automation 16/330	General Automation 16/440	General Automation 16/550	General Automation SPC-16	General Robotics CD/X3
DATA FORMATS					
Word length, bits	16 + 2	16 + 2	16 + 2	16	16
Fixed-point operand length, bits	16	16	16	16	16
Instruction length, bits	16, 32, 48	16, 32, 48	16, 32, 48	16	16, 32, 48
MAIN STORAGE					
Storage type	Core	Core	Cache	Core	MOS
Cycle time, microseconds/word	0.72	0.72	0.24	0.8, 0.96, 1.44	0.45
Access time, microseconds/word	0.225	0.225	0.225	0.4, 0.48, 0.72	0.30
Minimum capacity, words	4K	16K	128K	4K	32K
Maximum capacity, words	32K	1024K	2048K	128K	32K
Parity checking	Optional	Optional	Standard	No	No
Error correction	No	No	Standard	No	No
Storage protection	Optional	Optional	Optional	Optional	No
CENTRAL PROCESSOR					
No. of accumulators	16	16	16	16	8
No. of index registers	8	8	8	6	8
No. of directly addressable words	64K	64K	64K	32K	32K
No. of addressing modes	11	11	11	11	8
Control storage	ROM; 320 x 34 bits	PROM; 512 x 64 bits	PROM; 512 x 64 bits	ROM; 4K words	PROM; 256 x 16
Add time, microseconds	1.9	0.78	0.78	0.8, 0.96, 1.44	3.5
Hardware multiply/divide	Standard	Standard	Standard	Standard	Standard
Hardware floating point	Optional	Optional	Optional	Optional	Standard
Hardware byte manipulation	Standard	Standard	Standard	Standard	Standard
Battery backup	No	No	No	No	Optional
Real-time clock or timer	Standard	Standard	Standard	Standard	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	140K; 1200K (DMA)	1M	1M	1.04M	500K
No. of external interrupt levels	Unlimited, vectored	64-unlimited	64-unlimited	64-unlimited	1
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	500K-2M bytes	500K-2M bytes	500K-2M bytes	294-884K bytes	No
Disk pack/cartridge drives	Pack & cartridge; 5-2400M bytes	Pack & cartridge; 5-2400M bytes	Pack & cartridge; 5-2400M bytes	Pack & cartridge; 5-2400M bytes	No
Drum/Fixed-head disk storage	Fixed-head; 256K-2M bytes	Fixed-head; 256K-2M bytes	Fixed-head; 256K-2M bytes	Fixed-head; 256K-2M bytes	No
Magnetic tape cassettes/cartridges	No	No	No	No	No
Magnetic tape, 1/2-inch	20-60 KBS	20-60 KBS	20-60 KBS	20-60 KBS	No
Punched card input	400, 1000 cpm	400, 1000 cpm	400, 1000 cpm	300-1000 cpm	No
Serial printer	10, 165 cps	10, 165 cps	10, 165 cps	10, 165 cps	No
Line printer	200-600 lpm	200-600 lpm	200-600 lpm	200-600 lpm	No
Data communications interface	75-9600 bps	75-9600 bps	75-9600 bps	75-9600 bps	No
CRT	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	See Comments	No
Other standard peripheral units	TTY, paper tape units, card punches, A/D converters, digital I/O plotters	TTY, paper tape units, card punches, A/D converters, digital I/O plotters	TTY, paper tape units, card punches, A/D converters, digital I/O plotters	TTY, A/D units, paper tape units	None
SOFTWARE					
Assembler	Macro assembler	Macro assembler	Macro assembler	Assembler & macro assembler	Assembler and macro assembler
Compilers	FORTRAN IV, BASIC, COBOL	FORTRAN IV, BASIC, COBOL	FORTRAN IV, BASIC, COBOL	FORTRAN IV, BASIC, COBOL	FORTRAN, BASIC, APL
Operating system	Batch, real-time	Batch, real-time, time-sharing	Batch, real-time, time-sharing	Real-time, batch	Batch, real-time, time-sharing
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$4,550 (4K words)	\$8,950 (16K words)	\$8,950 (16K words)	\$5,550 (4K words)	\$18,000
Price of memory increment	\$3,250 (16K words)	\$6,980 (16K words)	Not est. to date	\$1,400 (4K words)	NA
Date of first delivery	December 1975	June 1975	NA	NA	November 1977
Number installed to date	250	250	NA	8,300	50
COMMENTS		Software and I/O compatible with SPC-16; oriented toward multi-user environment	Software and I/O compatible with SPC-16; oriented toward multi-user environment	The DM-100 Series is a line of packaged systems based on the SPC/16; CRT may be either 32 char. x 16 lines or 74 char. x 27 lines	Based on DEC LSI-11 with RK05-compatible hard disk

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	General Robotics CD/X3S	General Robotics FD/X3	General Robotics FD/X3S	General Robotics MVT/X3	GRI System 99/50
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 16 16, 32, 48	16 16 16, 32, 48	16 16 16, 32, 48	16 16 16, 32, 48	16 — 16-48
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 0.45 0.30 32K 32K No No No	MOS 0.45 0.30 32K 32K No No No	MOS 0.45 0.30 32K 32K No No No	MOS 0.45 0.30 32K 32K No No No	Core; MOS 1.76 0.3 32K bytes 64K bytes Optional No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	8 8 32K 8 PROM; 256 x 16 3.5 Standard Standard Standard Optional Standard	8 8 32K 8 No 3.5 Standard Standard Standard Optional Standard	8 8 32K 8 No 3.5 Standard Standard Standard Optional Standard	8 8 32K 8 PROM; 256 x 16 3.5 Standard Standard Standard Optional Standard	8 1 32K 5 — 1.76 Optional No Standard Optional Optional
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 500K 1	Standard 500K 1	Standard 500K 1	Standard 500K 1	Standard 568K Unlimited
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	No No No No No No No No No None	3.75M bytes No No No No No No No None	3.75M bytes No No No No No No 2000 char. None	1.3M bytes No No No 120 cps No No No 480 char. None	No Cartridge; 10.6-42.4M bytes No Cassette 60 KBS 300 cpm 88-330 cps 200-600 lpm Up to 9600 bps 80 char. x 24 lines Paper tape equip., A/D and D/A con- verters, industrial devices
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Assembler and macro assembler FORTRAN, BASIC, APL Batch, real-time, time-sharing No No	Yes BASIC, RPG II Real-time, multi-user No No			
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$24,000 NA November 1977 50	\$11,000 NA June 1976 200	\$17,000 NA June 1976 200	\$12,000 NA June 1978 NA	\$6,410 (8K words) \$3,890 (16K words) NA NA
COMMENTS	Based on DEC LSI-11 with RK05- compatible hard disk	Triple drive double- sided double-density floppy disk with LSI-11 CPU	Triple drive double- sided double-density floppy disk with LSI-11 CPU	Complete desktop LSI-11 computer system with key- board, screen, printer, CPU, and disks in self-con- tained unit	Basis for the GRI System 99 small business computer

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Harris Slash 4	Harris Slash 6	Harris Slash 7	Harris 550	Harris 570
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	24 + 2 24, 48 24	24 + 5 24, 48 24	24 + 2 24, 48 24	24 24, 48 24	24 24, 48 24
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	Core; MOS 0.75; 0.2 0.3 8K 256K Standard No Optional	MOS 0.45 0.3 16K 256K No Standard Optional	Core; MOS 0.43; 0.2 0.3 32K 256K Standard No Optional	MOS; core 0.3 2.9 960K bytes 3072K bytes No Standard Optional	Core; MOS 0.3 2.9 960K bytes 3072K bytes Standard Standard Optional
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	5 3 64K 4 No 0.75 Standard Optional Standard No Optional	5 3 64K 4 No 0.6 Standard Optional Standard Optional Optional	5 3 64K 4 No 0.58 Standard Optional Standard No Optional	5 3 1024K 3 No 0.72 Standard Optional Standard Standard Optional	5 3 1024K 3 No 0.72 Standard Optional Standard Standard Optional
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Optional 1.3M 4-48	Optional 2.3M 8-24	Optional 1.9M 4-48	Optional 7.9M 16; 48 opt.	Optional 7.9M 16; 48 opt.
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	310K-1.2M bytes Pack & cartridge; 2.7-300M bytes Fixed-head; 10.8M bytes — 25-320 KBS 300-1000 cpm 30 cps 300-900 lpm 96K bps; synch. 80 char. x 24 lines Paper tape units, plotter/printer	310K-3.7M bytes Pack & cartridge; 2.7-300M bytes Fixed-head; 10.8M bytes — 25-320 KBS 300-1000 cpm 30 cps 300-900 lpm 98K bps; synch. 80 char. x 24 lines Paper tape units, plotter/printer	310K-1.2M bytes Pack & cartridge; 2.7-300M bytes Fixed-head; 10.8M bytes — 25-320 KBS 300-1000 cpm 30 cps 300-900 lpm 98K bps; synch. 80 char. x 24 lines Paper tape units, plotter/printer	310K bytes Cartridge; 10.8M bytes Moving-head; 40, 80, 150, & 300 MB — 800/1600 bpi 300, 600, 1K cpm — 300, 600, 900 lpm Synch.; asynch. Yes Printer/plotters, paper tape devices, remote terminals	310K bytes Cartridge; 10.8M bytes Moving-head; 40, 80, 150, & 300 MB — 800/1600 bpi 300, 600, 1K cpm — 300, 600, 900 lpm Synch.; asynch. Yes Printer/plotters, paper tape devices, remote terminals
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Macro assembler FORTRAN IV, BASIC, RPG II, SNOBOL, FORGO Batch, real-time, time-sharing No No	Macro assembler FORTRAN IV, BASIC, RPG II, SNOBOL, FORGO Batch, real-time, time-sharing No No	Macro assembler FORTRAN IV, BASIC, RPG II, FORGO, SNOBOL Batch, real-time, time-sharing No No	Macro assembler BASIC V, APL, RPG II, SNOBOL, FORGO, FORTRAN Batch, real-time, time-sharing No No	Macro assembler BASIC V, APL, RPG II, SNOBOL, FORGO, FORTRAN Batch, real-time, time-sharing No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$24,000 (8K words) \$7,000 (8K words) September 1973 NA	\$17,900 (16K words) \$5,500 (16K words) December 1976 NA	\$55,000 (32K words) \$30,000 (32K words) November 1975 NA	\$255,000 — 1st qtr. 1979 NA	\$376,000 — 1st qtr. 1979 NA
COMMENTS					

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Hewlett-Packard Fort Collins Division HP 250	Hewlett-Packard Desktop Com- puter Division 9825	Hewlett-Packard Desktop Com- puter Division 9830	Hewlett-Packard Desktop Com- puter Division System 45	Hewlett-Packard Data Systems Division HP 1000 E-Series
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8-bit byte 64 16	16 64 bits 16	8-bit byte — 16	16 64 16	16 + 1 16, 32 16, 32
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 1.2 — 32K bytes 64K bytes No No No	MOS — — 6844 bytes 31,420 bytes No No No	MOS 13 — 3520 bytes 30,144 bytes No No No	MOS 1 — 13,498 bytes 62,650 bytes No No No	MOS 0.595, 0.35 — 16K 1,024,000 Standard Optional Optional
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	4 Software-assigned 2K 8 —	2 — 2K 8 See Comments	Software-assigned Software-assigned — 4 See Comments	4 — 2K 8 —	2 2 2K 7 ROM/RAM; 16K
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Std.; 1 — 2	Standard 400K 2	No 1.2K 0	Standard 400K 2	Optional 1140K 50
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	3 units; 1.2M bytes 20 MB; 10 MB fixed, 10 MB cartridge — — — 180 cps 30, 180 cps, 136 col. None currently offered 1920 characters —	468K-15M bytes No No Cartridge; 2.75 KBS No 300 cpm 30-180 cps 240 lpm Up to 9600 bps See comments Paper tape reader, paper tape punch, plotter, digitizer,	No Cartridge; 4.8-9.6M bytes No Cassette; 375 bps No 300 cpm 30 cps 165-300 lpm Up to 9600 bps 80 char. x 24 lines Paper tape reader, paper tape punch, plotter	500K-24M bytes Pack & cartridge; 15M-6400M bytes No Cartridge; 1.48 KBS No 300 cpm 30-100 cps 240-480 lpm Up to 9600 bps 80 char. x 24 lines Paper tape reader, paper tape punch, plotter	0.5-2M bytes Cartridge & pack; 4.9-400M bytes No Yes 20-72 KBS 300, 600 cpm 180 cps 1250 lpm 50K-2.5M bytes 80 char. x 25 lines Plotters, meas. or control processor plug-in ADC, IEEE std. 488-1975 intfca., TV intfca. Assembler & micro assembler FORTRAN, BASIC
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	No Business BASIC — — —	No HPL Interactive/inter- pretive Fully Fully	No BASIC Interactive Fully Fully	No BASIC Interactive/ interpretive Fully Fully	Assembler & micro assembler FORTRAN, BASIC Real-time, time-sharing, DBMS Partially Partially
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$24,500; 3 to 7 year leases available — September 1978 NA	\$5,900 (6844 bytes) \$1,600 (8K bytes) \$3,200 (16K bytes) January 1976 NA	\$4,900 (3520 bytes) \$1,000 (4K bytes) \$3,000 (12K bytes) November 1972 NA	\$11,500 (13,498 bytes) \$2,400 (16,384 bytes) November 1977 NA	\$9,250 (32K MOS) \$1,400 (32 KB); \$4,000 (128 KB) November 1976 NA
COMMENTS		Approx. 31K bytes of ROM for oper. system and HPL language interp.; up to 16K bytes of addl. ROM can be added for language extension & periph. control; system price also includes mag. tape cartridge drive, 16-char. strip printer, and 32-char. display; CRT can be added as a peripheral	Approx. 15K bytes of ROM for oper. sys. and BASIC language interp.; BASIC language extensions can be added in 2K-byte ROM modules to a maximum of 16K; sys. price also incl. mag. tape cassette drive & 32-char. display	98K bytes of ROM for operating system and enhanced BASIC interpreter; up to 80K bytes of additional ROM can be added for language extensions and peripheral control; internal options can handle graphics capability, 2nd tape drive, and 80-char. thermal printer	Packaged systems include HP 1000, Models 20, 30, and 40; HP 1000 is also available as a board computer; peripheral units also include a graphics CRT and multipoint interface

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Hewlett-Packard Data Systems Division HP 1000 F-Series	Hewlett-Packard Data Systems Division HP 1000 M-Series	Hewlett-Packard General Sys. Div. HP 3000 Series I	Hewlett-Packard General Sys. Div. HP 3000 Series II	Hewlett-Packard General Sys. Div. HP 3000 Series III
DATA FORMATS					
Word length, bits	16 + 1	16 + 1	17	21	22
Fixed-point operand length, bits	16, 32	16, 32	—	—	—
Instruction length, bits	16, 32	16, 32	8, 16	8, 16, 32, 64	8, 16, 32, 64
MAIN STORAGE					
Storage type	MOS	MOS	Core	MOS	MOS
Cycle time, microseconds/word	0.35	0.65	1.05	0.7	0.7
Access time, microseconds/word	—	—	0.525	0.35	0.35
Minimum capacity, words	32K	8K	128K bytes	128K bytes	256K bytes
Maximum capacity, words	2048 KB	1,024,000	128K bytes	512K bytes	2048K bytes
Parity checking	Standard	Standard	Standard	Standard	Standard
Error correction	Optional	Optional	No	Standard	Standard
Storage protection	Optional	Optional	Standard	Standard	Standard
CENTRAL PROCESSOR					
No. of accumulators	2	2	16	20	20
No. of index registers	2	2	1	1	1
No. of directly addressable words	2K	2K	64K bytes	64K bytes	64K bytes
No. of addressing modes	7	7	6	6	6
Control storage	ROM/RAM; 16K	ROM/RAM; 4K	ROM; 4K x 32	ROM; 10K x 32 bits	ROM; 10K x 32 bits
Add time, microseconds	0.910	1.9	1.23	1.05	1.05
Hardware multiply/divide	Standard	Standard	Standard	Standard	Standard
Hardware floating point	Floating pt. or std.	Firmware	Standard	Standard	Standard
Hardware byte manipulation	Standard	Standard	Standard	Standard	Standard
Battery backup	Optional	Optional	No	Standard	Standard
Real-time clock or timer	Optional	Optional	Standard	Standard	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	Optional	Optional	Standard	Standard	Standard
Maximum I/O rate, words/sec.	1140K	616K	1.92M	2.86M	2.86M
No. of external interrupt levels	50	50	To 125	To 125	To 124
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	0.5-2M bytes	0.5-2M bytes	No	No	No
Disk pack/cartridge drives	Cartridge & pack; 4.9-400M bytes	Cartridge & pack; 4.9-400M bytes	15M-400M bytes	50M-960M bytes	50M-960M bytes
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	Yes	Yes	No	110K bytes	110K bytes
Magnetic tape, 1/2-inch	20-72 KBS	20-72 KBS	72 KBS	72 KBS	72 KBS
Punched card input	300, 600 cpm	300, 600 cpm	600 cpm	600 cpm	600 cpm
Serial printer	180 cps	180 cps	30, 180 cps	30, 180 cps	30, 180 cps
Line printer	1250 lpm	1250 lpm	200-1250 lpm	200-1250 lpm	200-1250 lpm
Data communications interface	50K-2.5M bytes	50K-2.5M bytes	1200 bps	To 9600 bps	To 9600 bps
CRT	80 char. x 25 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines
Other standard peripheral units	Plotters, meas. or control processor plug-in ADC, IEEE Std. 488-1975 intfce.; TV intfce.	Plotters, meas. & control processor, plug-in ADC, IEEE Std. 88-1975 intfce.; TV intfce.	Paper tape, punched card reader/punch, graphics terminal	Paper tape, punched card reader/punch, graphics terminal	Paper tape, punched card reader/punch, graphics terminal
SOFTWARE					
Assembler	Assembler & micro assembler	Assembler & micro assembler	Assembler & macro assembler	Assembler & macro assembler	Assembler & macro assembler
Compilers	FORTRAN, BASIC	FORTRAN, BASIC	SPL, COBOL, RPG II, FORTRAN IV, BASIC	COBOL, RPG II, FORTRAN IV, BASIC, SPL, APL	COBOL, RPG II, FORTRAN IV, BASIC, SPL, APL
Operating system	Real-time, time-sharing, DBMS	Real-time, time-sharing DBMS	Batch, real-time, time-sharing	Batch, time-sharing, transaction processing	Batch, time-sharing, transaction processing
Language implemented in firmware	Partially	No	Partially	Partially	Partially
Operating system implemented in firmware	Partially	No	Partially	Partially	Partially
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$12,250	17,425 (64K bytes)	\$64,000 (128K bytes)	\$99,000 (256K bytes)	\$115,000 (256K bytes)
Price of memory increment	\$1,700 (16K bytes); \$5,000 (128K bytes)	\$1,400 (32K bytes); \$4,000 (128K bytes)	—	\$4,000 (64K bytes)	\$8,000 (256K bytes)
Date of first delivery	July 1978	May 1974	April 1977	June 1976	June 1978
Number installed to date	—	—	—	—	—
COMMENTS	Model 45 system includes F-Series processor with 128KB memory, 20 MB disk, graphics terminal, RTE-IV software, desk-style cabinet, 1000 software, installation, and 90-day support services	Unique scientific instruction set includes most trigonometric functions and logarithmic functions, including hyperbolic tangent, arctangent, and base 10 logarithm	The Series I is the entry-level product in HP's 3000 line; it is fully upgradable to a Series II	The Series II is the mid-range HP 3000, with a \$99,000 entry price; it is fully upgradable to a Series III and offers the same communications, languages, data entry, data base mgmt., and peripherals	The Series III offers on-line transaction processing power with up to 2 MB of memory, and a variety of communications, languages, data entry, data base mgmt., and peripherals

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Honeywell Level 6 Model 23	Honeywell Level 6 Model 33	Honeywell Level 6 Models 43, 47	Honeywell Level 6 Models 53, 57	Honeywell Level 62
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 + 2 16, 32 16, 32, 48	16 + 2, + 6 16, 32 16, 32, 48	16 + 2, + 6 16, 32 16, 32, 48	16 + 2, + 6 16, 32 16, 32, 48	8 + 1 16, 32 16-64
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS — — 16K 64K Standard No No	MOS 0.65 or 0.55 — 8K bytes 64K bytes Standard Optional No	MOS 0.65 or 0.55 — 16K bytes 1024K bytes Standard Optional Optional	MOS 0.65 or 0.55 — 16K bytes 1024K bytes Standard Optional Standard	MOS 1.0 (2-byte fetch) 0.5 (2-byte fetch) 48K bytes 992K bytes Standard Yes Standard
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	7 3 64K 19 — 3.0 Standard No Standard Optional Standard	7 3 64K 19 ROM; 512 x 56 bits 1.9 Standard No Standard Optional Standard	7 3 1024K 19 ROM; 1K x 64 bits 1.0 Standard Optional Standard Standard	7 3 1024K 19 ROM; 1K x 64 bits 0.7 Standard Optional Standard Standard	16 8 992K 4 ROM; to 30K bytes See Comments Standard Optional Standard No Standard
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 900 KW 64	Standard 3 MW 64	Standard 3 MW 64	Standard 3 MW 64	Standard 1.587M 1-14
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	4 x 256/512K No No No No 120, 160 cps 300, 600, 900 lpm 50-9600 bps 1920 char. —	4 x 256/512K Cartridge; 4 x 10, 33, 66, 128, or 256 MB No No 25-120 KBS 300, 500 cpm 120, 160 cps 300, 600, 900 lpm 50-72 KB 1920 char. Card punch	4 x 256/512K Cartridge; 4 x 10, 33, 66, 128, or 256 MB No No 25-120 KBS 300, 500 cpm 120, 160 cps 300, 600, 900 lpm 50-72 KB 1920 char. Card punch	4 x 256/512K Cartridge; 4 x 10, 33, 66, 128, or 256 MB No No 25-120 KBS 300, 500 cpm 120, 160 cps 300, 600, 900 lpm 50-72 KB 1920 char. Card punch	256-512K bytes Pack; 40-1,800M bytes No 700 bps 10-60 KBS 300-1050 cpm 30/120 cps 100-1600 lpm To 9600 bps 80 char. by 12 lines Card punch
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Assembler & macro- preprocessor FORTRAN, COBOL, RPG Batch, multi-tasking, real-time No No	Assembler and macro preprocessor COBOL, FORTRAN, RPG Batch, real-time, real-time, multi-task. No No	Assembler and macro preprocessor COBOL, FORTRAN, RPG Multi-tasking, batch, real-time, time-shar. No No	Assembler and macro preprocessor COBOL, FORTRAN, RPG Multi-tasking, batch, real-time, time-shar. No No	No COBOL, RPG, FORTRAN Batch, real-time, time-sharing No Partially
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$4,750 (16K words) \$1,500 (16K words) 1978 100	\$6,300 (8K words) \$875 (8K words) 1976 1000	43: \$11,025 (16 KW); 47: \$28,050 (16 KW) \$875 (8K words) 1977 1000	53: \$27,250 (16 KW); 57: \$52,050 (16 KW) \$875 (8K words) 1978 25	\$36,900 (48K bytes) \$4,677 (16K bytes) June 1975 Over 1800
COMMENTS		Model 33 is field- upgradable to Model 43, 47, 53, or 57; all use common megabus	Writable control store (2K x 64) is optional; scientific instrument processing also op- tional (standard on Model 47)	Models 53 and 57 are cache processors; Model 57 also in- cludes high-speed commercial instruc- tion processor	Business data proces- sing system built in Italy; CPU is available with 4 different per- formance levels

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	IBM Series/1	IBM System/3	IBM System/7	IBM System/32	IBM System/34
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 32 32, 64	8-bit byte 8-248 32, 40, 48	16 + 2 16 16, 32	8-bit byte 1-16 digits 24-48	8-bit byte 1-16 digits 32, 40, 48
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 0.6, 0.8 — 16K bytes 128K bytes Standard No Standard	Core, MOS 1.52 — 8K bytes 256K bytes Standard Std. (Model 15) Std. (Model 15)	Bipolar 0.4 0.15 2K 64K Standard — No (Models A & B); Std. (Model E)	MOS 0.6 0.250 16K bytes 32K bytes Standard Standard No	MOS 0.6 — 32K bytes 128K bytes Standard No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	— 34 64K bytes 4 No 2.6, 8.4 (2 bytes) No Optional Standard Optional Optional	1 2 64K bytes 1 No 24.4 No No Standard Optional Optional	4 28 64K 1 No 0.8 No No No No Optional	— 2 32K bytes 2 ROM; 4K bytes 150.8 (5 digits) No No Standard No No	— 2 32K bytes 2 — 68.5 (5 digits) No No Standard — —
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard — 256	Standard 658K 5 (Models 8, 10, 12) 8 (Model 15)	Standard 2M 64	Standard 889K 4	Standard — —
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	492-606K bytes/drive Nonrem. cartridge; 9.3-258M bytes/drive No No No No 120 cps 155-414 lpm 2400-9600 bps 80 char. x 24 lines Sensor I/O	243K bytes/drive Pack & cartridge; 2.5-506M bytes No No 20-80 KBS 600, 1000 cpm 85, 115 cps 100-1100 lpm Up to 50K bps 40 char. x 12 lines MICR reader/sorter, optical mark reader	No Pack & cartridge; 4.9-69.8M bytes Fixed-head; 502K bytes No No 300 cpm No 40-155 lpm Up to 50K bps No A/D converters, sensor units	243-303K bytes Nonrem. cartridge; 3.2-13.7M bytes No No No 12-50 cpm 40-80 cps 50-155 lpm Up to 7200 bps 40 char. x 6 lines Magnetic card reader	303K bytes Nonrem. cartridge; 8.6-27.1M bytes No No No 100, 600 cpm 15 cps 40-1100 lpm Up to 4800 bps 960 or 1920 char. No
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Macro assembler FORTRAN, PL/1, COBOL Real-time, multi- tasking Partially Partially	No BASIC, RPG II, COBOL, FORTRAN Batch, time-sharing	Assembler & macro assembler FORTRAN, APG/7 Batch, real-time	Macro assembler RPG II Batch (one-program)	Yes RPG II, FORTRAN Interactive
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$4,360 \$1,510 (16K bytes) — NA	\$12,560 (8K bytes) \$2,950 (4K bytes) December 1970 30,000+	\$5,310 (2K words) \$2,285 (2K words) 1st quarter 1971 NA	\$33,560 (16K bytes) \$878 (8K bytes) March 1975 15,000+	\$26,300 \$1,600 (16K bytes) January 1978 NA
COMMENTS	Offered on a purchase-only basis; nine different CPU models	Six different model lines currently avail- able	System/7's form the base for many custom systems for voice response, Touch-Tone data entry communica- tions processing, etc.	Entry-level business computer; strong emphasis on packaged applica- tions software; system price also includes 3.92M- byte fixed disk drive, diskette drive, CRT, keyboard, and 40-cps unidirectional printer	Similar to System/ 34, but features more processing power, larger memory, larger disk capacity, and multiple independent workstations

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	IBM System/360 Model 20	IBM 1130	IBM 5100	IBM 5110	ICL System Ten/220
DATA FORMATS					
Word length, bits	8-bit byte	16 + 2	8-bit byte	8-bit byte	6
Fixed-point operand length, bits	8-128	16, 32	—	—	1-10
Instruction length, bits	16, 32, 48	16, 32	16	16	3-60
MAIN STORAGE					
Storage type	Core	Core	MOS	MOS	Core
Cycle time, microseconds/word	See Comments	2.2; 3.6	0.530	0.530	2.2
Access time, microseconds/word	—	—	0.330	0.330	1.1
Minimum capacity, words	4K bytes	4K	16K bytes	16K bytes	20K
Maximum capacity, words	32K bytes	32K	64K bytes	64K bytes	160K
Parity checking	Standard	Standard	Standard	Standard	Standard
Error correction	No	No	No	No	No
Storage protection	No	No	No	No	Standard
CENTRAL PROCESSOR					
No. of accumulators	8 (see Comments)	2	64	64	1
No. of index registers	8 (see Comments)	3	0	0	3-60
No. of directly addressable words	—	32K	64K bytes	64K bytes	160K
No. of addressing modes	—	2	2	2	2
Control storage	ROM	No	ROM; 180K x 9 bits	ROM; 180K x 9 bits	—
Add time, microseconds	58	8; 4.9	1000 (approx.)	1000 (approx.)	36.3
Hardware multiply/divide	Standard	Standard	Standard	Standard	Standard
Hardware floating point	No	No	Standard	Standard	No
Hardware byte manipulation	Standard	No	Standard	Standard	Standard
Battery backup	No	No	No	No	No
Real-time clock or timer	Optional	No	No	No	Optional
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Optional	Standard	Standard	Standard
Maximum I/O rate, words/sec.	156K	278K; 455K	500K	500K	229, 166
No. of external interrupt levels	1	6	3	3	1-300
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	No	No	No	303K-4.8M bytes	No
Disk pack/cartridge drives	Pack; 2.7-21.6M bytes	Pack & cartridge; 512K-2.56M bytes	No	No	Pack & Cartridge
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	No	No	Cartridge; 2.85 KBS	Cartridge; 2.85 KBS	No
Magnetic tape, 1/2-inch	15-60 KBS	15 KBS	No	No	20KBS
Punched card input	600, 1000 cpm	100, 600 cpm	No	No	No
Serial printer	15.5 cps	15 cps	80, 120 cps	80, 120 cps	165-330 cps
Line printer	260-1100 lpm	40-1100 lpm	No	No	125-400 lpm
Data communications interface	Up to 50K bps	Up to 4800 bps	Up to 300 bps	Up to 9600 bps	2400-9600 bps
CRT	No	74 char. x 52 lines	64 char. x 16 lines	64 char. x 16 lines	80 char. x 24 lines
Other standard peripheral units	Card punch, MICR reader/sorter	Paper tape reader, paper tape punch, optical mark reader, plotter	RS 232C interface available for non-IBM peripherals	RS 232C, IEEE interfaces available for non-IBM peripherals	—
SOFTWARE					
Assembler	Assembler & macro assembler RPG II, PL/1	Assembler & macro assembler RPG II, FORTRAN	No	No	Assembler & macro assembler RPG II
Compilers			BASIC, APL	BASIC, APL	
Operating system	Batch	Batch	Batch (one-program)	Batch (one-program)	Batch, real-time
Language implemented in firmware	No	No	Fully	Fully	No
Operating system implemented in firmware	No	No	Fully	Fully	Partially
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$8,210 (4K bytes)	\$8,630 (4K words)	\$6,285 (16K bytes)	\$8,475 (16K bytes)	\$15,000 (20K words)
Price of memory increment	\$2,160 (4K bytes)	\$4,390 (4K words)	\$1,750 (16K bytes)	\$1,750 (16K bytes)	\$3,000 (20K words)
Date of first delivery	November 1964	November 1965	September 1975	February 1978	June 1970
Number installed to date	15,000+	4000+	NA	NA	5000
COMMENTS	Low end of IBM's 360 series; cycle times vary with processor models; 8 general-purpose registers are used for indexing, base addressing, and as accumulators	IBM 1800 is similar CPU with storage protection; real-time operating system, and extensive A/D and sensor units	Portable computer weighing 50 pounds; system price also includes cartridge tape drive, CRT, and BASIC language interpreter	Features floppy disk and/or magnetic tape storage, and approximately two to three times the internal computing power of the 5100	Improved version of the former Singer System Ten; CPU power fail/auto restart included in price. System Ten/220 is an entry-level business computer system with strong emphasis on packaged software

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	ICL 1501/40	ICL 1503/43	ICL 2903	ICL 2904	Intelligent Systems 8031/8051
DATA FORMATS					
Word length, bits	8	8	24 + 2	24 + 2	8
Fixed-point operand length, bits	8	8	12	12	8, 16
Instruction length, bits	16	16	24	24	8, 16, 24
MAIN STORAGE					
Storage type	MOS	MOS	MOS	MOS	MOS
Cycle time, microseconds/word	0.3	0.3	1.14	1.14	0.5
Access time, microseconds/word	4.0	4.0	0.57	0.57	0.5
Minimum capacity, words	16K	16K	16K	32K	32K
Maximum capacity, words	16K	32K	48K	96K	64K
Parity checking	Standard	Standard	Standard	Standard	No
Error correction	No	No	No	No	No
Storage protection	No	No	No	No	No
CENTRAL PROCESSOR					
No. of accumulators	1	1	8	8	1
No. of index registers	7	7	4	4	3
No. of directly addressable words	256K	256K	4K	4K	64K
No. of addressing modes	2	2	4	4	2
Control storage	ROM; 16 bytes	ROM; 16 bytes	8K, 12K	8K, 12K	No
Add time, microseconds	30	30	17.7	11.8	2
Hardware multiply/divide	No	No	Standard	Standard	No
Hardware floating point	No	No	Optional	Optional	No
Hardware byte manipulation	No	No	No	No	No
Battery backup	Optional	Optional	No	No	No
Real-time clock or timer	Optional	Optional	Standard	Standard	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	No
Maximum I/O rate, words/sec.	60K	60K	500K	500K	167K
No. of external interrupt levels	1	1	None	None	8
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	No	No	No	No	80-591K bytes
Disk pack/cartridge drives	2.5MB (fixed)	Cart.; 5MB min., 20MB max.	Cartridge & pack; 9.8-270M (6-bit)	Cartridge & pack; 9.8-270M (6-bit)	No
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	Cart.; 2K bytes	Cart.; 2K bytes	No	No	No
Magnetic tape, 1/2-inch	6.9-20K bytes	6.9-20K bytes	80 KCS	80 KCS	No
Punched card input	Optional	Optional	300 cpm	300 cpm	No
Serial printer	165, 300 cps	165, 300 cps	No	No	60-180 cps
Line printer	100-400 lpm	100-400 lpm	150-1500 lpm	150-1500 lpm	No
Data communications interface	To 9600 bps	To 9600 bps	To 9600 bps	To 9600 bps	9600 bps
CRT	256 chars.	1920 char.	80 chars. x 25 lines DDE terminals, 256 chars.; hard- copy printer for CRT's	80 chars. x 25 lines DDE terminals, 256 chars.	80 char. x 24 lines Light pen
Other standard peripheral units	—	—	—	—	—
SOFTWARE					
Assembler	Yes	Yes	No	No	Assembler
Compilers	BTL, COBOL, BASIC	BTL, COBOL, BASIC	COBOL, FORTRAN, BASIC, RPG, ALGOL	COBOL, FORTRAN, RPG, ALGOL	3 BASIC interp., FORTRAN, COBOL
Operating system	No	No	Batch, multitasking, data base mgmt.	Batch, multitasking, data base mgmt.	Single-user
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	Partially	Partially	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$13,600	\$18,000	\$85,000	\$35,000	\$4,495
Price of memory increment	—	\$1,037 (8KB)	\$7,806-19,106 (4K)	\$12,116 (8K); \$18,174 (12K)	\$500 (8K bytes) \$800 (16K bytes)
Date of first delivery	1975	1975	July 1974	NA	—
Number installed to date	10	100	20	5	—
COMMENTS			Data characters are 6 bits; Cincom's TOTAL data base management system available	Data characters are 6 bits; Cullinane's IDMS and Cincom's TOTAL data base management systems available	Complete system with color graphics; the 8031 features a 13-inch color CRT, the 8051 a 19-inch color CRT, with 192 x 160 graphics; features also include disk BASIC and operating system

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Intelligent Systems 8070/Business	Intelligent Systems 8071/Business	Intelligent Systems 8080/Dev. Sys.	Intelligent Systems 8090	Interdata 6/16
DATA FORMATS					
Word length, bits	8	8	8	8	16 + 1
Fixed-point operand length, bits	8, 16	8, 16	8, 16	8, 16	8, 16, 32
Instruction length, bits	8, 16, 24	8, 16, 24	8, 16, 24	8, 16, 24	16, 32
MAIN STORAGE					
Storage type	MOS	MOS	MOS	MOS	MOS; core
Cycle time, microseconds/word	0.5	0.5	0.5	0.5	0.6, 1.0
Access time, microseconds/word	0.5	0.5	0.5	0.5	—; 0.35
Minimum capacity, words	32K	32K	32K	56K	4K
Maximum capacity, words	64K	64K	64K	64K	32K
Parity checking	No	No	No	No	Optional
Error correction	No	No	No	No	No
Storage protection	No	No	No	No	No
CENTRAL PROCESSOR					
No. of accumulators	1	1	1	1	16
No. of index registers	3	3	3	3	15
No. of directly addressable words	64K	64K	64K	64K	32K
No. of addressing modes	2	2	2	2	3
Control storage	No	No	No	No	ROM
Add time, microseconds	2	2	2	2	0.9, 1.0
Hardware multiply/divide	No	No	No	No	Optional
Hardware floating point	No	No	No	No	No
Hardware byte manipulation	No	No	No	No	Standard
Battery backup	No	No	No	No	Optional
Real-time clock or timer	Standard	Standard	Standard	Standard	Optional
INPUT/OUTPUT CONTROL					
Direct memory access channel	No	No	No	No	Standard
Maximum I/O rate, words/sec.	167K	167K	167K	167K	1M
No. of external interrupt levels	8	8	8	8	1-255
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	80-591K bytes	80-591K bytes	80-591K bytes	80-591K bytes	No
Disk pack/cartridge drives	No	No	No	No	Pack & cartridge; 2.5-1024M bytes
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	No	No	No	No	Cassette, 1 KBS
Magnetic tape, 1/2-inch	No	No	No	No	9-120 KBS
Punched card input	No	No	No	No	400, 1000 cpm
Serial printer	60-180 cps	60-180 cps	60-180 cps	60-180 cps	10-30 cps
Line printer	No	No	No	No	60-600 lpm
Data communications interface	9600 bps	9600 bps	9600 bps	9600 bps	To 9600 bps
CRT	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 48 lines	80 char. x 24 lines
Other standard peripheral units	Light pen	Light pen	Light pen	Light pen	Paper tape units, A/D & D/A converters, graphic display
SOFTWARE					
Assembler	Assembler	Assembler	Assembler	Assembler	Assembler & macro assemblers
Compilers	3 BASIC interp., FORTRAN, COBOL	3 BASIC interp., FORTRAN, COBOL	3 BASIC interp., FORTRAN, COBOL	3 BASIC interp., FORTRAN, COBOL	FORTRAN, BASIC
Operating system	Single-user	Single-user	Single-user	Single-user	Batch, real-time
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$7,000	\$7,500	\$6,500	\$12,000	\$2,900 (4K words)
Price of memory increment	\$500 (8K bytes) \$800 (16K bytes)	\$500 (8K bytes) \$800 (16K bytes)	\$500 (8K bytes) \$800 (16K bytes)	\$500 (8K bytes) \$800 (16K bytes)	\$500 (4K words)
Date of first delivery	—	—	—	—	February 1975
Number installed to date	—	—	—	—	NA
COMMENTS	Complete business system with a 48 line x 80 char. display; includes dual 8-in. floppy disk drives, matrix printer, disk BASIC interpreter, and operating system	Complete business system with a 48 line x 80 char., 13 in. color display; also includes 5-in. mini-floppy disk drive, dual 8-in. floppy disk drives, matrix printer, disk BASIC interpreter, and operating system	Microcomputer development system with 19-in. color display, 8080 assembler, editor and operating system in ROM, dual 5-in. mini-floppy disk drives; EPROM programmer, and matrix printer	System price includes 19-in. color display with medium-resolution graphics, light pen, disk BASIC, assembler, text editor, operating system in ROM, dual 8-in. double-headed floppy disk drives, matrix printer, and PROM/EPROM programmer	Single-board processor with single-board memory as large as 64K bytes; options include turn-key control panel, bootstrap loader, serial I/O port, chassis & power supply

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Interdata 8/16E	Interdata 7/32C	Interdata 8/32C	Interdata 5/16	Jacquard J-100
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 + 1 8, 16, 32 16, 32	32 + 2 32 16, 32, 48	32 + 2 32 16, 32, 48	16 8, 16, 32 16, 32	16 16, 32, 64 16
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	Core 0.75 0.275 16K 131K Optional No Optional	Core 0.75, 1.0 0.4, 0.5 16K 256K Optional No Optional	Core 0.3 0.4 32K 256K Optional No Standard	MOS 0.6 — 4K 32K No No No	Core, MOS 1.5 — 16K 64K No No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	16 15 32K 4 ROM 0.75 Optional Optional Standard NA Optional	32 30 256K 7 ROM; 1792 x 24 bits 1.0 Standard Optional Standard No Optional	32-256 30-240 256K 7 ROM; 1240 x 32 bits 0.4 Standard Optional Standard No Optional	16 15 32K 3 Opt. ROM; to 48K bytes 1.2 Standard No Standard No Standard	4 2 64K 4 No 7 No No No No Standard
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 1.33M 1-255	Standard 500K 1-1023	Standard 1.25M 4-1024	Standard 475K 1-255	Standard 667K 32
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	Yes Pack & cartridge; 2.5-1024M bytes No Cassette; 1 KBS 9-120 KBS 400, 1000 cpm 10-30 cps 60-600 lpm To 9600 bps 80 char. x 24 lines Paper tape units, A/D & D/A convert- ers, graphic display	Yes Pack & cartridge; 2.5-1024M bytes No Cassette; 1 KBS 9-120 KBS 400, 1000 cpm 10-30 cps 60-600 lpm To 9600 bps 80 char. x 24 lines Paper tape units, A/D & D/A convert- ers, graphic display	No Pack & cartridge; 2.5-1024M bytes No Cassette; 1 KBS 9-120 KBS 400, 1000 cpm 10-30 cps 60-600 lpm To 9600 bps 80 char. x 24 lines Paper tape units, A/D & D/A convert- ers, graphic display	Yes No No Cassette; 1 KBS 9-120 KBS 400, 1000 cpm 10-30 cps 60-600 lpm To 9600 bps 80 char. x 24 lines Paper tape units, A/D & D/A convert- ers, graphic display	512K-1M bytes Pack & cartridge; 6-320M bytes No No 10-72 KBS No 30-166 cps 300-900 lpm Up to 9600 bps 80 char. x 24 lines RS-232C interface
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Assembler & macro assembler FORTRAN, BASIC Batch, real-time No No	Assembler & macro assembler FORTRAN V, BASIC, COBOL Batch, real-time No No	Assembler & macro assembler FORTRAN V, BASIC, COBOL Batch, real-time No No	Assembler & macro assembler FORTRAN, BASIC Batch, real-time No No	Yes BASIC, DATA- RITE Time-sharing, multitasking No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$9,330 (16K words) \$2,500 (16K words) October 1977 NA	\$11,695 (16K words) \$6,550 (16K words) July 1974 600+	\$51,900 (32K words) \$19,000 (64K words) June 1975 100+	\$2,100 (4K words) \$600 (4K words) 4th quarter 1976 NA	\$14,900 (16K words) \$2,600 (16K words) August 1975 1,500
COMMENTS	Available options include hardware single & double precision floating-point units, fixed-point multiply/divide		512 words of writable control store optional; features instruction look-ahead; ITAM software provides remote batch terminal emulators	Available as a board-based processor without chassis and peripherals	Sold only in packaged configuration consisting of a 16K-word CPU, dual floppy disk, CRT display/key-board, real-time clock, and all software

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Jacquard J-500	Katcard Systems International KSL System 340	Keronix 16/8	Keronix 16/10	Keronix 16/12
DATA FORMATS					
Word length, bits	16	16	16	16	16
Fixed-point operand length, bits	16	16	16	16	16
Instruction length, bits	16	1-3 words	16	16	16
MAIN STORAGE					
Storage type	MOS	Semiconductor	Core	Core	Core
Cycle time, microseconds/word	0.74	500 AS	0.8	1.0	1.2
Access time, microseconds/word	0.6	500 AS	—	—	—
Minimum capacity, words	16K	32K	8K	8K	8K
Maximum capacity, words	64K	128K	1024K	1024K	1024K
Parity checking	No	Yes	No	No	No
Error correction	No	Yes	No	No	No
Storage protection	No	NA	Optional	Optional	Optional
CENTRAL PROCESSOR					
No. of accumulators	4	16	4	4	4
No. of index registers	2	8	2	2	2
No. of directly addressable words	64K	64K	65K	65K	65K
No. of addressing modes	4	11	8	8	8
Control storage	PROM: 28KB	Yes: 1K bytes	No	No	No
Add time, microseconds	1.6	9.0	NA	NA	NA
Hardware multiply/divide	No	Yes	NA	NA	NA
Hardware floating point	No	Optional	No	No	No
Hardware byte manipulation	No	Optional	No	No	No
Battery backup	No	Yes	No	No	No
Real-time clock or timer	Standard	Yes	Standard	Standard	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Yes	Standard	Standard	Standard
Maximum I/O rate, words/sec.	1M	1, 1M	833K	1M	1.25M
No. of external interrupt levels	16	64	62	62	62
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	512K-4M bytes	Yes	512K-1.3M bytes	512K-1.3M bytes	512K-1.3M bytes
Disk pack/cartridge drives	Pack & cartridge; 3M-48M bytes	Yes	Cartridge & pack; 10M-24M bytes	Cartridge & pack; 10M-24M bytes	Cartridge & pack; 10M-24M bytes
Drum/Fixed-head disk storage	No	Yes	No	No	No
Magnetic tape cassettes/cartridges	No	No	No	No	No
Magnetic tape, 1/2-inch	No	Yes	400 KBS	400 KBS	400 KBS
Punched card input	No	Yes	300-600 cpm	300-600 cpm	300-600 cpm
Serial printer	30-166 cps	Yes	10-330 cps	10-330 cps	10-330 cps
Line printer	300-1200 lpm	Yes	To 600 lpm	To 600 lpm	To 600 lpm
Data communications interface	Up to 9600 bps	Yes	To 19.2K bytes	To 19.2K bytes	To 19.2K bytes
CRT	80 char. x 24 lines	Yes	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines
Other standard peripheral units	Auto dialer program, CRT char. generator	Yes	RS-232C interface, paper tape units, processor-to-processor	RS-232C interface, paper tape units, processor-to-processor	RS-232C interface, paper tape units, processor-to-processor
SOFTWARE					
Assembler	Yes	Yes	Assembler	Assembler	Assembler
Compilers	BASIC, DATA-RITE	COBOL, RPG II, Comm. FORTRAN, Ext. FORTRAN, BASIC MIBS, Time-sharing	BASIC, ASGOL, COBOL	BASIC, ASGOL, COBOL	BASIC, ASGOL, COBOL
Operating system	Time-sharing, multitasking		Multi-user, time-sh., multi-tasking	Multi-user, time-sh., multi-tasking	Multi-user, time-sh., multi-tasking
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$9,200	\$21,000	\$5,000 (8KB)	\$4,200 (8KB)	\$4,200 (8KB)
Price of memory increment	\$1,200 (32K bytes)	\$3,100 (32K bytes)	\$1,750 (8KB)	\$1,500 (8KB)	\$1,500 (8KB)
Date of first delivery	November 1978	January 1978	April 1974	April 1974	April 1974
Number installed to date	NA	2	Over 2000	Over 2000	Over 2000
COMMENTS		Shared logic word processing, legal time accounting, A/R, A/P, gen. lgr., payroll, order/entry, inventory control, work in process, bill of material	The Keronix 16 series is software and I/O compatible with the Data General Nova 1200 series	The Keronix 16 series is software and I/O compatible with the Data General Nova 1200 series	The Keronix 16 series is software and I/O compatible with the Data General Nova 1200 series

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Lockheed LEC 16	Lockheed SUE/System III	MCM Computers MCM/800	MCM Computers MCM/900	Melcom Business Systems Inc. Metcom 80 Series Model 8
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 + 1 8, 16 16	16 8, 16 16, 32	8 + 1 8-64 Variable	8 8-64 Variable	48 + 8 (sign) + 7 12 digits 48
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	Core 1.0 0.5 8K 64K Optional No Optional	Core, MOS 1.8-0.6 0.5, 0.425 16K MOS, 8K core 256K on SUE Optional No No	MOS 1.2 — 4K bytes 16K bytes Standard No No	MOS 0.3 — 8K bytes 24K bytes Standard No No	MOS 0.8 NA 16K bytes 24K bytes Standard No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	1 1 1K 4 No 2.0 Optional No Standard No Standard	7 7 32K 19 ROM: 52 x 36 bits 2.85-3.0 on SUE Optional No Standard No Standard	1 0 16K — ROM, 32K bytes — No Standard Standard Standard No	1 0 24K — ROM; 40K bytes — No Standard Standard No No	3 0 7K bytes 1 ROM; 1.5K bytes 900 (12 digits) Standard No No No No
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 333K 8-64	Standard 1M Variable	No — No	No — None	No 40K bytes 1
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	No No No No No No No 110-9600 bps No —	256K-512K bytes Pack & cartridge; 5.0- (4) 150M bytes No No 80/1600 bpi 285 cps 120, 180 cpm 300, 600 lpm 110-9600 bps 80 char. x 24 lines —	250K-2M bytes No No Cassette, 810 cps No 400 cpm 45 cps No To 1200 bps 80 char. x 24 lines GP interface; pro-grammable RS-232C interface	250K-1M bytes No No No 400 cpm 45-180 cps 300 lpm To 4800 bps 80 char. x 24 lines GP interface; pro-grammable RS-232C interface	486-972K bytes No No No No No 120 cps No 9600 bps 512 (32 x 16) None
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Yes FORTRAN Real-time No No	Macro assembler FORTRAN, RPG II Multi-tasking No No	No No Virtual memory, interactive Fully Fully	No No Virtual memory Fully interpretive Fully	Yes NA NA Fully Fully
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$7,615 (8K words) \$2,475 (4K words) February 1969 Over 2000	\$10,780 (16K MOS) \$3,350 (16K MOS); \$1,950 (8K core) November 1972 Over 2000	\$9,200 (8K bytes) \$1,600 (8K bytes) July 1976 150+	\$9,200 — October 1978 —	\$16,000 NA December 1976 9000+ (all models)
COMMENTS	Formerly known as MAC; sold for OEM usage only; peripherals supplied only on special request	Used as the basis for Lockheed System III business minicomputer system	MSI implementation of MCM/700 CPU; provides 8 to 10 times the performance levels of the MCM/700; features virtual storage capacity of up to 256K bytes using cassette tape or diskette; system price also includes an integral cassette drive, display, keyboard, and RS-232 interface	The MCM/900 CPU is four times faster than the MCM/800 CPU; it features APL firmware and is MCM 800-compatible	

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Melcom Business Systems Inc. Melcom 80 Series Model 38	Microdata Micro-One	Microdata 1600 Series	Modular Computer Systems Classic 7860	Modular Computer Systems Modcomp II
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8 + 1 1-16 digits 16, 32, 48	8-bit byte 8, 16, 24, 32 8, 16, 24, 32	16 8, 16, 24, 32 8, 16, 24, 32	16 8, 16, 32 16, 32, 48, 64	16 + 1 16, 32 16, 32, 48
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 0.75 (2 bytes) NA 32K bytes 192K bytes Standard No Standard	Core, MOS 1.1 0.44 8K 32K No No No	Core 1.0 0.4 4K 32K No No No	Core; MOS 250 250 64K 625 Standard (Core) Standard (MOS) Standard	Core 0.8 0.4: — 16K 64K Standard No Optional
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	2 2 64K bytes 2 ROM; 7.7K bytes 51.0 (5 digits) Standard No Standard Optional Optional	15 Firmware-controlled 32K Firmware-controlled 4K-byte ROM & PROM 6.38 Standard No Standard No Standard	3 1 16K 8 4K-byte ROM & PROM 6.38 Standard No Standard No Standard	16 blocks of 15 16 blocks of 7 64K 9 No 0.2 Standard Standard Standard Optional Standard	15 7 64K 7 No 0.8 Standard Optional Standard No Optional
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 2.35M bytes 7	Optional 1M 2; 128	Optional 1M 2; 128	Standard 4M Up to 128	Standard 1.93M Up to 128
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	243-486K bytes Pack & cartridge; 10-400M bytes No Cassette; 750 bps 20KB/sec.; 40KB/sec. 300, 600 cpm No 110, 600 lpm 9600 bps 2000 char. (80 x 25) None	No Cassette; 10-40M bytes No No 40KBS 200-1000 cpm 165 cps 300-600 lpm To 9600 bps 80 char. x 24 lines Paper tape reader/ punch	No Cartridge; 10-40M bytes No No 40KBS 200-1000 cpm 165 cps 300-600 lpm To 9600 bps 80 char. x 24 lines Paper tape reader/ reader/punch	315-630K bytes Pack & cartridge Fixed-head; 262K-2M bytes No 120 KBS 300-1000 cpm 30-132 cps 300-1000 lpm 50-56K bps 80 char. x 24 lines Printer/plotter, A/D & D/A convert- ers & discrete I/O and memory	315-630K bytes Pack & cartridge; 2.4-168M bytes Fixed-head; 262K-2M bytes No 120 KBS 300, 1000 cpm 30-165 cps 280-600 lpm 50-56K bps 80 char. x 24 lines Printer/plotter, A/D & D/A convert- ers & discrete I/O
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Yes COBOL, RPG, PROGRESS Batch, real-time No No	Yes BASIC No No No	Yes BASIC No No No	Assembler & macro assembler FORTRAN, BASIC, RPG II, COBOL, CORAL Batch, real-time No No	Assembler & macro assembler FORTRAN, BASIC, RPG II, COBOL, CORAL 66, TOTAL Batch, real-time, comm. exec. No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$45,000 (std. config.) NA August 1977 9000+ (all models)	\$3,060 (8K words) \$75 (1K bytes) December 1974 150+	\$5,550 (4K words) \$1,400 (4K words) November 1971 6000+	\$37,000 (128K bytes) \$10,000 (128K bytes) June 1978 NA	\$13,000 (32K words) \$8,000 (32K words) March 1971 Over 2000
COMMENTS		Single-board processor, compatible with Microdata 800 and 1600 computers	1600 Series features stack processing and character string manipulation also available in packaged version called REALITY	First member of Modcomp's Classic multi-word architecture family, which will range both upwards and downwards from the 7860	4-port memory available for multi-processor and I/O processor configurations; high-speed communications processor available

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Modular Computer Systems Modcomp IV	Mylee Digital Sciences 3000	Nanodata QM/1	NCR 299-100	NCR 299-200
DATA FORMATS					
Word length, bits	16 + 1	16	18 + 2	64	64
Fixed-point operand length, bits	16, 32	8-128	Variable	16 digits	16 digits
Instruction length, bits	16, 32, 48	16-48	Variable	Variable	Variable
MAIN STORAGE					
Storage type	Core	MOS	Core	Core	Core
Cycle time, microseconds/word	0.5	0.8	0.75-1.25	7 per bit	7 per bit
Access time, microseconds/word	0.4	—	0.35	—	—
Minimum capacity, words	64K	12K	16K	512 bytes	1K bytes
Maximum capacity, words	1024K	72K	1,024K	1K bytes	2K bytes
Parity checking	Standard	No	Standard	Standard	Standard
Error correction	No	No	Optional	No	No
Storage protection	Standard	No	Optional	No	No
CENTRAL PROCESSOR					
No. of accumulators	16 blocks of 15	4	32	10-50 (in memory)	30-100 (in memory)
No. of index registers	16 blocks of 7	4	32	—	—
No. of directly addressable words	64K	28K	256K	—	—
No. of addressing modes	7	—	Variable	—	—
Control storage	No	ROM	RAM; 40K x 18; 1K x 360	ROM; 12K words	ROM; 12K words
Add time, microseconds	0.56	20	0.75	220 milliseconds	220 milliseconds
Hardware multiply/divide	Standard	Standard	Standard	Standard	Standard
Hardware floating point	Optional	No	Standard	No	No
Hardware byte manipulation	Standard	Standard	Standard	No	No
Battery backup	No	Yes	Optional	No	No
Real-time clock or timer	Standard	No	Optional	No	No
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Optional	No	No
Maximum I/O rate, words/sec.	3.5M	1M	1M	—	—
No. of external interrupt levels	Up to 128	1-18	2,048	None	None
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	315-630K bytes	Yes	No	No	No
Disk pack/cartridge drives	Pack & cartridge; 2.4-168M bytes	Cartridge; 48-96M bytes	Pack & cartridge; 12-60M	No	No
Drum/Fixed-head disk storage	Fixed-head; 262K-2M bytes	No	No	No	No
Magnetic tape cassettes/cartridges	No	No	Cartridge; 2.5M bytes	No	Cassette, 750 cps
Magnetic tape, 1/2-inch	120 KBS	No	200 KBS	No	No
Punched card input	300, 1000 cpm	300 cpm	200-1000 cps	No	No
Serial printer	30-165 cps	165 cps	120 cps	15 cps	15 cps
Line printer	280-600 lpm	300 lpm	600-1250 lpm	No	No
Data communications interface	50-56K bps	9600 bps	Up to 50K bps	No	1200 bps
CRT	80 char. x 24 lines	32 char. x 11 lines	Yes	No	No
Other standard peripheral units	Printer/plotter, A/D & D/A converters & discrete I/O and memory	None	IBM 360 and Univac 1100 compatible channel	Paper tape punch	Paper tape punch, mag. ledger card reader
SOFTWARE					
Assembler	Assembler & macro assembler	No	Assembler and macro assembler	Assembler	Assembler
Compilers	FORTRAN, BASIC, RPG II, COBOL, CORAL 66, TOTAL	ACE	PASCAL, APL/SV, see Comments	No	No
Operating system	Batch, real-time	Real-time	See Comments	No	No
Language implemented in firmware	No	Partially	Yes	Fully	Fully
Operating system implemented in firmware	No	Partially	No	Fully	Fully
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$46,750 (64K words)	\$24,950 (56K bytes)	\$176,000	\$7,250 (512 bytes)	\$9,300 (1K bytes)
Price of memory increment	\$17,400 (64K words)	—	\$4,960 (16K words)	\$325	\$325
Date of first delivery	June 1974	May 1976	1975	November 1974	March 1975
Number installed to date	Over 300	150	14	3000 both types	3000 both types
COMMENTS	Features 32-bit parallel internal operation; 2048 relocating registers and eight map files	System price also includes a CRT (32 x 11 or 24 x 80), 16MB of disk storage, a 165-cps printer, system software, and an inventory control applications package	Emulations offered include IBM 360, 370, 7094; Univac 1106; DEC 11/05-11/40; DG Nova; CDC 160A; Delco 352; RCA 234SCP, UYK-7, -20; and microprocessors; emulation lab software provided; both vertical and horizontal control storage spacing	Replacement for electromechanical accounting machines	Replacement for electromechanical accounting machines

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	NCR 499	NCR Century 50	NCR Century 75	NCR Century 100	NCR Century 101
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 + 1 12 Variable	8 + 1 1-256 digits 32-64	8 + 1 8, 16 32-64	8 + 1 1-256 digits 32-64	8 + 1 1-256 digits 32-64
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	Core 1.2 0.65 12K 32K Standard No No	Thin film 0.80 — 16K bytes 32K bytes Standard No No	Core 1.2 0.65 16K bytes 64K bytes Standard No No	Thin film 0.80 — 16K bytes 32K bytes Standard No No	Core 1.2 0.60 16K bytes 128K bytes Standard No Optional
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	— — — — ROM, 64K words 1.7 milliseconds Standard No No No No	— 63 (in memory) — — No 59 (5 digits) No Standard Standard No No	— 63 (in memory) — — No 25 (5 digits) Optional Standard Standard No Optional	— 63 (in memory) — — No 59 (5 digits) No Standard Standard No No	— 63 (in memory) — — No 28.8 (5 digits) Optional Standard Standard No Optional
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 833K 8	Standard 40K & 108K 2	Standard 120K & 416K 8	Standard 40K & 108K 2	Standard 120K & 416K 9
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	No Cartridge 4.9-9.8M bytes No Cassette, 750 cps No 300 cpm 75, 130 cps 55-300 lpm 300-9600 bps No Paper tape units, mag. ledger card reader	No Pack; 8.4-33.5M bytes No Cassette; 750 cps 10-40 KBS 300-750 cpm 6 cps 125-900 lpm 45-50,000 bps 80 char. x 24 lines Paper tape units; MICR/OCR units	No Cartridge; 4.9-9.8M bytes No No 10-320 KBS 300 cpm 6 cps 200-450 lpm 45-50,000 bps Interface only Paper tape units; MICR/OCR units	No Pack; 8.4-33.5M bytes No Cassette; 750 cps 10-80 KBS 300-1200 cpm 6 cps 450-3000 lpm 45-50,000 bps 80 char. x 24 lines Paper tape units; MICR/OCR units	No Pack; 8.4-381.6M bytes No Cassette; 750 cps 10-320 KBS 300-1200 cpm 6 cps 450-3500 lpm 45-50,000 bps 80 char. x 24 lines Paper tape units; MICR/OCR units
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	NEAT/AM No No No No	No COBOL, BASIC, FORTRAN, NEAT/3 Batch, multipro- gramming No No	No COBOL, BASIC, FORTRAN, RPG, NEAT/3 Batch, multipro- gramming No No	No COBOL, BASIC, FORTRAN, NEAT/3 Batch, multipro- gramming No No	No COBOL, BASIC, FORTRAN, NEAT/3 Batch, multipro- gramming No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$17,900 (12K bytes) \$1,100 (2K bytes) February 1976 4000	\$47,000 (16K bytes) \$3,500 (16K bytes) December 1970 800 (50's and 100's)	\$56,850 (16K bytes) \$5,000 (8K bytes) May 1976 50	\$71,500 (16K bytes) \$3,500 (16K bytes) March 1963 800 (50's & 100's)	\$69,520 (16K bytes) \$5,000 (8K bytes) August 1972 900
COMMENTS	Replacement for NCR 399	System price also in- cludes line printer, 8.4 MB disk drive, and card reader; no longer manufactured; available only in used or used-refurbished units	System price also in- cludes a card reader, line printer, disk drive, TTY and cabinet; can be upgraded to Cen- tury 101	System price also in- cludes line printer, 8.4 MB disk drive, and card reader, no longer manufactured; available only in used or used-refurbished units	System price also in- cludes line printer, 8.4 MB disk drive, and card reader

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	NCR Century 151	NCR 8200	NCR 8130/8150	NCR 8230	NCR 8250
DATA FORMATS					
Word length, bits	8 + 1	16 + 2	16 + 2	16 + 2	16 + 2
Fixed-point operand length, bits	1-256 digits	16	16	16	16
Instruction length, bits	32-64	16, 32, 48	32, 64	16, 32	16, 32
MAIN STORAGE					
Storage type	MOS	Core	MOS	MOS	MOS
Cycle time, microseconds/word	0.75 (1 or 2 bytes)	1.2	0.6	0.8	0.8
Access time, microseconds/word	—	0.65	—	—	—
Minimum capacity, words	64K bytes	32K bytes	48K bytes	64K bytes	64K bytes
Maximum capacity, words	128K bytes	128K bytes	64K bytes	96K bytes	128K bytes
Parity checking	Standard	Standard	Standard	Standard	Standard
Error correction	No	No	No	No	No
Storage protection	Optional	No	Optional	Optional	Optional
CENTRAL PROCESSOR					
No. of accumulators	—	—	None	1	1
No. of index registers	63 (in memory)	27 (in memory)	None	27 (in memory)	27 (in memory)
No. of directly addressable words	—	—	64K	64K words	64K words
No. of addressing modes	—	—	7	7	7
Control storage	No	No	None	No	No
Add time, microseconds	18.0 (5 digits)	24 (8 digits)	—	—	—
Hardware multiply/divide	Standard	Standard	—	Standard	Standard
Hardware floating point	No	No	No	No	No
Hardware byte manipulation	Standard	Standard	Standard	Standard	Standard
Battery backup	No	No	Optional	No	No
Real-time clock or timer	Optional	No	—	No	No
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	120K & 545K	833K	NA	833K	833K
No. of external interrupt levels	9	8	NA	8	8
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	No	No	900K-3.6M bytes	250K-1M bytes	250K-1M bytes
Disk pack/cartridge drives	Pack; 8.4-381.6M bytes	Cartridge; 4.9-39.2M bytes	4.9-39.2M bytes	Cartridge; 4.9-39.2M bytes	Cartridge; 9.8-80M bytes
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	Cassette; 750 cps	Cassette; 750 cps	Cassette; 327K bytes	Cassette; 450K bytes	Cassette; 450K bytes
Magnetic tape, 1/2-inch	10-320 KBS	No	No	10-20 KBS	10-20 KBS
Punched card input	300-1200 cpm	300 cpm	No	300 cpm	300 cpm
Serial printer	6 cps	50, 70, 125 cps	50-125 lpm	173 cps	173 cps
Line printer	450-3500 lpm	See Comments	200 lpm	100-300 lpm	100-300 lpm
Data communications interface	45-50K bps	1200, 9600 bps	—	1200, 9600 bps	1200, 9600 bps
CRT	80 char. x 24 lines	80 char. x 24 lines	32 char. x 16 lines	80 char. x 24 lines	80 char. x 24 lines
Other standard peripheral units	Paper tape units; MICR/OCR units	—	Visual record printer	—	—
SOFTWARE					
Assembler	No	No	No	No	No
Compilers	COBOL, BASIC, FORTRAN, NEAT/3	NEAT/3, COBOL	COBOL	NEAT/3, COBOL	NEAT/3, COBOL
Operating system	Batch, multiprogramming	Batch, multiprogramming	Interactive	Batch, multiprogramming	Batch, multiprogramming
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$119,925 (64K bytes)	Available only used	\$14,065/\$22,960	\$14,755	\$16,775
Price of memory increment	\$20,000 (64K bytes)	—	\$1,800 (16K bytes)	—	—
Date of first delivery	February 1975	September 1974	January 1978	June 1977	March 1977
Number installed to date	300	300-400	NA	NA	NA
COMMENTS		Line printers; 50, 70, and 125 lpm matrix; 200, 300 and 600 lpm band			

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	New England Digital Corp. ABL/20	New England Digital Corp. ABL/40	New England Digital Corp. ABL/60	New England Digital Corp. ABL/80	Olivetti P3030
DATA FORMATS					
Word length, bits	16	16	16	16	16
Fixed-point operand length, bits	16, 32	16, 32	16, 32	16, 32	16
Instruction length, bits	16, 32	16, 32	16, 32	16, 32	16-32
MAIN STORAGE					
Storage type	MOS, BIP	MOS, BIP	MOS, BIP	MOS, BIP	MOS
Cycle time, microseconds/word	0.9 max.; 0.59 avg.	0.9 max.; 0.59 avg.	0.9 max.; 0.59 avg.	0.9 max.; 0.59 avg.	—
Access time, microseconds/word	0.59 avg.	0.59 avg.	0.59 avg.	0.59 avg.	—
Minimum capacity, words	2K	2K	2K	2K	40K bytes
Maximum capacity, words	64K	64K	64K	64K	56K bytes
Parity checking	No	No	No	No	No
Error correction	No	No	No	No	No
Storage protection	No	No	No	No	No
CENTRAL PROCESSOR					
No. of accumulators	4	4	4	4	1
No. of index registers	16	16	16	16	16
No. of directly addressable words	65,536	65,536	65,536	65,536	3500
No. of addressing modes	8	8	8	8	4
Control storage	16 x 256	16 x 256	16 x 256	16 x 256	No
Add time, microseconds	0.25	0.25	0.25	0.25	—
Hardware multiply/divide	No	Optional	Optional	Optional	—
Hardware floating point	No	Optional	Optional	Optional	—
Hardware byte manipulation	Standard	Standard	Standard	Standard	—
Battery backup	No	No	No	No	No
Real-time clock or timer	Standard	Standard	Standard	Standard	No
INPUT/OUTPUT CONTROL					
Direct memory access channel	No	No	No	No	Standard
Maximum I/O rate, words/sec.	2.8M bytes	2.8M bytes	2.8M bytes	2.8M bytes	—
No. of external interrupt levels	12	12	12	12	—
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	90K bytes	180-360K bytes	0.64-2.56M bytes	180-360K bytes	256K-1024K bytes
Disk pack/cartridge drives	No	No	Winchester; 10-160M bytes	Winchester; 10-160M bytes	Cart.; 10-20MB; Nonrem.; 2.5-20MB
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	No	No	Cart.; 192KB/sec.	Cart.; 192KB/sec.	Cassette; 1 KBS
Magnetic tape, 1/2-inch	No	No	60 KB/sec.	60 KB/sec.	800-1600 bpi
Punched card input	No	No	100-600 cpm	30-120 cps	300 cpm
Serial printer	No	30-120 cps	30-275 cps	No	90-175 cps
Line printer	No	No	150-600 lpm	150-600 lpm	300-600 lpm
Data communications interface	Asynch.; 9600 bps	—	—	—	Up to 9600 bps
CRT	1920 char.	1920 char.	1920 char.	1920 char.	80 char. x 24 lines
Other standard peripheral units	None	None	None	None	None
SOFTWARE					
Assembler	Yes	Yes	Yes	Yes	Macro assembler
Compilers	Cross-compiler (XPL)	XPL	XPL, BXPL, S/BASIC	XPL	MINI PL/1, RPG II
Operating system	Partly (Auto-load)	Partly (Auto-load)	Partly (auto-load)	Partly (auto-load)	Interactive, batch
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	—	—	—	—	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$2,895	\$4,650	\$5,700	\$6,000	\$11,000
Price of memory increment	\$327 (2K bytes)	\$750 (8K bytes)	\$750 (8K bytes)	\$750 (8K bytes)	\$850 (8K bytes)
Date of first delivery	March 1976	June 1977	April 1978	April 1976	March 1978
Number installed to date	10	20	—	—	NA
COMMENTS	Basic price also includes single mini-floppy, 4KB memory, RS-232 port	Basic price also includes single mini-floppy, 32KB memory, RS-232 port	Basic price also includes single mini-floppy, 32KB memory, RS-232 port	Basic price also includes 16-channel, 12-bit A/D, 32-bit digital I/O, dual 10-bit DAC, oscilloscope driver, scientific timer, dual mini-floppy disk drives with 32 KB memory, and RS-232 port	—

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Olivetti P6060	Philips P300	Philips P330	Philips P350	Plessey Peripheral Systems Syst-1
DATA FORMATS					
Word length, bits	—	8	8	64	16
Fixed-point operand length, bits	—	Variable	Variable	64	16
Instruction length, bits	—	8, 56	1-8	64	16, 32, or 48
MAIN STORAGE					
Storage type	MOS	Core	Core	Core	MOS or core
Cycle time, microseconds/word	—	1.5	1.5	1.5	0.5
Access time, microseconds/word	—	0.6	0.6	0.6	0.375
Minimum capacity, words	16K bytes	8K bytes	24K bytes	600	4K (MOS); 16K (core)
Maximum capacity, words	48K bytes	16K bytes	32K bytes	1200	32K
Parity checking	No	No	No	No	No
Error correction	No	No	No	No	No
Storage protection	No	No	Standard	No	No
CENTRAL PROCESSOR					
No. of accumulators	—	8	16	Software-assigned	8
No. of index registers	—	8	8	0	8
No. of directly addressable words	—	—	16	1200	32K
No. of addressing modes	—	—	3	—	8
Control storage	—	ROM; 64K x 8 bits	ROM; 64K bits	No	No
Add time, microseconds	—	—	1.2	1.5	3.5
Hardware multiply/divide	—	No	No	Standard	Optional
Hardware floating point	—	No	No	No	No
Hardware byte manipulation	—	Standard	Standard	—	Standard
Battery backup	No	No	No	No	No
Real-time clock or timer	No	No	No	No	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	Optional	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	—	—	—	—	833K
No. of external interrupt levels	—	None	None	None	1
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	256K-512K bytes	1M bytes	2M bytes	No	256-512KB
Disk pack/cartridge drives	Cart.; 10-20 MB; nonrem.; 2.5-20 MB	No	No	Cartridge; 256K-9.2M bytes	2.5-192 MB
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	Cassette; 1 KBS	Cassette; 1 KBS	Cassette; 1 KBS	Cassette; 1 KBS	No
Magnetic tape, 1/2-inch	800-1600 bpi	No	No	No	36-200 KBS
Punched card input	300 cpm	No	No	280 cpm	No
Serial printer	30-175 cps	100 cps	80-100 cps	40 cps	30-180 cps
Line printer	Optional	70 lpm	70 lpm	120-600 lpm	150-600 lpm
Data communications interface	Up to 9600 bps	To 9600 bps; synch.	To 9600 bps; synch.	To 9600 bps; synch.	110-9600 bps
CRT	80 char. x 24 lines	No	80 char. x 24 lines	No	24 char. x 80 lines
Other standard peripheral units	Paper tape reader, paper tape punch	Paper tape punch, card punch, mag. ledger card reader	Card punch	Paper tape units, card punch, mag. ledger card reader	A/D, 16-chan. 12-bit; D/A, 4-output 12-bit
SOFTWARE					
Assembler	No	Yes	Yes	Yes	Yes
Compilers	BASIC	—	PHOCAL	—	DIBOL (DBL), BASIC, FORTRAN
Operating system	Interactive, batch	Transaction	Transaction	Batch (one program)	TSX (time-sharing), RT-11
Language implemented in firmware	Partially	Partially	Partially	No	No
Operating system implemented in firmware	Partially	Partially	Partially	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$9,950	\$7,500 (8K bytes)	\$18,990 (24K bytes)	\$13,500 (600 words)	\$4,590 (64K bytes)
Price of memory increment	\$850 (8K bytes)	\$1,200 (8K bytes)	\$1,500 (8K bytes)	\$6,900 (6 words)	\$1,050 (32K bytes)
Date of first delivery	January 1977	June 1975	July 1977	June 1970	January 1977
Number installed to date	NA	1550	275	2100	300
COMMENTS	Desktop computer features integrated 80-cps/80-col. thermal printer, single floppy disk drive display, 16K user memory, and full typewriter keyboard with BASIC keywords and operating system commands	Asynch. communications speed to 2400 bps	Transaction-oriented business computer with strong emphasis on packaged application software	Asynch. communications speed to 2400 bps	The System-1 series is based on the DEC LSI-11/2 microcomputer; configurations come with all Q BUS and Unibus devices

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Plessey Peripheral Systems Syst-04	Plessey Peripheral Systems Syst-34	Plessey Peripheral Systems PM-1150/5RP	Prime 100	Prime 200
DATA FORMATS					
Word length, bits	16	16	16	16	16 + 2
Fixed-point operand length, bits	16	16	16	16, 32	16, 32
Instruction length, bits	16, 32, or 48	16, 32 or 48	16, 32, or 48	16, 32	16, 32
MAIN STORAGE					
Storage type	MOS or core	MOS or core	MOS or core	MOS	MOS
Cycle time, microseconds/word	0.5	0.5	0.5	1.0	0.750
Access time, microseconds/word	0.375	0.375	0.375	0.680	0.600
Minimum capacity, words	4K (MOS); 16K (core)	4K (MOS); 16K (core)	4K (MOS); 16K (core)	16K bytes	16K bytes
Maximum capacity, words	32K	128K	128K	128K bytes	128K bytes
Parity checking	Optional	Standard	Standard	No	Standard
Error correction	No	No	No	No	No
Storage protection	No	No	No	No	No
CENTRAL PROCESSOR					
No. of accumulators	8	8	8	1	1
No. of index registers	8	8	8	1	1
No. of directly addressable words	32K	32K	32K	64K	64K
No. of addressing modes	8	8	8	4	4
Control storage	No	No	No	No	No
Add time, microseconds	3.17	2.03	2.03	2.44	1.96
Hardware multiply/divide	Optional	Standard	Standard	Optional	Optional
Hardware floating point	No	Optional	Optional	No	Optional
Hardware byte manipulation	Standard	Standard	Standard	Standard	Standard
Battery backup	Optional	Optional	Optional	Optional	Optional
Real-time clock or timer	Optional	Standard	Standard	Optional	Optional
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	2M	2M	2M	694K	1.0M
No. of external interrupt levels	Variable	Variable	Variable	64	64
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	256-512 KB	256-512 KB	256-512 KB	512K-2.0M bytes	5.12K-2.0M bytes
Disk pack/cartridge drives	2.5-2032 MB	2.5-2032 MB	2.5-2032 MB	Pack & cartridge; 12-2400M bytes	Pack & cartridge; 12-2400M bytes
Drum/Fixed-head disk storage	No	No	No	Fixed-head; 512K-1M bytes	Fixed-head; 512K-1M bytes
Magnetic tape cassettes/cartridges	No	No	No	No	No
Magnetic tape, 1/2-inch	36-200 KBS	36-200 KBS	36-200 KBS	To 120 KBS	To 120 KBS
Punched card input	No	No	No	285 cpm	285 cpm
Serial printer	30-180 cps	30-180 cps	30-180 cps	165 cps	165 cps
Line printer	150-600 lpm	150-600 lpm	150-600 lpm	To 1220 lpm	To 1220 lpm
Data communications interface	110-9600 bps	110-9600 bps	110-9600 bps	To 56K bps	To 56K bps
CRT	24 char. x 80 lines	24 char. x 80 lines	24 char. x 80 lines	80 char. x 24 lines	80 char. x 24 lines
Other standard peripheral units	—	—	—	Paper tape, A/D and D/A conv., card reader/punch	Paper tape, A/D and D/A conv., card reader/punch
SOFTWARE					
Assembler	Yes	Yes	Yes	Macro assembler	Macro assembler
Compilers	BASIC, FORTRAN	BASIC, FORTRAN	BASIC, FORTRAN	BASIC, FORTRAN	BASIC, FORTRAN
Operating system	RSX-11M, RT-11	RSX-11M, RSTS/E, RT-11	RT-11, RSX-11M, RSTS/E	Batch, real-time, multi-user	Batch, real-time, multi-user
Language implemented in firmware	No	No	No	Partially	Partially
Operating system implemented in firmware	No	No	No	Partially	Partially
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	Available as systems only	Available as systems only	\$19,500 (32KB)	\$5,500 (16K bytes)	\$6,800 (16K bytes)
Price of memory increment	\$1,385 (32 KB)	\$1,480 (32 KB); \$2,130 (64 KB)	\$1,480 (32 KB); \$2,130 (64 KB)	\$3,400 (16K bytes)	\$3,900 (16K bytes)
Date of first delivery	June 1977	June 1977	November 1976	June 1973	November 1972
Number installed to date	100	350	175	650	300
COMMENTS	The System-04 series is based on the DEC PDP-11/04 minicomputer	The System-34 series is based on the DEC PDP-11/34 minicomputer	The PM-1150/5RP is a ruggedized version of the PDP-11/04 minicomputer		

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Prime 300	Prime 350	Prime 400	Prime 500	Qantel 210
DATA FORMATS					
Word length, bits	16 + 2	16 + 2	16 + 2 or + 6	16 + 2 or + 6	8
Fixed-point operand length, bits	16, 32	16, 32	16, 32	16, 32	—
Instruction length, bits	16, 32	16, 32, 48	16, 32, 48	16, 32, 48	24-48
MAIN STORAGE					
Storage type	MOS	MOS; bipolar	MOS; bipolar cache	MOS; bipolar cache	MOS
Cycle time, microseconds/word	0.750	0.750	0.760	0.760	0.8
Access time, microseconds/word	0.600	0.600	0.600	0.600	—
Minimum capacity, words	16K bytes	64K bytes	128K bytes	256K bytes	48K
Maximum capacity, words	128K bytes	768K bytes	8M bytes	8M bytes	64K
Parity checking	Standard	Standard	Standard	Standard	Standard
Error correction	No	No	Optional	Standard	No
Storage protection	Std., 3 levels	Standard	Std.; 3 levels	Std.; 3 levels	No
CENTRAL PROCESSOR					
No. of accumulators	1	1 (32 bit)	1 (32-bit)	1 (32-bit)	1
No. of index registers	1	2 (32-bit)	2 (32-bit)	2 (32-bit)	0
No. of directly addressable words	64K	64K	64K	64K	64K
No. of addressing modes	4	4	4	4	3
Control storage	PROM; 512 x 64 bits	PROM; 2K x 64 bits	PROM; 2K x 64 bits	PROM; 2K x 64 bits	ROM
Add time, microseconds	1.56	Standard	0.56	0.56	22
Hardware multiply/divide	Standard	Standard	Standard	Standard	No
Hardware floating point	Optional	Standard	Standard	Standard	No
Hardware byte manipulation	Standard	Standard	Standard	Standard	Standard
Battery backup	Optional	—	No	No	No
Real-time clock or timer	Optional	Standard	Standard	Standard	No
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	No
Maximum I/O rate, words/sec.	1.137M	1.2M	1.25M	1.25M	—
No. of external interrupt levels	64	64	64	64	None
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	512K-2.0M bytes	512K-2.0M bytes	512K-2.0M bytes	512-2.0M bytes	1.3-5.2MB
Disk pack/cartridge drives	Pack & cartridge; 12-2400M bytes	Pack & cartridge; 12-2400M bytes	Pack & cartridge; 2.9-1200M bytes	Pack & cartridge; 12-2400M bytes	No
Drum/Fixed-head disk storage	Fixed-head; 512K-1M bytes	Fixed-head; 512K-1M bytes	Fixed-head; 512K-1M bytes	Fixed-head; 512K-1M bytes	No
Magnetic tape cassettes/cartridges	No	No	No	No	No
Magnetic tape, 1/2-inch	To 120 KBS	To 120 KBS	To 120 KBS	To 120 KBS	No
Punched card input	285 cpm	285 cpm	285 cpm	285 cpm	No
Serial printer	165 cps	165 cps	165 cps	165 cps	45-120 cps
Line printer	To 1220 lpm	To 1220 lpm	To 1220 lpm	To 1220 lpm	300 lpm
Data communications interface	To 56K bps	To 56K bps	To 56K bps	To 56K bps	1200 bps
CRT	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	64 char. x 27 lines
Other standard peripheral units	Paper tape, A/D and D/A conv. card reader/punch	Paper tape, A/D and D/A conv. card reader/punch	Paper tape, A/D and D/A conv. card reader/punch	Paper tape, A/D and D/A conv. card reader/punch	None
SOFTWARE					
Assembler	Macro and micro assemblers	Macro assembler	Macro and micro assemblers	Macro and micro assemblers	Yes
Compilers	BASIC, FORTRAN, COBOL, RPG II	BASIC, FORTRAN, COBOL, RPG II	BASIC, FORTRAN, RPG II, COBOL, FORMS	BASIC, FORTRAN, RPG, COBOL, FORMS	QIC (BASIC)
Operating system	Real-time, multi-user, virtual memory	Virtual memory, batch, real-time	Real-time, multi-user, virtual memory	Real-time, multi-user, virtual memory	Time-sharing
Language implemented in firmware	Partially	Partially	Partially	Partially	Partially
Operating system implemented in firmware	Partially	Partially	Partially	Partially	Partially
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$17,600 (16K bytes)	\$35,000 (64KB)	\$65,100 (128K bytes)	\$125,500 (256K bytes)	\$11,950 (system price)
Price of memory increment	\$8,500 (64K bytes)	\$8,500 (64KB); \$31,000 (256KB)	\$8,500 (64K bytes)	\$30,000 (256K bytes)	\$1,450 (16K bytes)
Date of first delivery	September 1973	April 1978	March 1976	March 1976	4th qtr. 1977
Number installed to date	450	50	250	10	Over 2000 (all models)
COMMENTS	Virtual memory management system permits addressing up to 128K bytes per user	Virtual memory management system permits addressing up to 128K bytes per user. Monthly maintenance \$110, system has 90-day warranty	Virtual memory management system permits addressing up to 512M bytes per user. 2K-byte cache memory std.; 2 to 1 memory interleaving std	Virtual memory management system permits addressing up to 512M bytes per user; 2K-byte cache memory std.; 2 to 1 memory interleaving std	Basic system price includes 48K bytes of memory, CRT, and 1.3M-byte disk unit

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Qantel 950	Qantel 960	Qantel 970	Qantel 1400	Qantel 1400-2
DATA FORMATS					
Word length, bits	8	8	8	8	8
Fixed-point operand length, bits	—	—	—	—	—
Instruction length, bits	24-48	24-48	24-48	24-48	24-48
MAIN STORAGE					
Storage type	MOS	MOS	MOS	MOS	MOS
Cycle time, microseconds/word	1.5	1.5	0.8	1.1	1.1
Access time, microseconds/word	—	—	—	—	—
Minimum capacity, words	48K	48K	128K	40K	48K
Maximum capacity, words	48K	64K	256K	128K	128K
Parity checking	Standard	Standard	Standard	Standard	Standard
Error correction	No	No	No	No	No
Storage protection	No	No	No	No	No
CENTRAL PROCESSOR					
No. of accumulators	1	1	1	1	1
No. of index registers	0	0	0	0	0
No. of directly addressable words	48K	64K	256K	128K	128K
No. of addressing modes	3	4	4	4	4
Control storage	ROM	ROM	ROM	ROM	ROM
Add time, microseconds	18	8	4	8	8
Hardware multiply/divide	No	No	Standard	No	No
Hardware floating point	No	No	No	No	No
Hardware byte manipulation	Standard	Standard	Standard	Standard	Standard
Battery backup	No	No	NA	No	No
Real-time clock or timer	Optional	Optional	Optional	Optional	Optional
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	667K	909K	375K	909K	909K
No. of external interrupt levels	1	1	1	1	1
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	1.3-5.2 MB	1.3-5.2 MB	1.3-5.2 MB	1.3-5.2 MB	1.3-5.2 MB
Disk pack/cartridge drives	Cart.; 6-36 MB	Cart.; 6-36 MB	Cart.; 12-36 MB	Cart.; 12-48 MB	Fixed; moving heads; 25-600 MB
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	No	No	No	No	No
Magnetic tape, 1/2-inch	36-72 KBS	36-72 KBS	36-72 KBS	36-72 KBS	36-72 KBS
Punched card input	500 cpm	500 cpm	500 cpm	500 cpm	500 cpm
Serial printer	45-120 cps	45-120 cps	45-120 cps	45-120 cps	45-120 cps
Line printer	300-600 lpm	300-600 lpm	300-600 lpm	300-600 lpm	300-600 lpm
Data communications interface	To 50K bps	To 50K bps	To 50K bps	Up to 50K bps	Up to 50K bps
CRT	64 char. x 27 lines	64 char. x 27 lines	64 char. x 27 lines	64 char. x 27 lines	64 char. x 27 lines
Other standard peripheral units	None	None	None	None	None
SOFTWARE					
Assembler	Yes	Yes	Yes	Yes	Yes
Compilers	QIC (BASIC)	QIC (BASIC)	QIC (BASIC)	QIC (BASIC)	QIC (BASIC)
Operating system	Time-sharing	Time-sharing	Time-sharing	Time-sharing	Time-sharing
Language implemented in firmware	Partially	Partially	Partially	Partially	Partially
Operating system implemented in firmware	Partially	Partially	Partially	Partially	Partially
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$27,900 (system price)	\$27,900 (system price)	\$69,900	\$43,900 (system price)	\$64,900 (system price)
Price of memory increment	\$1,450 (16K bytes)	\$1,450 (8K bytes)	See Comments	\$1,450 (8K bytes)	\$1,450 (8K bytes)
Date of first delivery	1st qtr. 1975	3rd qtr. 1976	Avail. 1st qtr. 1979	2nd qtr. 1977	2nd qtr. 1977
Number installed to date	Over 2000 (all models)	Over 2000 (all models)	Over 2000 (all models)	Over 2000 (all models)	Over 2000 (all models)
COMMENTS	Basic system price includes 48K bytes of memory, CRT, 6-MB disk unit, and 45-cps printer	Basic system price includes 48K bytes of memory, CRT, 6-MB disk unit, and 45-cps printer	Basic system price includes 128K bytes of memory, CRT, 12-MB disk unit, and 50-100-lpm printer; Memory increment prices are \$1,000 for initial purchase of 32 KB; \$2,950 for upgrading an existing system with 32 KB	Basic system price includes 40K memory, 12-MB disk, CRT, and 300-lpm printer	Basic system price includes 48K memory, 25-MB disk, 2 CRTs, and 300-lpm printer

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Qantel 1450	Qantel 1450-2	Randal Link 100	Randal Link 200	Randal Link 500
DATA FORMATS					
Word length, bits	8	8	16	16	16
Fixed-point operand length, bits	—	—	Variable	Variable	Variable
Instruction length, bits	24-48	24-48	16, 32, 48	16, 32, 48	16, 32, 48
MAIN STORAGE					
Storage type	MOS	MOS	MOS	MOS	MOS
Cycle time, microseconds/word	0.8	0.8	0.3	0.3	0.3
Access time, microseconds/word	—	—	0.3	0.3	0.3
Minimum capacity, words	128K	128K	16K	16K bytes	16K
Maximum capacity, words	1024K (1 MB)	1024K (1 MB)	32K	32K bytes	64K
Parity checking	Standard	Standard	No	No	No
Error correction	No	No	No	No	No
Storage protection	No	No	No	No	No
CENTRAL PROCESSOR					
No. of accumulators	1	1	4	4	4
No. of index registers	0	0	2	2	2
No. of directly addressable words	1024K (One MB)	1024K (One MB)	512	512	512
No. of addressing modes	4	4	4	4	4
Control storage	ROM	ROM	ROM; 256 × 64 bits	ROM; 256 × 64 bits	ROM; 256 × 64 bits
Add time, microseconds	4	4	1.2	1.2	1.2
Hardware multiply/divide	Standard	Standard	No	No	No
Hardware floating point	No	No	No	No	No
Hardware byte manipulation	Standard	Standard	No	No	No
Battery backup	—	—	No	No	No
Real-time clock or timer	Optional	Optional	Standard	Standard	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	No	No	Standard	Standard	Standard
Maximum I/O rate, words/sec.	—	—	800K	800K	800K
No. of external interrupt levels	1	1	1	1	1
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	1, 3-5.2 MB	1, 3-5.2 MB	4K-2.4M bytes	400K-6M bytes	4K-2.4M bytes
Disk pack/cartridge drives	Fixed, moving heads; 25-600 MB	Fixed, moving heads; 25-600 MB	Cartridge; 4-40M bytes	Cartridge; 10-40M bytes	Cartridge; 4-40M bytes
Drum/Fixed-head disk storage	No	No	No	No	No
Magnetic tape cassettes/cartridges	No	No	No	No	No
Magnetic tape, 1/2-inch	36-72 KBS	36-72 KBS	10-72 KBS	10-72 KBS	10-72 KBS
Punched card input	500 cpm	500 cpm	450 cpm	450 cpm	450 cpm
Serial printer	45-120 cps	45-120 cps	30-180 cps	30-180 cps	30-180 cps
Line printer	300-600 lpm	300-600 lpm	300 lpm	300 lpm	300 lpm
Data communications interface	Up to 50K bps	Up to 50K bps	9600 bps	Up to 9600 bps	9600 bps
CRT	64 char. × 27 lines	64 char. × 27 lines	84 char. × 24 lines	84 char. × 12 lines	84 char. × 24 lines
Other standard peripheral units	None	None	—	—	—
SOFTWARE					
Assembler	Yes	Yes	No	No	No
Compilers	QIC (BASIC)	QIC (BASIC)	No	No	No
Operating system	Time-sharing	Time-sharing	Time-sharing	Time-sharing	Time-sharing
Language implemented in firmware	Partially	Partially	No	No	No
Operating system implemented in firmware	Partially	Partially	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$44,900	\$69,900	\$12,750	\$12,750 (16K bytes)	\$45,900
Price of memory increment	\$2,950 (52K bytes)	See Comments	\$1,900 (16K bytes)	\$1,900 (16K bytes)	\$2,950 (32K bytes)
Date of first delivery	1st qtr. 1979	1st qtr. 1979	October 1975	August 1976	October 1977
Number installed to date	—	—	225	225	3
COMMENTS					
	Basic system price includes 128K bytes of memory, 2 CRT's, 12-MB disk, and 300-lpm printer	Basic system price includes 128K bytes of memory, 2 CRT's, 25-MB sealed disk unit, 1600-bpi tape drive, and 300-lpm printer; memory increment prices are the same as for Qantel 970 system	Sold as packaged business system only; includes hard-copy terminal and 630K-byte diskette drive	Available only in packaged business system; price also includes CRT and 10-megabyte disk drive	Sold as packaged business system only; includes 180-cps printer, CRT, 50M-byte disk drive, and 1.2M-byte floppy drive

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Raytheon RDS-500	Raytheon RDS-5000	RoIm 1602A (AN/UYP-19)	RoIm 1603A (AN/UYP-12)	RoIm 1606 (AN/UYP-19)
DATA FORMATS					
Word length, bits	16 + 2	16 + 2	16	16	16
Fixed-point operand length, bits	16	16	16, 32	16	16, 32
Instruction length, bits	16, 32	16, 32	16, 32	16, 32	16, 32, 48
MAIN STORAGE					
Storage type	Core or MOS	Core or MOS	Core	Core	Core
Cycle time, microseconds/word	0.700	0.700	1.0	1.0	1.0
Access time, microseconds/word	0.450	0.450	0.5	0.6	0.5
Minimum capacity, words	16K	64K	16K	16K	16K
Maximum capacity, words	64K	448K	64K	32K	1024K
Parity checking	Standard	Standard	No	No	No
Error correction	Standard (MOS)	Standard (MOS)	No	No	No
Storage protection	Standard	Standard	No	No	Standard
CENTRAL PROCESSOR					
No. of accumulators	8 G.P. registers	8 G.P. registers	4	4	4
No. of index registers	8 G.P. registers	8 G.P. registers	2	2	2
No. of directly addressable words	64K	64K	64K	32K	64K
No. of addressing modes	2	3	5	6	6
Control storage	No	No	ROM; 1K x 56 bits	—	ROM; 4K x 36 bits
Add time, microseconds	1.4	1.4	1.0	5.9	1.0
Hardware multiply/divide	Standard	Standard	Standard	Optional	Standard
Hardware floating point	Optional	Optional	Standard	Optional	No
Hardware byte manipulation	Standard	Standard	Standard	Standard	Standard
Battery backup	Optional	Optional	No	No	No
Real-time clock or timer	Optional	Standard	Optional	Optional	Optional
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	2M	14M	666K	768K	1M
No. of external interrupt levels	16	16/112	16	16	16
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	No	No	Yes	Yes	0.6-1.2M bytes
Disk pack/cartridge drives	Cartridge & pack; 2.5-920 bytes	Pack, 8 drives; 60-2000M bytes	Cartridge; 5-10M bytes	Cartridge; 5-10M bytes	Cartridge & Pack; 5-160M bytes
Drum/Fixed-head disk storage	Fixed-head; 770K-25.2M bytes	No	Fixed-head; 2M bytes	Fixed-head; 2M bytes	Fixed-head; 0.5-4M bytes
Magnetic tape cassettes/cartridges	Cassette	Cassette	No	No	No
Magnetic tape, 1/2-inch	30-468 KBS	8 drives; 468 KBS	60 KBS	60 KBS	60 KBS
Punched card input	300, 1000 cpm	300, 1000 cpm	300 cpm	300 cpm	300 cpm
Serial printer	10-165 cps	10-165 cps	60 cps	60 cps	60 cps
Line printer	300-1250 lpm	300-1250 lpm	1100 lpm	1100 lpm	1100 lpm
Data communications interface	To 19.2K bps	To 19.2 bps	20K bps	20K bps	20K bps
CRT	80 char. x 24 lines	1920 characters	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines
Other standard peripheral units	Apollo Array Processor, plotters, A, D and D/A converters	A/D converters, plot- ters, array processor, bulk memory	Paper tape units D/A & A/D con- verters, NTDS 1533	Paper tape units, D/A & A/D con- verters	Paper tape units, D/A & A/D con- verters, NTDS 1533
SOFTWARE					
Assembler	Macro assembler	Macro assembler	Assembler & macro assembler	Assembler & macro assembler	Assembler & macro assembler
Compilers	FORTRAN	FORTRAN	ALGOL, BASIC, FORTRAN	ALGOL, BASIC, FORTRAN	ALGOL, BASIC, FORTRAN
Operating system	Batch, real-time multiprogramming	Multiprocessing	Batch, real-time	Batch, real-time	Batch, real-time
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$15,800 (32K words)	\$18,300 (32KB)	\$25,250 (16K words)	\$13,400 (16K words)	\$43,900
Price of memory increment	\$3,750 (16K words)	\$3,750 (16 KW)	\$7,000 (16K words)	\$6,000 (16K words)	\$7,000 (16 KW)
Date of first delivery	February 1973	1977	1977	1976	1978
Number installed to date	Over 750	NA	Approx. 500	90	100
COMMENTS	Apollo Array Processor can perform 22 special- ized array opera- tions	Multiprocessing system	Qualified to Mil-E-5400 & Mil-E-16400 specif.; ATR chassis; micro- programmed militarized CPU	Qualified to Mil-E-5400 & Mil-E-16400 specif.; ATR chassis; low- priced, faster version of previously offered Model 1603; Model compatible with DG Nova	Qualified to Mil-E 16400; system used on Navy DPEWS (AN/SLO-32); same as 1666 except for floating-point capability

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Roim 1650 (AN/UJK-19)	Roim 1664 (AN/UJK-19)	Roim 1666 (AN/UJK-19)	Systems Approach Ltd. IM/70	Systems Approach Ltd. IM/70 Designer's Workbench
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	16 16, 32 16, 32	16 16, 32 16, 32, 48	16 16, 32 16, 32, 48	16 8, 16 8, 16	16 8, 16 8, 16
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	Core 1.0 0.5 16K 32K No No Optional	Core 1.0 0.5 16K 64K No No Optional	Core 1.0 0.5 16K 1024K No No Standard	MOS, core 0.6/1.2 1K 32K NA No No	MOS, core 0.6/1.2 1K 32K NA No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	4 2 32K 5 PROM; 1K x 52 bits 1.05 Standard Optional Standard No Optional	12 2 64K 6 ROM; 4K x 32 bits 1.0 Standard Standard Standard No Optional	4 2 64K 6 ROM; 4K x 36 bits 1.0 Standard No Standard No Optional	1 1 512 x 256 12 ROM; 256 words 5.4 Standard No Standard No Standard	1 1 512 x 256 12 ROM; 256 words 5.4 Standard No Standard No Standard
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 666K 16	Standard 1M 16	Standard 1M 16	Standard 1.7M 3	Standard 1.7M 3
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	Yes Cartridge; 5-10M bytes Fixed-head; 2M bytes NA 60 KBS 300 cpm 60 cps 1100 lpm 20K bps 80 char. x 24 lines Paper tape units, D/A & A/D units, NTDS, 1533	Yes Cartridge; 5-10M bytes Fixed-head; 2M bytes No 60 KBS 300 cpm 60 cps 1100 lpm 20K bps 80 char. x 24 lines Paper tape units, D/A & A/D con- verters	Yes; 0.6-1.2 MB Pack & Cartridge; 5-160M bytes Fixed-head, 0.5-4.0M bytes No 60 KBS 300 cpm 60 cps 1100 lpm 20K bps 80 char. x 24 lines Paper tape units, D/A & A/D con- verters, NTDS, 1533	4 x 0.33 M bytes 4 x 40M bytes No No 1,100 cpm No 7,900 lpm 12, up to 19.2K bps NA OMR card reader	4 x 0.33 M bytes 4 x 40M bytes No No No 1 1,300-900 lpm Yes Yes Graphics terminal
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Assembler & macro assembler ALGOL, BASIC, FORTRAN Batch, real-time No No	Assembler & macro assembler ALGOL, BASIC, FORTRAN Batch, real-time No No	Assembler & macro assembler ALGOL, BASIC, FORTRAN Batch, real-time No No	No FORTRAN, BASIC, PASCAL Time-sharing No No	No GRAPPLE Interactive No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$26,250 (16K words) \$7,000 (16K words) 1976 NA	\$39,450 (16K words) \$7,000 (16K words) 1976 100	\$48,900 \$7,000 (16K words) 1977 40	\$19,145 \$5,845 (32K bytes) 3rd qtr. 1975 30	\$19,145 \$5,845 (32K bytes) 3rd qtr. 1975 16
COMMENTS	Designed to meet Mil-E-5400 & Mil-E-16400 specif., half ATR version of Roim 1602-A	Designed to meet Mil-E-5400 & Mil-E-16400 specif., ATR chassis; tri-proc- essor militarized computer, upward- compatible with other Roim com- puters	Qualified to Mil-E-5400 & Mil-E-16400; Std. 64K-bit floating-point arithmetic, std memory mgmt. for up to 10 words; com- plete protection and security features	Features include simultaneous RJE communications to 3 mainframes; RJE concurrent with multi-user WILBUR program develop- ment, batch submis- sion capability from a local or remote user CRT terminal; prices are Canadian	The Designer's Work bench is a low-cost, stand-alone graphics minicomputer suited to interactive design and drafting; prices are Canadian

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Systems Engineering Laboratories 32/35	Systems Engineering Laboratories 32/55	Systems Engineering Laboratories 32/75	Tandem Computers T16/1102	Tandem Computers T16/1403
DATA FORMATS					
Word length, bits	32 + 4	32 + 4	32 + 4	16 + 1	16 + 1
Fixed-point operand length, bits	16, 32	16, 32	16, 32	8, 16, 32, 48	8, 16, 32, 48
Instruction length, bits	16, 32	16, 32	16, 32	16	16
MAIN STORAGE					
Storage type	Core	Core	Core	Core	MOS
Cycle time, microseconds/word	0.9	0.6	0.6/0.9	0.8	0.5
Access time, microseconds/word	0.45	0.3	0.3/0.45	0.5	0.5
Minimum capacity, words	16K	8K	32K	32K	32K
Maximum capacity, words	128K	256K	4M	256K	256K
Parity checking	Standard	Standard	Standard	Standard	No
Error correction	No	No	No	No	Standard
Storage protection	Standard	Standard	Standard	Standard	Standard
CENTRAL PROCESSOR					
No. of accumulators	8	8	8	8	8
No. of index registers	3	3	3	3	3
No. of directly addressable words	128K	128K	128K	128K	128K
No. of addressing modes	4	4	4	5	5
Control storage	PROM; 2K × 48 bits	PROM; 4K × 48 bits	ROM	PROM; 4K × 32 bits	PROM; 4K × 32 bits
Add time, microseconds	1.8	1.2	1.2/1.8	0.5	0.5
Hardware multiply/divide	Standard	Standard	Standard	Standard	Standard
Hardware floating point	Standard	Standard	Standard	Optional	Optional
Hardware byte manipulation	Standard	Standard	Standard	Standard	Standard
Battery backup	No	No	No	No	Standard
Real-time clock or timer	Standard	Standard	Standard	Standard	Standard
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	6.67M	6.67M	6.67M	NA	NA
No. of external interrupt levels	6-112	6-112	6-112	16	16
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	No	No	No	No	No
Disk pack/cartridge drives	Pack & cartridge; 5-1200M bytes	Pack & cartridge; 5-1200M bytes	Pack & cartridge; 5-1200M bytes	Pack & cartridge; 10M-24M bytes	Pack & cartridge; 10M-24M bytes
Drum/Fixed-head disk storage	Fixed-head; 1-8M bytes	Fixed-head; 1-8M bytes	Fixed-head; 1-8M bytes	No	No
Magnetic tape cassettes/cartridges	No	No	No	No	No
Magnetic tape, 1/2-inch	72-120 KBS	72-120 KBS	72-120 KBS	36-120 KBS	36-120 KBS
Punched card input	300-1000 cpm	300-1000 cpm	400-1000 cpm	600 cpm	600 cpm
Serial printer	No	No	No	Yes	Yes
Line printer	125-600 lpm	125-600 lpm	125-600 lpm	300-1500 lpm	300-1500 lpm
Data communications interface	50K bps; synch.	50K bps; synch.	50K bps; synch.	50-80K bps	50-80K bps
CRT	80 char. × 24 lines	80 char. × 24 lines	80 char. × 24 lines	80 char. × 24 lines	80 char. × 24 lines
Other standard peripheral units	Card punch, TTY, A/D, D/A equip.	Card punch, TTY, A/D, D/A equip.	Paper tape equip.	None	None
SOFTWARE					
Assembler	Assembler & macro assembler	Assembler & macro assembler	Assembler & macro assembler	Assembler, macro assembler	Assembler, macro assembler
Compilers	FORTRAN IV, BASIC, COBOL	FORTRAN IV, BASIC, COBOL	BASIC, FORTRAN, COBOL	COBOL, TAL, FORTRAN	COBOL, TAL, FORTRAN
Operating system	Real-time	Real-time	Real-time	Multiprocessing, multiprog., virt. mem.	Multiprocessing, multiprog., virt. mem.
Language implemented in firmware	No	No	No	Partially	Partially
Operating system implemented in firmware	No	No	No	Partially	Partially
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$27,000	\$49,000	\$72,300	\$20,400	\$22,000
Price of memory increment	\$13,000 (128K bytes)	\$21,000 (128K bytes)	\$8,500 (128K bytes)	\$8,000 (64K bytes)	\$9,600 (96K bytes with ECC)
Date of first delivery	August 1976	October 1975	January 1978	May 1976	May 1976
Number installed to date	10	250	—	206 processors	206 processors
COMMENTS	Asynch. communications to 9600 bps; instruction look-ahead utilized	Asynch. communications to 9600 bps	600 and 800-nanosecond memory; minimum configuration is CPU with 32K words of memory, real-time clock, control panel, power supplies, cabinet, chassis, tie controller	Multiprocessor system containing from 2 to 16 CPU's for fault-tolerance; all system components are dual-ported; CPU's have dual buses	Multiprocessor system containing from 2 to 16 CPU's for fault-tolerance; all system components are dual-ported; CPU's have dual buses

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Tektronix 4051	Texas Instruments 960B	Texas Instruments 980B	Texas Instruments 990/4	Texas Instruments 990/10
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8-bit byte 8 8, 16, 24	16 + 6 8, 16 32	16 + 6 8, 16 16, 32, 48	16 + 1 8, 16 16, 32, 48	16 + 1 or + 16 8, 16 16, 32, 48
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 1.2 0.45 8K bytes 32K bytes No No No	MOS 0.75 — 8K 64K No Standard Standard	MOS 0.75 — 8K 64K No Standard Standard	MOS 0.65 — 1K 32K Optional No Optional	MOS 0.65 — 8K 1024K Standard Optional Optional
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	2 1 32K 7 ROM; 32K-156K bytes 2.0 No No Standard No No	16 16 64K 15 ROM; 256 × 16 bits 3.6 Optional No No Optional Optional	2 1 64K 15 ROM; 256 × 16 bits 1.75 Standard No Standard Optional Optional	Unlimited (memory) Unlimited (memory) 64K 8 ROM 4.7 Standard No Standard — Standard	Unlimited (memory) Unlimited (memory) 32K 8 No 3.6 Standard No Standard — Standard
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Optional 3.5K No	Standard 1.3M 3-2048	Standard 1M 4-32	No 1.5M 8 vectored interrupts	Standard 3M 16 vectored interrupts
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	630K-1.9M bytes No No 300K bytes each No No 60, 180 cps No 2400asyn.; 9600sync. 72 char. × 35 lines Plotters, RS-232C printer interface, CRT hard-copy unit, graphic joystick	No Cartridge & pack; 2.28-392M bytes No Cassette; 120 cps 30 KBS 300 cpm 30-330 cps No 110-9600 bps 80 char. × 24 lines Process control inter- faces, A/D & D/A converters	No Cartridge & pack; 2.28-392M bytes No Cassette; 120 cps 30 KBS 300 cpm 30-330 cps No 110-9600 bps 80 char. × 24 lines Paper tape units	242-968K bytes No No Cassette; 120 cps No 400 cpm 30-150 cps 300-600 lpm 75-9600 bps 80 char. × 24 lines PROM programmer	242-968K bytes Cartridge; 3-200M bytes No Cassette; 120 cps 30-60 KBS 400 cpm 30-150 cps 300-600 lpm 75-9600 bps 80 char. × 24 lines PROM programmer
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	No No Single-user, real-time Fully Fully	Assembler & macro preprocessor FORTRAN No No	Assembler & macro preprocessor FORTRAN, BASIC No No	Yes FORTRAN Real-time, multi-task No No	Assembler & macro assembler FORTRAN, BASIC, COBOL, PASCAL, RPG II Real-time, multi-task No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$5,995 (8K bytes) \$1,400 (8K bytes) December 1975 NA	\$4,500 (8K words) \$1,400 (8K words) May 1974 NA	\$5,150 (8K words) \$1,400 (8K words) May 1974 NA	\$1,525 (256 words) \$575 (4K words) March 1976 NA	\$3,450 (8K words) \$900 (8K words); \$1,500 (8K ERCC) March 1976 NA
COMMENTS	Based on Motorola/AMI 6800; processor is transparent to user since all programming is in extended BASIC; extensions in BASIC include device-independent key words for I/O, polling and interrupt handling on built-in IEEE interface bus	Heavily supported for process control applications		Based on TI's TMS9900 16-bit microprocessor	MSI implementation of 990/4 CPU with enhancements; can have up to 16 disk controllers per CPU 2M bytes with memory mapping

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Univac BC/7 600	Univac BC/7 700	Univac BC/7 800	Univac V73	Univac V76
DATA FORMATS					
Word length, bits	8	8	8	16 + 2	16 + 2
Fixed-point operand length, bits	8	8	8	16 (8, 32 opt.)	8, 16, 32
Instruction length, bits	8, 16, 24	8, 16, 24	8, 16, 24	16, 32	16, 32
MAIN STORAGE					
Storage type	MOS	MOS	MOS	Core; MOS	MOS
Cycle time, microseconds/word	1.0	1.0	1.0	0.66; 0.33	0.66
Access time, microseconds/word	0.5	0.5	0.5	—	—
Minimum capacity, words	48K bytes	48K bytes	128K bytes	8K	16K
Maximum capacity, words	64K bytes	64K bytes	128K bytes	256K	1024K
Parity checking	Standard	Standard	Standard	Optional	Optional
Error correction	No	No	No	No	No
Storage protection	No	No	No	Standard	Standard
CENTRAL PROCESSOR					
No. of accumulators	1	1	1	3	8
No. of index registers	6	6	6	1	7
No. of directly addressable words	64K bytes	64K bytes	64K bytes	2K	2K
No. of addressing modes	3	3	3	8	8
Control storage	4K bytes	4K bytes	4K bytes	WCS; 4K × 64 bits	WCS; 4K × 64 bits
Add time, microseconds	106 (5 digits)	106 (5 digits)	106 (5 digits)	1.32; 0.66	1.32
Hardware multiply/divide	—	—	—	Standard	Standard
Hardware floating point	—	—	—	Optional	Optional
Hardware byte manipulation	Standard	Standard	Standard	Optional	Standard
Battery backup	No	No	No	Optional	Optional
Real-time clock or timer	Standard	Standard	Standard	Standard	Optional
INPUT/OUTPUT CONTROL					
Direct memory access channel	Standard	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	1M bytes	1M bytes	1M bytes	1M	1M
No. of external interrupt levels	5	5	5	8-64	8-64
PERIPHERAL EQUIPMENT					
Floppy disk (diskette) drives	2M-6M bytes	2M-6M bytes	2M-6M bytes	No	No
Disk pack/cartridge drives	No	Cartridge; 5M-40M bytes	Cartridge; 10M-40M bytes	Cartridge & pack; 2.34-373.6M bytes	Cartridge & pack; 2.34-373.6M bytes
Drum/Fixed-head disk storage	No	No	No	Fixed-head; 123-492K bytes	Fixed-head; 123-492K bytes
Magnetic tape cassettes/cartridges	No	No	No	No	No
Magnetic tape, 1/2-inch	No	20, 40 KBS	20, 40 KBS	20, 30 KBS	20, 30 KBS
Punched card input	300-600 cpm	300-600 cpm	300-600 cpm	300 cpm	300 cpm
Serial printer	200 cps	200 cps	200 cps	10, 165 cps	10, 165 cps
Line printer	125 lpm	125-600 lpm	125-600 lpm	300-2000 lpm	300-2000 lpm
Data communications interface	9600 bps	9600 bps	9600 bps	To 50K bps	To 50K bps
CRT	80 char. × 24 lines	80 char. × 24 lines	80 char. × 24 lines	80 char. × 24 lines	80 char. × 24 lines
Other standard peripheral units	Punched card reader	Punched card reader	Punched card reader	Status line of printer/plotters; A/D & D/A converters	Status line of printer/plotters; A/D & D/A converters
SOFTWARE					
Assembler	No	No	No	Macro assembler & micro assembler	Macro assembler & micro assembler
Compilers	RPG II, ESCORT	RPG II, ESCORT	RPG II, ESCORT	FORTRAN, BASIC, COBOL, RPG	FORTRAN, BASIC, COBOL, RPG
Operating system	Interactive, batch	Interactive, batch	Interactive, batch	Batch, real-time, multi-task	Batch, real-time, multi-task
Language implemented in firmware	No	No	No	No	No
Operating system implemented in firmware	No	No	No	No	No
PRICING & AVAILABILITY					
Price of CPU, power supply, front panel and min. mem. in chassis	\$21,795 (48K bytes)	\$31,200 (48K bytes)	\$35,475 (128K bytes)	\$15,530 (8K words)	\$8,400 (16K words)
Price of memory increment	\$1,100 (16K bytes)	\$1,100 (16K bytes)	\$1,100 (16K bytes)	\$5,000 (8K MOS); \$3,500 (8K core)	\$2,900 (16K words)
Date of first delivery	April 1977	April 1977	July 1978	November 1972	January 1976
Number installed to date	NA	NA	NA	NA	NA
COMMENTS					
	System price includes CRT workstation, dual diskette drives, 200-cps printer, and I/O controllers	System price includes CRT workstation, 5-megabyte disk drive, 200-cps printer, and I/O controllers	System price includes CRT workstation, 10-megabyte disk drive, 200-cps printer, and I/O controllers	Dual-ported memories; odd/even interleaving for core memories standard; TOTAL data base management system available	Dual-ported memories; optional 1K-word cache memory; TOTAL data base management system available

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Univac V77-200	Univac V77-400	Univac V77-600	Univac 9200 & 9300
DATA FORMATS				
Word length, bits	16	16	16	8-bit byte
Fixed-point operand length, bits	16	16	16	1, 32
Instruction length, bits	16, 32	16, 32	16, 32	16, 32, 48
MAIN STORAGE				
Storage type	MOS	MOS	MOS	Plated wire
Cycle time, microseconds/word	0.66	0.66	0.66	1.2, 0.6
Access time, microseconds/word	0.56	0.56	0.56	—
Minimum capacity, words	8K	8K	16K	8K bytes
Maximum capacity, words	32K	1024K	1024K	32K bytes
Parity checking	Optional	Optional	Optional	Standard
Error correction	No	No	No	No
Storage protection	Optional	Std., with mega map	Standard	No
CENTRAL PROCESSOR				
No. of accumulators	2	8	8	8
No. of index registers	2	7	7	8
No. of directly addressable words	32K	32K	2048	—
No. of addressing modes	8	8	8	—
Control storage	ROM; 512 x 24	ROM	WCS, 4K x 64 bits	No
Add time, microseconds	2.31	2.64	0.66-2.15	40.8; 20.4 (16 bits)
Hardware multiply/divide	Standard	Standard	Standard	See Comments
Hardware floating point	No	Optional	Optional	No
Hardware byte manipulation	Standard	Standard	Standard	Standard
Battery backup	Optional, 1.5 hrs.	Optional, 8 hrs.	Optional	No
Real-time clock or timer	Standard	Standard	Standard	No
INPUT/OUTPUT CONTROL				
Direct memory access channel	Standard	Standard	Standard	Optional
Maximum I/O rate, words/sec.	319K	1.5M	1.51M	312K
No. of external interrupt levels	8-64	8-64	8-64	—
PERIPHERAL EQUIPMENT				
Floppy disk (diskette) drives	No	No	No	No
Disk pack/cartridge drives	Cartridge & pack, 2.34-312M bytes	Cartridge & pack; 2.34-1031M bytes	Cartridge & pack, 515.6 words Fixed-head, 246K words	Pack & cartridge, 3.2-1860M bytes
Drum/Fixed-head disk storage	No	No	No	No
Magnetic tape cassettes/cartridges	No	No	No	No
Magnetic tape, 1/2-inch	135 KBS	135 KBS	20, 30 KBS	34, 68 KBS
Punched card input	300 cpm	300 cpm	300 cpm	400-1000 cpm
Serial printer	165 cps	165 cps	165 cps	30 cps
Line printer	300/600 lpm	300/600 lpm	300/600 lpm	250-2000 lpm
Data communications interface	50K bytes	50K bytes	50K bytes	To 250K bytes
CRT	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	—
Other standard peripheral units	Consult mfr.	Consult mfr.	Paper tape units, plotters	Paper tape reader punch, card punch
SOFTWARE				
Assembler	Assembler, macro assembler	Assembler, macro assembler	Macro assembler & micro assembler	Yes
Compilers	FORTRAN IV, BASIC, RPG II	FORTRAN IV, BASIC, COBOL, RPG II	FORTRAN, BASIC COBOL, RPG	COBOL, FORTRAN, RPG
Operating system	Batch, real-time	Batch, real-time	Batch, real-time, multi-tasking	Batch real-time timesharing
Language implemented in firmware	No	No	No	No
Operating system implemented in firmware	No	No	No	No
PRICING & AVAILABILITY				
Price of CPU, power supply, front panel and min. mem. in chassis	\$5,350 (8K words)	\$7,850 (8K words)	\$13,950 (16K words)	\$34,176 (8K-9200) \$57,120 (8K-9300)
Price of memory increment	\$1350 (8K words)	\$1,350 (8K words)	\$2,900 (16K words)	\$13,008 (4K-9200) \$15,120 (4K-9300)
Date of first delivery	NA	NA	December 1976	3rd quarter 1966
Number installed to date	NA	NA	NA	NA
COMMENTS				Multiply & divide are optional on 9200 & 9300 card system, and standard on all others, no longer being manufactured

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Univac 90/25	Univac 90/30	Univac 90/40	Wang PCS-II
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8-bit 1-32 16, 32, 48	8-bit byte 1-32 16, 32, 48	8-bit byte 1-32 16, 32, 48	8-bit byte 8 8
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 0.65 — 64K bytes 163K bytes Standard No Optional	MOS 0.6 (2-byte fetch) — 64K bytes 524K bytes Standard No Optional	MOS 0.5 (2-byte fetch) — 512K bytes 1024K bytes Standard No Optional	MOS 1.6 — 8K bytes 32K bytes No No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage	16 16 — — ROM; 1K x 32 bits	16 16 — — ROM; 1K x 82 bits	16 16 — — ROM; 1K x 82 bits	NA NA — — ROM; 425K bytes
Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	7.8 (32 bits) Standard Optional Standard No Standard	5.4 (32 bits) Standard Optional Standard No Standard	4.1 (32 bits) Standard Optional Standard No Standard	800 Standard Standard Standard No Optional
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	Standard 760K bytes 6	Standard 1.8M 6	Standard 1.8M 6	No 10K None
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	972K Pack, cartridge; 33-116M bytes No No 40 KBS 300 cpm 30 cps 300-500 lpm 50K bps 64 char. x 16 lines Paper tape, card punch	972K bytes Pack, 33-3200M bytes No No 5-320 KBS 300-1000 cpm 70-160 cps 300-2000 lpm To 50K bps 64 char. x 16 lines Paper tape reader/ punch, card punch	972K bytes Pack, 33-3200M bytes No No 5-320 KBS 300-1000 cpm 70-160 cps 300-2000 lpm To 50K bps 64 char. x 16 lines Paper tape reader/ punch, card punch	89-178K bytes No No Cassette 326 bps No 300 cpm 200 cps 600 lpm To 9600 bps 64 char. x 16 lines Plotter
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	Assembler & macro assembler COBOL, FORTRAN, RPG II, BASIC Batch, real-time No Partially	Yes COBOL, FORTRAN, RPG II Batch, real-time, time-sharing No Partially	Yes COBOL, FORTRAN, RPG II Batch, real-time, time-sharing No Partially	No BASIC Interactive Fully Partially
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$66,096 \$14,256 (32K bytes) July 1977 NA	\$82,728 (65KB) \$10,800 (32KB) January 1975 Over 2000	\$304,272 (512KB) \$34,560 (131KB) NA NA	\$6,200 (8K bytes) \$1,700 (8K bytes) March 1977 NA
COMMENTS	Smallest member of Univac Series 90 family	System price also includes integrated peripheral channel, interval timers, CRT keyboard, and Univac 9200/9300 & IBM 360/20 com- patibility	Features full compatibility with the Univac 90/30 plus an internal performance increase of about 33 percent	Portable computer weighing 62 lbs.

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Wang 2200 VP/MVP	Wang 2200S/2200T	Wang 2200VS	Warrex Centurion I/IA
DATA FORMATS Word length, bits Fixed-point operand length, bits Instruction length, bits	8-bit byte 8 8	8-bit byte 8 8	32 32 Variable	8+1 8, 16 8, 16, 24
MAIN STORAGE Storage type Cycle time, microseconds/word Access time, microseconds/word Minimum capacity, words Maximum capacity, words Parity checking Error correction Storage protection	MOS 0.6 — 16K bytes 64K bytes No No No	MOS 1.6 — 4K bytes 32K bytes No No No	MOS 0.66 — 64K bytes 512K bytes Standard Standard Standard	MOS 0.8 — 32K 64K Optional No No
CENTRAL PROCESSOR No. of accumulators No. of index registers No. of directly addressable words No. of addressing modes Control storage Add time, microseconds Hardware multiply/divide Hardware floating point Hardware byte manipulation Battery backup Real-time clock or timer	— — — — ROM; 48K words 13 Standard Standard Standard No Optional	32; not user-access 32; not user-access — — ROM; 42.5K words 800 Standard Standard Standard No No	— 32 512K bytes — — — — — No Optional	128 16 256 7 No 3.6 (16 bits) No No Standard No Standard
INPUT/OUTPUT CONTROL Direct memory access channel Maximum I/O rate, words/sec. No. of external interrupt levels	No 100K None	No 10K None	Standard — 5	Standard 600K 16
PERIPHERAL EQUIPMENT Floppy disk (diskette) drives Disk pack/cartridge drives Drum/Fixed-head disk storage Magnetic tape cassettes/cartridges Magnetic tape, 1/2-inch Punched card input Serial printer Line printer Data communications interface CRT Other standard peripheral units	262-786K bytes Cartridge; 1.5-20M bytes No Cassette; 326 bps 10 KBS 300 cpm 200 cps 600 lpm To 9600 bps 64 char. x 16 lines Paper tape reader, paper tape punch, card punch, plotter	262-786K bytes Cartridge; 1.2-20M bytes No Cassette; 326 bps 10 KBS 300 cpm 200 cps 250 lpm To 9600 bps 64 char. x 16 lines Paper tape reader, paper tape punch, card punch, plotter	315.4K bytes 2,304M bytes No No 120 KBS No 30, 120, 200 cps 300,600 lpm To 9600 bps 80 char. x 16 lines None	Standard No No No No 300 cps 125-600 lpm Optional 80 char. x 24 lines None
SOFTWARE Assembler Compilers Operating system Language implemented in firmware Operating system implemented in firmware	No BASIC Interactive Fully Partially	No BASIC Interactive Fully Partially	Yes BASIC, COBOL, RPG II Interactive Fully Partially	Yes None Multi-tasking No No
PRICING & AVAILABILITY Price of CPU, power supply, front panel and min. mem. in chassis Price of memory increment Date of first delivery Number installed to date	\$9,000 (16K bytes) \$3,000 (16K bytes) November 1977 NA	\$4,000 (4K bytes) \$2,000 (8K bytes) February 1975 NA	\$25,000 \$6,000 December 1977 NA	\$14,900 \$20,000 \$1,250 NA NA
COMMENTS		Also available in packaged systems WCS-20 & WCS-30		

Minicomputers — Basic Characteristics

MANUFACTURER & MODEL	Warrex Centurion IIA	Warrex Centurion IIB/III	Warrex Centurion VI	Westinghouse 2500
DATA FORMATS				
Word length, bits	8 + 1	8 + 1	8 + 1	16
Fixed-point operand length, bits	8, 16	8, 16	4, 8	16, 32
Instruction length, bits	8, 16, 24	8, 16, 24	4, 8, 16	16, 32
MAIN STORAGE				
Storage type	MOS	MOS	MOS	Core
Cycle time, microseconds/word	0.8	0.8	0.6	0.75; 0.95
Access time, microseconds/word	—	—	—	0.33; 0.35
Minimum capacity, words	32K	32K	32K	8K
Maximum capacity, words	60K	60K	252K	1M
Parity checking	Optional	Optional	Optional	Standard
Error correction	No	No	Standard	No
Storage protection	No	No	No	Optional
CENTRAL PROCESSOR				
No. of accumulators	128	128	128	1
No. of index registers	16	16	16	2
No. of directly addressable words	256	256	256	256
No. of addressing modes	7	7	7	14
Control storage	No	No	No	PROM, 1K words
Add time, microseconds	3.6 (16 bits)	3.6 (16 bits)	2.2	1.7
Hardware multiply/divide	No	No	No	Standard
Hardware floating point	No	No	No	Standard
Hardware byte manipulation	Standard	Standard	Standard	No
Battery backup	No	No	No	No
Real-time clock or timer	Standard	Standard	Standard	Optional
INPUT/OUTPUT CONTROL				
Direct memory access channel	Standard	Standard	Standard	Standard
Maximum I/O rate, words/sec.	600K	600K	600K	1M
No. of external interrupt levels	16	16	16	4-128
PERIPHERAL EQUIPMENT				
Floppy disk (diskette) drives	Standard	Optional	Optional	250-1000K bytes
Disk pack/cartridge drives	Pack, 10.4-41.6M bytes	Cartridge 10.4-41.6M bytes	Cartridge; 10.4-77.6M bytes	Pack & cartridge; 2.4-67M bytes
Drum/Fixed-head disk storage	No	No	No	Fixed-head; 128K-2M bytes
Magnetic tape cassettes/cartridges	No	No	No	No
Magnetic tape, 1/2-inch	No	No	No	20, 40 KBS
Punched card input	No	300 cpm	300 cpm	300, 600 cpm
Serial printer	175 cps	175 cps	Optional	10, 30 cps
Line printer	125-600 lpm	125-600 lpm	125-600 lpm	300, 700 lpm
Data communications interface	Optional	Optional	Optional	9600 bps; synch.
CRT	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines	80 char. x 24 lines
Other standard peripheral units	None	None	None	Paper tape units, plotter, D/A & A/D, converters, process I/O
SOFTWARE				
Assembler	Yes	Yes	Yes	Assembler & macro assembler
Compilers	None	None	No	FORTRAN, BASIC, RPG
Operating system	Multi-tasking	Multi-tasking	Multi-tasking	Batch, real-time
Language implemented in firmware	No	No	No	No
Operating system implemented in firmware	No	No	No	No
PRICING & AVAILABILITY				
Price of CPU, power supply, front panel and min. mem. in chassis	\$30,000	\$36,000/\$40,000	—	\$14,700 (32K words)
Price of memory increment	\$1,250	\$1,250	—	\$3,500 (8K words); \$8,000 (32K words)
Date of first delivery	NA	NA	1st qtr. 1978	June 1971
Number installed to date	NA	NA	NA	750
COMMENTS				Virtual addressing used with 1M-word memory; multiple CPU's with shared memory up to 4M words; asynchronous com- munications speeds to 1800 bps; energy mgmt. and computer numerical control packages also avail- able

