

# All About Plug-Compatible Mainframes

In the nearly six years since Amdahl Corporation installed its first 470V/6 system, the plug-compatible mainframe (PCM) has grown to a multi-billion-dollar-a-year business. The primary thrust of the PCM has been a cost-effective alternative to the IBM System/370, 303X Series, and the 4300 Series computers. In that area, as well as in the areas of performance and compatibility, the industry has been an unqualified success. It certainly appears the PCM manufacturers have laid to rest most doubting Thomases in the industry.

Plug-compatible mainframes can be installed easily, can replace or augment IBM mainframes with little or no need for changes in software or operating procedures, and can be expected to perform reliably and efficiently. What's more, most of the PCM suppliers have demonstrated their ability to provide first-class field maintenance and software support.

Should your organization install a PCM? And if so, which one? This report is designed to help you answer those questions by assessing the pros and cons of PCM's in general, profiling their current suppliers, and presenting the characteristics of 38 PCM's from 8 vendors in detailed comparison charts.

## The PCM Concept

Plug-compatible mainframes are typically defined as computer mainframes that can directly execute all application programs and systems software written for the IBM System/370, 303X Series, and/or 4300 Series computers and can utilize the peripheral equipment available for these computers. The PCM concept would,

To help you evaluate the many important aspects of installing a plug-compatible mainframe, Datapro has provided comparison charts of 38 systems from 8 manufacturers. We've also investigated the impact of using a PCM, and profiled all the current PCM suppliers.

of course, be equally applicable to the computers made by Burroughs, Honeywell, Univac, or any other mainframe supplier. IBM, with its large user base, attracts the most serious attention from the PCM vendors. Only one manufacturer, Telefile Computer Products (Irvine, CA), has developed a system compatible with a non-IBM product line. Its T-85 is compatible with the Xerox Sigma family of systems.

The PCM industry resulted from the convergence of two important trends:

- The widespread availability and user acceptance of plug-compatible peripherals designed to directly replace IBM's own magnetic tape units, disk storage units, printers, terminals, and even main memory units. From there, the next logical step was to offer replacements for the IBM central processors themselves.
- The acknowledgement that the IBM System/360 and System/370 instruction set has become a de facto standard for the industry, and that most IBM computer users will not seriously consider switching to a computer that requires extensive reprogramming. A ➤



Plug-compatible mainframes directly execute all applications programs and systems software written for the IBM System/370, 303X Series, and/or 4300 Series computers. A leading manufacturer and supplier of PCMs is Magnuson Systems, whose M80 product line competes with the IBM 4300 Series. The basic M80 system, shown here, contains a central processor with up to 2 million bytes of main storage and 6 channels. The systems can be expanded to up to 16 million bytes of storage and 16 channels.

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▷ number of systems were developed in the 60's by RCA and Univac which used the System/360 instruction set but were incompatible with systems software and peripherals. The next logical step, which was first taken by Amdahl Corporation, was to build computers which exhibited total functional compatibility with the IBM mainframes and could use all the same software and peripheral equipment.

To date, Amdahl, and a host of others, have proven the viability of the PCM concept, and it appears the industry will play an important role in the 1980's.

The current trend in the PCM industry is to target a family of systems toward a specific IBM product line, rather than be all things to all users. For example, Amdahl Corporation pits its 470 and recently announced 580 Series against IBM's high-end systems, the System/370 and 303X Series, and the new 3081 (the first of the H-Series), respectively. Firms like Cambex and Magnuson compete with IBM's popular 4300 Series. Storage Technology Corporation, a maker of plug-compatible peripherals, has announced its intention to enter the PCM market to compete in the large mainframe arena. A new company, Acsys, formed recently by Amdahl founder Gene Amdahl, intends to develop systems to compete in the H-Series range. With high technology costs and the costs associated with maintenance and software support to consider, it is eminently more practical for a manufacturer to concentrate on a particular IBM product line. The various manufacturers and their product lines appear to bear this out.

### User Reaction

Four PCM manufacturers—Amdahl, Control Data, Magnuson, and NAS—were represented in Datapro's 1980 survey of computers. We received a total of 44 responses from Amdahl users, representing all four major product lines. Next was NAS, with 37 responses, followed by Control Data's Omega 480 with 7 responses, and Magnuson's M80 series, with 3 responses.

For comparison we've also included the weighted averages of the IBM system families the PCMs compete with, the System/370 (732 responses), 4300 (49 responses), and the 303X (213 responses).

Using Datapro's 14 rating criteria and our usual scale of 4.0 for Excellent, 3.0 for Good, 2.0 for Fair, and 1.0 for Poor, we've compiled the weighted average ratings these users have assigned to their systems, and present the results in the chart below.

As you can see, the user ratings earned by the PCM vendors once again compared favorably with those of IBM in all 14 categories. The PCM vendors were rated comparable to or above IBM in key categories like overall satisfaction, ease of conversion, technical support, and both responsiveness and effectiveness of maintenance service. Equipment reliability was essentially a stand-off between IBM and the PCM's, with all the parties earning high ratings. Thus, it seems clear that a wisely chosen PCM can yield worthwhile cost savings without imposing offsetting penalties in any of the other areas that help to determine overall user satisfaction.

### PCM Pros and Cons

The first and foremost advantage of plug-compatible mainframes is, of course, the prospect of substantial *increases in processing power per dollar*. The user can elect to realize this price/performance gain in either of two distinct ways: 1) by choosing a PCM that delivers performance comparable to that of a certain IBM mainframe but is offered at a lower price; or 2) by choosing a PCM that has a price tag comparable to that of a certain IBM mainframe but offers more processing power. The PCM vendors tend to position their product offerings so that users can elect either approach or, in some cases, a combination of the two (i.e., somewhat more power at a somewhat lower cost).

*Faster delivery* is another advantage that the PCM vendors will enjoy over IBM for at least another year or so. The slow delivery schedule of IBM's 4300 and 303X systems have generated many sales opportunities for the PCM vendors, who typically can ship a system 30 to 60 days ARO. This situation is gradually diminishing, however, especially in the very large system arena. IBM's 3081 processor, the first in the H-Series, is scheduled for shipment late in 1981. Of its two announced competitors, the NAS AS/9000 is scheduled for a late-1980 first delivery, and the Amdahl 580 Model 5860 is slated for April, 1982. The tide is gradually turning.

	<u>Amdahl</u>	<u>CDC</u>	<u>Magnuson</u>	<u>NAS</u>	<u>IBM S/370</u>	<u>IBM 4300</u>	<u>IBM 303X</u>
Ease of operation	3.6	3.5	4.0	3.6	3.2	3.5	3.0
Reliability of Mainframe	3.7	2.7	3.3	3.3	3.4	3.4	3.3
Reliability of Peripherals	3.1	2.5	3.0	2.7	3.1	3.2	3.2
Responsiveness of maintenance service	3.5	3.5	4.0	3.3	3.0	3.3	3.3
Effectiveness of maintenance service	3.4	2.5	3.7	3.1	2.8	3.1	3.1
Technical support:							
Trouble-shooting	3.1	2.2	3.7	2.9	2.6	3.0	3.0
Education	2.8	2.3	3.7	2.7	2.8	2.6	2.8
Documentation	2.9	2.2	3.7	2.8	2.8	2.7	2.8
Operating system	3.1	3.0	3.5	3.3	3.1	3.4	2.9
Compilers and assemblers	3.2	3.0	3.5	3.3	3.2	3.5	3.2
Applications programs	3.0	3.0	3.5	2.8	2.8	2.8	2.8
Ease of programming	3.4	3.2	3.5	3.2	3.0	3.1	3.0
Ease of conversion	3.5	3.2	3.5	3.4	2.9	3.4	3.0
Overall satisfaction	3.6	2.8	3.5	3.2	3.1	3.1	3.1



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➤ Becoming a *multiple-vendor shop* can be viewed as either an advantage or disadvantage of installing a PCM. Some users are still "true-blue" IBM loyalists, who fear that their IBM service will deteriorate and every hardware problem will result in a nasty "finger-pointing" session if they allow any non-IBM equipment into their shops. Conversely, other users are convinced that dealing with multiple vendors helps to "keep IBM honest" and leads to better overall service and support.

Three potential disadvantages are commonly cited by prospective PCM users: the possibility of hardware or software incompatibilities, the possibility of weak vendor support, and the possibility that their PCM vendor may not survive. Each of these problems can be minimized through careful selection of a well-qualified vendor.

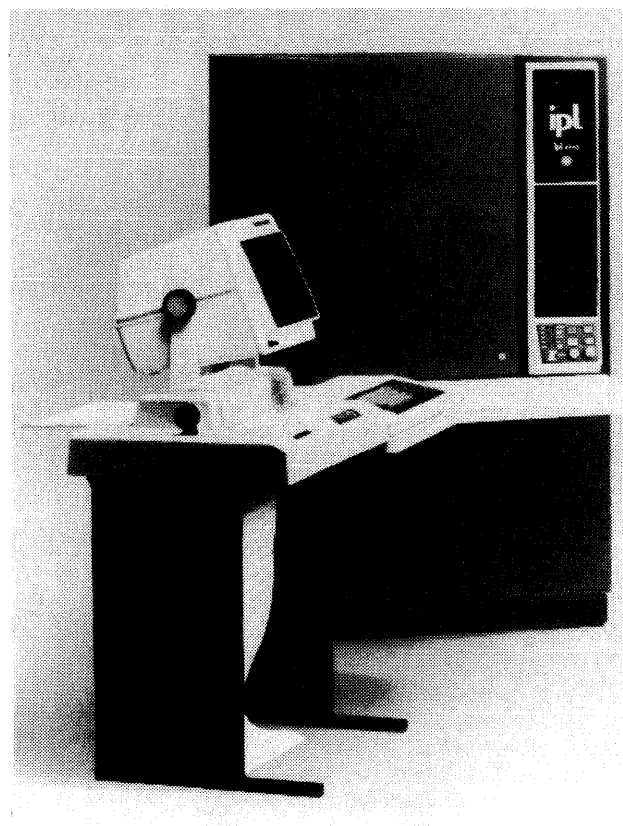
*Incompatibilities* in hardware or software were widely feared by early PCM users, but Datapro's user surveys have clearly shown that users who choose to deal with well-established PCM suppliers such as Amdahl or Control Data need have no fears. What's more, most PCM manufacturers have demonstrated their ability to develop the specialized hardware and/or software needed to maintain full compatibility when IBM adds new functions to its systems. Conversely, a user who decides to deal with a newer PCM vendor should demand proof (in the form of a rigorous benchmark test) and/or an iron-clad guarantee that the new mainframe will be totally compatible with his IBM equipment, systems software, and application programs.

*Poor vendor support* is another frequently expressed worry of prospective PCM users. Once again our user survey results make it clear that Amdahl, Control Data, Magnuson, and NAS have all established viable field service and support organizations whose effects are often judged to be superior to those of IBM. As always, it's up to the buyer to determine the amount of service and support he needs and is willing to pay for, and then to select a PCM vendor that can and will provide it.

*Vendor survival* has always been a topic of concern to PCM buyers, and the PCMs' long-term survival will depend upon their continued ability to maintain full compatibility together with a worthwhile price/performance advantage over the steadily improving mainframes that IBM will undoubtedly offer.

### The PCM Suppliers

*Amdahl Corporation*, which was formed in 1971 and delivered its first computer in June 1975, is the leading supplier (in terms of dollar volume) of IBM-compatible mainframes, with several hundred installations nationwide. The firm's software development efforts have resulted in significant improvements over comparable



IPL Systems has been making PCMs since 1977, and the systems have been marketed worldwide by such firms as Control Data and Olivetti. In late 1980, IPL announced its own end-user family of PCMs, the 4400 Series. The product line, which includes the IPL 4436, 4443 (shown here), and 4446, compete with the IBM 4300 Series, have memory sizes ranging from one to eight megabytes, and include from three to six channels.

IBM products. Amdahl also offers its Universal Time-Sharing System (UTS), which is based on the Unix operating system developed by Bell Laboratories.

Amdahl focuses on the upper end of IBM's mainframe product line and has developed advanced technology that enables its computers to deliver more performance per dollar than the comparable IBM models. The current Amdahl processor line ranges from the 470V/7 family which is comparable in performance to the IBM 3032 and 3033 uniprocessors, to the 470V/8, which is comparable to the dual-processor IBM 3033MP. Amdahl has also recently announced its largest systems, the 580 Series, with both single- and dual-processor models. They will be targeted at IBM's 3081, as well as future IBM offerings in that size range.

*Cambex Corporation*, formerly Cambridge Memories, Inc., is best known as a supplier of add-on memory for IBM System/360 and System/370 computers and for various minicomputers. Cambex entered the PCM market in 1977 with replacements for the System/370 Model 115 ➤

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▷ and 125, but the firm is now concentrating its attention on the IBM 4300 Series. The current product line consists of three models, the 1636, 1641, and 1651, that bracket the 4300 product line.

*Control Data Corporation* is the only established mainframe manufacturer that offers a line of IBM-compatible processors in addition to its own proprietary computer systems. CDC became the third major contender in the PCM market when it introduced its Omega family of System/370-compatible mainframes in June 1977. The present three models, the 480-I, 480-II, and 480-III, are made by IPL Systems. The 480-I and -II bracket the IBM 4331-2 in performance, and the larger 480-III exceeds both the IBM 3031 and 4341-2 in performance.

*IPL Systems, Inc.*, a seven-year-old firm, was formed by Stephen J. Ippolito to build IBM 360/370-compatible processors. The first IPL systems were shipped in April 1977 as the Control Data Omega 480 Series. Today IPL systems are still sold by CDC and by Olivetti in Europe. With an installed base of over 170 systems, IPL decided to market its own products in the U.S. In October, 1980, IPL announced three systems to compete against the IBM 4300; the IPL 4436, 4443, and 4446. The systems all offer improved price/performance over their IBM counterparts, the 4331-2, 4341-1, and 4341-2, respectively.

*Magnuson Systems Corporation* has become a key PCM supplier with an excellent reputation, as indicated in our surveys. Users continually sing the praises of their M80 systems. Magnuson's "Strategic Architecture" permits easy field upgrading of the processor, memory, and I/O channels, as well as rapid adaptation to maintain compatibility with new IBM functions or features. The current product line consists of the M80/31 and M80/32,

available now, which bracket the IBM 4331-2. Magnuson's three higher-level models, the M80/42, M80/43, and M80/44, compete with both the IBM 4341-1 and 4341-2. The M80/31 and M80/32 are fully field upgradable to the higher models simply by changing circuit boards. As the M80/42, 43, and 44 will not be delivered until the third quarter of 1981, Magnuson recommends a user obtain a smaller M80 and simply upgrade to the larger system once it becomes available.

*Time Sharing Resources*, a remote computing service vendor headquartered in Great Neck, New York, plans to market the MEGA I, a 370/138-class processor manufactured by Two Pi Company, Inc. The company is emphasizing its "Offsite" approach to on-line computing, which is based on clusters of the Mega computers located at its headquarters. A cluster would typically consist of six computers. Five of these would be owned or leased by MegaSystems customers and dedicated to their applications. The sixth computer would be a backup machine capable of being switched into service in the event of a malfunction in any of the others.

*Nanodata Corporation*, established in 1971, started out as a manufacturer of "universal emulators" that can be programmed to emulate the instruction set of the IBM System/370 or any other mainframe. In fact, a Nanodata QM-I system could concurrently execute a mix of programs written for IBM, Honeywell, Burroughs, and other computers. The systems employ a modular, multiple-bus, multiple-processor architecture that is said to provide great flexibility, easy expandability, and insurance against obsolescence. Carrying this expertise one step further, Nanodata introduced a line of three IBM-compatible processors, the QMX 6300 Series, in May, 1980. The QMX 6333, QMX 6336, and QMX 6343 are all more powerful than the IBM 4331-1, 4331-2, and 4341-1, respectively. The systems are based upon a flexible multibus architecture and feature three specialized ▷



The original PCM supplier, Amdahl, has a large family of systems that range in performance from the IBM System/370 Model 168-3 to IBM's recently announced 3081 large-scale processor. Amdahl's 470 Series (the 470V/6-II is shown here) is now complemented by the new high-performance 580 Series, with execution speeds in the range of 13 to 22 MIPS (million instructions per second).

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- processors: one or more Execution Processors, one or more Auxiliary Processors (for system support and I/O functions), and a Service Processor to monitor performance and handle system diagnostics.

*National Advanced Systems Corporation (NAS)* is the wholly owned subsidiary of National Semiconductor Corporation that was formed in October, 1979 to take over nearly all of Intel Corporation's IBM-compatible mainframe business. NAS took over Intel's worldwide computer activities, acquired Intel's inventory of computers, and assumed the maintenance and support responsibilities for all of Intel's installed computer base, including those systems manufactured by Hitachi, Ltd.

The company's current product lines, the AS/3000, AS/5000, AS/7000, and AS/9000 range in performance from the IBM 4341-1 up through the recently announced 3081, the first of the H-Series. All of the systems are made by NAS, except for the AS/9000, which is made by Hitachi. A number of AS/9000s have been installed, beating the IBM 3081 to the punch by a full year. The firm's AS/5000 Series can also support IBM's high-speed disk systems, the 3370, 3375, and 3380 in the data streaming mode.

### The Comparison Charts

The principal characteristics of 38 processors that are plug-compatible with the IBM System/370 computers are presented in the accompanying comparison charts. The entries for each model are spread across two facing pages to maximize the amount of useful information in the charts. All information in the charts was furnished by the eight vendors whose products are represented.

The entries on the left-hand pages of the comparison charts and their significance are explained in the following paragraphs:

*Model* refers to the product number as known in the equipment price book or list of the vendor or manufacturer.

*Machine check handling* analyzes errors and attempts recovery by retrying the failed instruction if possible. If retry is unsuccessful, it attempts to correct the malfunction or to isolate the affected task.

*Multiple bus architecture* implies that the various segments of the processor (namely, memory, arithmetic and logic, central control, etc.) are tied together by more than one central bus.

*Storage protection* determines the right of access to main storage by matching a protection key associated with a store or fetch reference to main storage with a storage key associated with each block of main storage.

The *time-of-day-clock* is incremented once every microsecond and provides a consistent measure of elapsed time suitable for the indication of data and time.

Some channels have the capability to perform *channel command retry*, a channel and control-unit procedure that causes a command to be retried without requiring an I/O interruption.

*Date of introduction* indicates when the processor was first announced to the public in the U.S.

*Production status* indicates whether the processor is now in new production or being sold from returned and refurbished stocks.

*Operating systems* indicates the IBM monitoring software that will run on the processor. All operating systems that apply to a particular processor are specified.

*Virtual storage capability* defines the presence of a hardware/software feature enabling the user to access and utilize memory space without regard to its existence in real main memory or auxiliary memory space.

The *Clock comparator* is a hardware feature that causes an interruption when the time-of-day equals or exceeds the value specified by a program or virtual machine.

The *CPU timer* measures the elapsed processing unit time and causes an interruption when a previously specified amount of time has elapsed.

*Control registers* are used for operating systems control of relocation, priority interruption, program event recording, error recovery, and masking operations.


*CPU one-level addressing* is a synonym for direct addressing, where the instruction contains the actual address of the data being requested.

A *doubleword buffer* consists of a 64-bit area temporarily reserved for data used in performing an I/O operation.

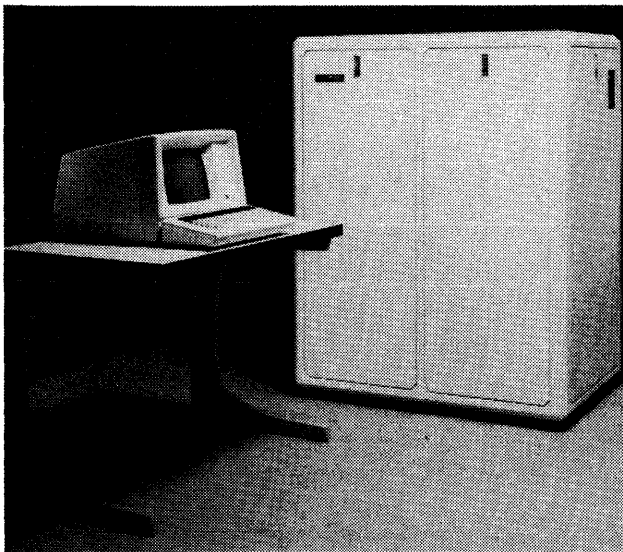
The *interval timer* is a 32-bit decremental counter that is reduced by one several hundred times per second. The timer generates an interrupt when the contained value is decremented from a positive to a negative number.

*Channel indirect addressing (CIA)* is a companion feature to dynamic address translation, providing data addresses for I/O operations. CIA permits a single channel command word to control the transmission of data that crosses noncontiguous pages in real main storage. If CIA is not indicated, then channel one-level (direct) addressing is employed.

The *byte oriented operand feature* permits storage operands of most non-privileged operations to appear on any byte boundary. Instructions must appear on even byte boundaries. The feature does not pertain to instruction addresses.

The *extended precision floating point* feature provides instructions to handle floating point numbers with a fraction of 28 hexadecimal digits. The characteristic is 

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Nanodata Corporation has used its expertise gained from the development of "universal emulator" systems to develop its QMX6300 family of processors. The three systems, the QMX6333, 6336 (shown here), and 6343, compete with IBM's 4300 Series. The QMX6300 Series uses a flexible multiple-bus architecture and three specialized processors: the Execution Processor, Auxiliary Processor, and the Service Processor. The systems have from 512K to 4 million bytes of main storage and from 2 to 8 channels.

▷ seven bits plus sign in short and extended floating point numbers.

The *high speed floating point feature* provides a means for improved execution of the floating point instruction set.

The *System/370 Universal Instruction set* is composed of storage protection, standard instruction set, decimal arithmetic, extended precision, dynamic address translation, and instructions to facilitate programming and reduce execution times for record blocking and unblocking.

The *console audible alarm* is a device activated when predetermined events occur that require operator attention or intervention for system operation.

The *integrated console printer* is an integral part of the system console, furnishing hard copy output from the console display.

A *light pen* is a photosensitive stylus used to detect and identify elements displayed on the console CRT.

A *remote console* is a console attached to a system through a data link. The remote console is configured in addition to the standard console.

The *remote data link* allows establishment of communications with a technical data center to remotely diagnose system malfunctions.

The *console file* is the basic microprogram loading device for the system, containing a read-only file device. The

medium read by this device contains all the microcode for field engineering device diagnostics, basic system features, and any optional system features.

The *CPU activity monitor* can be either hardware or software. It provides a measure of CPU utilization by various hardware or software elements.

The *extended control mode (EC)* is a mode in which all features of the System/370 computing system, including dynamic address translation, are operational.

*Program event recording* is a hardware feature used to assist in debugging programs by detecting and recording program events.

The *virtual machine assist* feature provides an assist to VM/370 firmware emulation of certain privileged operations. The feature causes a reduction in real supervisor time used by VM/370 to control the operation of virtual storage operating system such as DOS/VS and OS/VS1.

*1401/1440/1460 compatibility* provides the system with the ability to execute 1401/1440/1460 instructions under specific conditions of minimum and matching configurations.

Under *other features and comments* any additional information that may help to give you a feel for the distinctive attributes of each unit is included.

The right-hand pages of the charts compare Processor Performance, I/O Channels, Control Storage, Pricing, and Availability, and identify the manufacturer and vendor of each processor. These entries should all be self-explanatory.

### Manufacturers/Vendors

*Amdahl Corporation*  
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Sunnyvale, California 94086  
Telephone (408) 746-6000

*Cambex Corporation*  
360 Second Avenue  
Waltham, Massachusetts 02154  
Telephone (617) 890-6000

*Control Data Corporation*  
P.O. Box 0  
Minneapolis, Minnesota 55440  
Telephone (612) 853-8100

*IPL Systems Inc.*  
360 Second Avenue  
Waltham, Massachusetts 02154  
Telephone (617) 890-6620



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► *Magnuson Systems Corporation*  
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San Jose, California 95134  
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*Time Sharing Resources*  
777 Northern Boulevard  
Great Neck, New York 11021  
Telephone (212) 895-7880

*Nanodata Corporation*  
One Computer Park  
Buffalo, New York 14203  
Telephone (716) 845-6000

*National Advanced Systems*  
800 East Middlefield Road  
Mountainview, California 94043  
Telephone (415) 962-6000□

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MODEL	Amdahl 470V/5	Amdahl 470V/5-II	Amdahl 470V/6	Amdahl 470V/6-II
<b>SYSTEM PARAMETERS</b>				
Date of introduction	3/28/77	10/17/78	9/11/74	2/9/77
Date of first delivery	9/77	4/79	6/75	8/77
Number installed to date	Proprietary information	Proprietary information	Proprietary information	Proprietary information
Production status	Not in new production	Not in new production	Not in new production	Not in new production
Operating systems				
DOS/VS	No	No	No	No
DOS/VSE	No	No	No	No
OS/VS1	Yes	Yes	Yes	Yes
SVS	Yes	Yes	Yes	Yes
MVS	Yes	Yes	Yes	Yes
VM/370	Yes	Yes	Yes	Yes
VM/SP	Yes	Yes	Yes	Yes
Others	MVS/SEA, ACP	MVS/SEA, ACP	MVS/SEA, ACP	MVS/SEA, ACP
<b>PROCESSING FEATURES</b>				
Virtual storage capability	Standard	Standard	Standard	Standard
Processor arrangements				
Uniprocessor	Yes	Yes	Yes	Yes
Attached processor	—	—	—	—
Front end to	—	—	—	—
Back end to	—	—	—	—
Multiprocessor	—	—	—	—
Minimum in complex	—	—	—	—
Maximum in complex	—	—	—	—
Clock comparator	Standard	Standard	Standard	Standard
CPU timer	Standard	Standard	Standard	Standard
Control registers	Standard	Standard	Standard	Standard
CPU one-level addressing	Standard	Standard	Standard	Standard
Doubleword buffer	Standard	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard	Standard
Machine check handling	Standard	Standard	Standard	Standard
Multiple bus architecture	Standard	Standard	Standard	Standard
Storage protection	Standard	Standard	Standard	Standard
Time-of-day-clock	Standard	Standard	Standard	Standard
Channel command retry	Standard	Standard	Standard	Standard
Channel indirect addressing	Standard	Standard	Standard	Standard
Byte oriented operand feature	Standard	Standard	Standard	Standard
Extended precision floating point	Standard	Standard	Standard	Standard
High speed floating point	Standard	Standard	Standard	Standard
System/370 Universal Instruction set	Standard	Standard	Standard	Standard
Console audible alarm	Standard	Standard	Standard	Standard
Integrated console printer	No	No	No	No
Light pen	No	No	No	No
Remote console	Standard	Standard	Standard	Standard
Remote data link	Standard	Standard	Standard	Standard
Console file	Standard	Standard	Standard	Standard
CPU activity monitor	Optional	Optional	Optional	Optional
Extended control mode	Standard	Standard	Standard	Standard
Program event recording	Standard	Standard	Standard	Standard
Virtual machine assist	No	No	No	No
1401/1440/1460 compatibility	No	No	No	No
<b>OTHER FEATURES &amp; COMMENTS</b>	470 accelerator; two-byte channel interface optional on all models; all systems air cooled	470 accelerator		



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Amdahl 470V/5	Amdahl 470V/5-II	Amdahl 470V/6	Amdahl 470V/6-II	MODEL
32.5	32.5	32.5	32.5	<b>PROCESSOR PERFORMANCE</b>
IBM 370 Mod. 168-3 or 3032 .9 to 1.1	IBM 370 Mod. 168-3 or 3032 1.0 to 1.2	IBM 370 Mod. 168-3 or 3032 1.3 to 1.5	IBM 370 Mod. 168-3 or 3032 1.4 to 1.6	Machine cycle time, nanoseconds
—	—	—	—	Relative performance*
470V/5-II	470V/6	470V/6-II	—	To Performance of To Performance of Field Upgradable to
<b>Dynamic NMOS</b>	<b>Dynamic NMOS</b>	<b>Dynamic NMOS</b>	<b>Dynamic NMOS</b>	<b>MAIN STORAGE</b>
Yes	Yes	Yes	Yes	Storage type
Yes	Yes	Yes	Yes	Checking
1.0	1.0	1.0	1.0	Parity
—	—	—	—	Error detection & correction
320	320	320	320	No. of check bits per byte
320	320	320	320	No. of check bits per word
4	4	4	4	Read cycle, nanoseconds
4M	4M	4M	4M	Write cycle, nanoseconds
8M	8M	8M	8M	Bytes fetched per cycle
4M	4M	4M	4M	Minimum capacity, bytes
Yes	Yes	Yes	Yes	Maximum capacity, bytes
8	8	8	8	Increment size, bytes
16	16	16	16	Interleaving
—	—	—	—	Minimum number of ways
Yes	Yes	Yes	Yes	Maximum number of ways
<b>Bipolar RAM</b>	<b>Bipolar RAM</b>	<b>Bipolar RAM</b>	<b>Bipolar RAM</b>	<b>BUFFER (CACHE) STORAGE</b>
65	65	65	65	Storage type
4	4	4	4	Cycle time, nanoseconds
16K	32K	16K	32K	Bytes fetched per cycle
16K	32K	16K	32K	Minimum capacity, bytes
—	—	—	—	Maximum capacity, bytes
8	8	8	8	<b>I/O CHANNELS</b>
16	16	16	16	Selector channels standard
8	8	8	8	Selector channels optional
16	16	16	16	Block multiplexers standard
8	8	8	8	Block multiplexers optional
16	16	16	16	Byte multiplexers standard
—	—	—	—	Byte multiplexers optional
256	256	256	256	Subchannels per channel
256	256	256	256	On a block multiplexer
256	256	256	256	On a byte multiplexer
Yes	Yes	Yes	Yes	On a selector
—	—	—	—	Channel to channel adapter
2M	2M	2M	2M	Maximum channel data rates
110K	110K	110K	110K	Block multiplexer, bytes/sec.
2M	2M	2M	2M	Byte multiplexer, bytes/sec.
7M	7M	7M	7M	Selector channel, bytes/sec.
Yes	Yes	Yes	Yes	Aggregate data rate, bytes/sec.
—	—	—	—	Data Streaming
N/A	N/A	N/A	N/A	<b>CONTROL STORAGE</b>
—	—	—	—	Storage type
—	—	—	—	Access time, nanoseconds
—	—	—	—	Word size, bits
—	—	—	—	Minimum number of words
—	—	—	—	Maximum number of words
—	—	—	—	Control storage usage
—	—	—	—	<b>PRICING &amp; AVAILABILITY</b>
\$1,472,000	\$1,572,000	\$1,702,000	\$1,802,000	Purchase of CPU with min. memory
Yes	Yes	Yes	Yes	Lease terms offered
Yes	Yes	Yes	Yes	Vendor's
—	—	—	—	Third party
\$37,000/mo. (4-yr)	\$39,550/mo. (4-yr)	\$42,950/mo. (4-yr)	\$45,500/mo. (4-yr)	Lease of CPU with min. memory (1-yr.)
4MB	4MB	4MB	4MB	Memory increment size
\$150,000	\$150,000	\$150,000	\$150,000	Memory increment purchase
Yes	Yes	Yes	Yes	Vendor offered maintenance
—	—	—	—	Prime time
—	—	—	—	Additional hours
\$8,925/mo.	\$9,030/mo.	\$9,275/mo.	\$9,380/mo.	24 hour
—	—	—	—	Other plans
Amdahl	Amdahl	Amdahl	Amdahl	Manufacturer
Amdahl	Amdahl	Amdahl	Amdahl	Vendor

\*As rated by the PCM vendor.

## All About Plug-Compatible Mainframes

MODEL	Amdahl 470V/7	Amdahl 470V/7A	Amdahl 470V/7B	Amdahl 470V/7C
<b>SYSTEM PARAMETERS</b>				
Date of introduction	3/28/77	8/1/79	11/79	11/18/80
Date of first delivery	8/78	9/79	3/80	3rd Quarter 1981
Number installed to date	—	—	—	—
Production status	Active	Active	Active	Active
Operating systems				
DOS/VS	No	No	No	No
DOS/VSE	No	No	No	No
OS/VS1	Yes	Yes	Yes	Yes
SVS	Yes	Yes	Yes	Yes
MVS	Yes	Yes	Yes	Yes
VM/370	Yes	Yes	Yes	Yes
VM/SP	Yes	Yes	Yes	Yes
Others	MVS/SEA, ACP	MVS/SEA, ACP	MVS/SEA, ACP	MVS/SEA, ACP
<b>PROCESSING FEATURES</b>				
Virtual storage capability	Standard	Standard	Standard	Standard
Processor arrangements				
Uniprocessor	Yes	Yes	Yes	Yes
Attached processor	—	—	—	—
Front end to	—	—	—	—
Back end to	—	—	—	—
Multiprocessor	—	—	—	—
Minimum in complex	—	—	—	—
Maximum in complex	—	—	—	—
Clock comparator	Standard	Standard	Standard	Standard
CPU timer	Standard	Standard	Standard	Standard
Control registers	Standard	Standard	Standard	Standard
CPU one-level addressing	Standard	Standard	Standard	Standard
Doubleword buffer	Standard	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard	Standard
Machine check handling	Standard	Standard	Standard	Standard
Multiple bus architecture	Standard	Standard	Standard	Standard
Storage protection	Standard	Standard	Standard	Standard
Time-of-day-clock	Standard	Standard	Standard	Standard
Channel command retry	Standard	Standard	Standard	Standard
Channel indirect addressing	Standard	Standard	Standard	Standard
Byte oriented operand feature	Standard	Standard	Standard	Standard
Extended precision floating point	Standard	Standard	Standard	Standard
High speed floating point	Standard	Standard	Standard	Standard
System/370 Universal Instruction set	Standard	Standard	Standard	Standard
Console audible alarm	Standard	Standard	Standard	Standard
Integrated console printer	No	No	No	No
Light pen	No	No	No	No
Remote console	Standard	Standard	Standard	Standard
Remote data link	Standard	Standard	Standard	Standard
Console file	Standard	Standard	Standard	Standard
CPU activity monitor	Optional	Optional	Optional	Optional
Extended control mode	Standard	Standard	Standard	Standard
Program event recording	Standard	Standard	Standard	Standard
Virtual machine assist	No	No	No	No
1401/1440/1460 compatibility	No	No	No	No
<b>OTHER FEATURES &amp; COMMENTS</b>	All systems air cooled; two-byte channel interface optional all models	470 accelerator	470 accelerator; 470 extended performance accelerator	470 accelerator

**All About Plug-Compatible Mainframes**

Amdahl 470V/7	Amdahl 470V/7A	Amdahl 470V/7B	Amdahl 470V/7C	MODEL
29	29	29	29	PROCESSOR PERFORMANCE Machine cycle time, nanoseconds Relative performance* To Performance of To Performance of Field Upgradable to
IBM 3033U 1.0 — — 470V/8	IBM 3033N 1.0 to 1.1 — — 470V/7	IBM 3032 1.4 to 1.6 — — 470V/7A	IBM 3033S 1.1 — — 470V/7B	
Dynamic NMOS	Dynamic NMOS	Dynamic NMOS	Dynamic NMOS	MAIN STORAGE Storage type Checking Parity Error detection & correction No. of check bits per byte No. of check bits per word Read cycle, nanoseconds Write cycle, nanoseconds Bytes fetched per cycle Minimum capacity, bytes Maximum capacity, bytes Increment size, bytes Interleaving Minimum number of ways Maximum number of ways
Yes Yes 1.0 — 320 320 4 4M 16M 4M Yes 8 16	Yes Yes 1.0 — 320 320 4 4M 16M 4M Yes 8 16	Yes Yes 1.0 — 320 320 4 4M 8M 4M Yes 8 16	Yes Yes 1.0 — 320 320 4 4M 8M 4M Yes 8 16	
Yes Bipolar RAM 58 4 32K 32K	Yes Bipolar RAM 58 4 32K 32K	Yes Bipolar RAM 58 4 32K 32K	Yes Bipolar RAM 58 4 32K 32K	BUFFER (CACHE) STORAGE Storage type Cycle time, nanoseconds Bytes fetched per cycle Minimum capacity, bytes Maximum capacity, bytes
12 16 12 16 12 16	12 16 12 16 12 16	8 16 8 16 8 16	8 8 8 8 8 8	
256 256 256 Yes	256 256 256 Yes	256 256 256 Yes	256 256 256 Yes	I/O CHANNELS Selector channels standard Selector channels optional Block multiplexers standard Block multiplexers optional Byte multiplexers standard Byte multiplexers optional Subchannels per channel On a block multiplexer On a byte multiplexer On a selector Channel to channel adapter Maximum channel data rates Block multiplexer, bytes/sec. Byte multiplexer, bytes/sec. Selector channel, bytes/sec. Aggregate data rate, bytes/sec. Data Streaming
2M 110K 2M 18M Yes	2M 110K 2M 18M Yes	2M 110K 2M 18M Yes	2M 110K 2M 18M Yes	
N/A — — — — —	N/A — — — — —	N/A — — — — —	N/A — — — — —	CONTROL STORAGE Storage type Access time, nanoseconds Word size, bits Minimum number of words Maximum number of words Control storage usage
\$1,975,000 Yes Yes — \$61,310/mo. (4-yr) 4MB \$150,000 Yes — — \$10,270/mo. —	\$1,550,000 Yes Yes — \$50,595/mo. (4-yr) 4MB \$150,000 Yes — — \$9,540/mo. —	\$1,250,000 Yes Yes — \$44,635/mo. (4-yr) 4MB \$150,000 Yes — — \$9,240/mo. —	\$1,050,000 Yes Yes — \$42,500/mo. (4-yr) 4MB \$150,000 Yes — — \$7,650/mo. —	
Amdahl Amdahl	Amdahl Amdahl	Amdahl Amdahl	Amdahl Amdahl	Manufacturer Vendor

## All About Plug-Compatible Mainframes

MODEL	Amdahl 470V/8	Amdahl 5860	Amdahl 5880	Cambex 1636
<b>SYSTEM PARAMETERS</b>				
Date of introduction	10/17/78	11/18/80	11/18/80	August 1980
Date of first delivery	9/79	4/82	2nd Quarter 1983	4th Quarter 1980
Number installed to date	—	—	—	5 (total product line)
Production status	Active	Active	Active	Active
Operating systems				
DOS/VS	No	No	No	Yes
DOS/VSE	No	No	No	Yes
OS/VS1	Yes	Yes	Yes	Yes
SVS	Yes	Yes	Yes	Yes
MVS	Yes	Yes	Yes	No
VM/370	Yes	Yes	Yes	Yes
VM/SP	Yes	Yes	Yes	No
Others	MVS/SEA, ACP	MVS/SEA, ACP	MVS/SEA	ACP
<b>PROCESSING FEATURES</b>				
Virtual storage capability	Standard	Standard	Standard	Standard
Processor arrangements				
Uniprocessor	Yes	Yes	No	Yes
Attached processor	—	—	—	—
Front end to	—	—	—	—
Back end to	—	—	—	—
Multiprocessor	—	—	Yes	—
Minimum in complex	—	—	2	—
Maximum in complex	—	—	2	No
Clock comparator	Standard	Standard	Standard	Standard
CPU timer	Standard	Standard	Standard	Standard
Control registers	Standard	Standard	Standard	Standard
CPU one-level addressing	Standard	Standard	Standard	Standard
Doubleword buffer	Standard	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard	Standard
Machine check handling	Standard	Standard	Standard	Standard
Multiple bus architecture	Standard	Standard	Standard	No
Storage protection	Standard	Standard	Standard	Standard
Time-of-day-clock	Standard	Standard	Standard	Standard
Channel command retry	Standard	Standard	Standard	Standard
Channel indirect addressing	Standard	Standard	Standard	Standard
Byte oriented operand feature	Standard	Standard	Standard	Standard
Extended precision floating point	Standard	Standard	Standard	Standard
High speed floating point	Standard	Standard	Standard	Standard
System/370 Universal Instruction set	Standard	Standard	Standard	Standard
Console audible alarm	Standard	Standard	Standard	Standard
Integrated console printer	No	No	No	Optional
Light pen	No	No	No	No
Remote console	Standard	Standard	Standard	Optional
Remote data link	Standard	Standard	Standard	Optional
Console file	Standard	Standard	Standard	Standard
CPU activity monitor	Optional	Standard	Standard	No
Extended control mode	Standard	Standard	Standard	Standard
Program event recording	Standard	Standard	Standard	Standard
Virtual machine assist	No	No	No	Standard
1401/1440/1460 compatibility	No	No	No	No
<b>OTHER FEATURES &amp; COMMENTS</b>		Distributed microcode; Macrocode in both 5860 and 5880		Formerly Cambridge Memories; 1636 upgraded from 1638

## All About Plug-Compatible Mainframes

Amdahl 470V/8	Amdahl 5860	Amdahl 5880	Cambex 1636	MODEL
26	24	24	50	PROCESSOR PERFORMANCE Machine cycle time, nanoseconds
IBM 3033U	IBM 3081	IBM 3081	IBM 4331-2	Relative performance*
1.1	1.3	2.3	1.1 to 1.3	To
—	—	—	—	Performance of
—	5880	—	Cambex 1641	To
—	—	—	—	Performance of
—	—	—	—	Field Upgradable to
Dynamic NMOS	Dynamic NMOS	Dynamic NMOS	Dynamic NMOS	MAIN STORAGE
Yes	Yes	Yes	—	Storage type
Yes	Yes	Yes	Yes	Checking
1.0	1.0	1.0	—	Parity
—	—	—	—	Error detection & correction
320	280	280	400	No. of check bits per byte
320	280	280	400	No. of check bits per word
4	8	8	8	Read cycle, nanoseconds
4M	16M	16M	1M	Write cycle, nanoseconds
16M	32M	32M	4M	Bytes fetched per cycle
4M	8M	8M	1M	Minimum capacity, bytes
Yes	Yes	Yes	No	Maximum capacity, bytes
8	16	16	—	Increment size, bytes
16	16	16	—	Interleaving
—	—	—	—	Minimum number of ways
Yes	Yes	Yes	No	Maximum number of ways
Bipolar RAM	Two Bipolar RAMs	Two Bipolar RAMs	—	BUFFER (CACHE) STORAGE
52	—	—	—	Storage type
4	8	8	—	Cycle time, nanoseconds
64K	64K	64K	—	Bytes fetched per cycle
64K	64K	64K	—	Minimum capacity, bytes
—	—	—	—	Maximum capacity, bytes
12	—	—	—	I/O CHANNELS
16	—	—	—	Selector channels standard
12	16	16	2	Selector channels optional
16	16	18	2	Block multiplexers standard
12	2	2	1	Block multiplexers optional
16	0	0	0	Byte multiplexers standard
—	—	—	—	Byte multiplexers optional
256	256	256	256	Subchannels per channel
256	256	256	256	On a block multiplexer
256	—	—	—	On a byte multiplexer
Yes	Yes	Yes	Yes	On a selector
—	—	—	—	Channel to channel adapter
2M	6M	6M	1.86M	Maximum channel data rates
110K	200K	200K	50K	Block multiplexer, bytes/sec.
2M	—	—	—	Byte multiplexer, bytes/sec.
18M	50M	50M	5M	Selector channel, bytes/sec.
No	Yes	Yes	No	Aggregate data rate, bytes/sec.
—	—	—	—	Data Streaming
N/A	4K RAM	4K RAM	Bipolar RAM	CONTROL STORAGE
—	N/A	N/A	25	Storage type
—	Variable	Variable	36	Access time, nanoseconds
—	Variable	Variable	72K	Word size, bits
—	Variable	Variable	144K	Minimum number of words
—	Variable	Variable	Instruc. microcode, op-	Maximum number of words
—	Variable	Variable	erating system assist	Control storage usage
—	—	—	—	PRICING & AVAILABILITY
\$2,175,000	\$3,800,000	\$7,500,000 (32M memory)	\$125,000	Purchase of CPU with min. memory
Yes	Yes	Yes	Yes; check vendor	Lease terms offered
Yes	Yes	Yes	Yes; check vendor	Vendor's
—	—	—	Check vendor	Third party
\$66,450/mo. (4-yr)	\$88,300/mo. (4-yr)	N/A	—	Lease of CPU with min. memory (1-yr.)
4MB	8MB	8MB	1MB	Memory increment size
\$150,000	\$200,000	\$200,000	\$15,000	Memory increment purchase
Yes	Yes	Yes	Yes	Vendor offered maintenance
—	—	—	\$395/mo.	Prime time
—	—	—	\$86.00/hr.	Additional hours
\$10,750/mo.	\$9,850/mo.	N/A	\$553/mo.	24 hour
—	—	—	Third party available	Other plans
Amdahl	Amdahl	Amdahl	Cambex	Manufacturer
Amdahl	Amdahl	Amdahl	Cambex	Vendor
—	—	—	Note: Upgrade costs for 1636 to 1641; \$70,000	—

\*As rated by the PCM vendor.

## All About Plug-Compatible Mainframes

MODEL	Cambex 1641	Cambex 1651	Control Data Omega 480-I	Control Data Omega 480-II
<b>SYSTEM PARAMETERS</b>				
Date of introduction	August 1980	August 1980	6/77	6/77
Date of first delivery	4th Quarter 1980	3rd Quarter 1981	6/77	1978
Number installed to date	—	—	100	100
Production status	Active	Active	Not in new production	Active
<b>Operating systems</b>				
DOS/VS	Yes	Yes	Yes	Yes
DOS/VSE	Yes	Yes	Yes	Yes
OS/VS1	Yes	Yes	Yes	Yes
SVS	Yes	Yes	Yes	Yes
MVS	Yes	Yes	Yes	Yes
VM/370	Yes	Yes	Yes	Yes
VM/SP	No	No	No	No
Others	ACP	ACP	No	No
<b>PROCESSING FEATURES</b>				
Virtual storage capability	Standard	Standard	Standard	Standard
<b>Processor arrangements</b>				
Uniprocessor	Yes	Yes	Yes	Yes
<b>Attached processor</b>				
Front end to	—	—	—	—
Back end to	—	—	—	—
Multiprocessor	—	—	—	—
Minimum in complex	—	—	—	—
Maximum in complex	—	—	—	—
Clock comparator	Standard	Standard	Standard	Standard
CPU timer	Standard	Standard	Standard	Standard
Control registers	Standard	Standard	Standard	Standard
CPU one-level addressing	Standard	Standard	No	No
Doubleword buffer	Standard	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard	Standard
Machine check handling	Standard	Standard	Standard	Standard
Multiple bus architecture	No	No	No	No
Storage protection	Standard	Standard	Standard	Standard
Time-of-day-clock	Standard	Standard	Standard	Standard
Channel command retry	Standard	Standard	Standard	Standard
Channel indirect addressing	Standard	Standard	Standard	Standard
Byte oriented operand feature	Standard	Standard	Standard	Standard
Extended precision floating point	Standard	Standard	Standard	Standard
High speed floating point	Standard	Standard	Standard	Standard
System/370 Universal Instruction set	Standard	Standard	Standard	Standard
Console audible alarm	Standard	Standard	Standard	Standard
Integrated console printer	Optional	Optional	Standard	No
Light pen	No	No	No	No
Remote console	Optional	Optional	No	No
Remote data link	Optional	Optional	No	No
Console file	Standard	Standard	Standard	Standard
CPU activity monitor	No	No	No	No
Extended control mode	Standard	Standard	Standard	Standard
Program event recording	Standard	Standard	Standard	Standard
Virtual machine assist	Standard	Standard	Standard	Standard
1401/1440/1460 compatibility	No	No	No	No
<b>OTHER FEATURES &amp; COMMENTS</b>	1641 upgraded from 1640	1651 initially available on field upgrade basis only		

## All About Plug-Compatible Mainframes

Cambex 1641	Cambex 1651	Control Data Omega 480-I	Control Data Omega 480-II	MODEL
50	50	50	50	PROCESSOR PERFORMANCE Machine cycle time, nanoseconds Relative performance*
IBM 4341-1	IBM 4341-2	IBM 370 Model 145	IBM 370 Model 148	To
0.9 to 1.1	0.9 to 1.1	1.25	1.25	Performance of
—	—	IBM 4331-2	IBM 4331-2	To
—	—	0.9	1.25	Performance of
Cambex 1651	—	480-II	480-III	Field Upgradable to
Dynamic NMOS	Dynamic NMOS	Static NMOS	Static NMOS	MAIN STORAGE
—	—	Yes	Yes	Storage type
Yes	Yes	Yes	Yes	Checking
—	—	—	—	Parity
—	—	—	—	Error detection & correction
400	400	400	400	No. of check bits per byte
400	400	400	400	No. of check bits per word
16	16	—	—	Read cycle, nanoseconds
2M	2M	.5M	1M	Write cycle, nanoseconds
8M	8M	2M	4M	Bytes fetched per cycle
1M	1M	.5M	1M	Minimum capacity, bytes
No	No	No	No	Maximum capacity, bytes
—	—	—	—	Increment size, bytes
—	—	—	—	Interleaving
—	—	—	—	Minimum number of ways
—	—	—	—	Maximum number of ways
Yes	Yes	No	Yes	BUFFER (CACHE) STORAGE
Bipolar RAM	Bipolar RAM	—	—	Storage type
100	100	—	100	Cycle time, nanoseconds
16	16	—	—	Bytes fetched per cycle
8K	8K	—	8K	Minimum capacity, bytes
8K	8K	—	8K	Maximum capacity, bytes
—	—	—	—	I/O CHANNELS
—	—	—	—	Selector channels standard
2	4	2	4	Selector channels optional
2	1	2	0	Block multiplexers standard
1	1	1	1	Block multiplexers optional
0	0	0	0	Byte multiplexers standard
—	—	—	—	Byte multiplexers optional
256	256	256	256	Subchannels per channel
256	256	256	256	On a block multiplexer
—	—	—	—	On a byte multiplexer
Yes	Yes	—	—	On a selector
—	—	—	—	Channel to channel adapter
1.86M	1.86M	1.85M	1.85M	Maximum channel data rates
50K	50K	50K	50K	Block multiplexer, bytes/sec.
—	—	—	—	Byte multiplexer, bytes/sec.
5M	5M	5M	5M	Selector channel, bytes/sec.
No	No	No	No	Aggregate data rate, bytes/sec.
—	—	—	—	Data Streaming
Bipolar RAM	Bipolar RAM	Bipolar R/W	Bipolar R/W	CONTROL STORAGE
25	25	50	50	Storage type
36	36	8	8	Access time, nanoseconds
72K	72K	54K	72K	Word size, bits
144K	144K	144K	144K	Minimum number of words
Instruction microcode, operating system assist	Instruction microcode, operating system assist	—	—	Maximum number of words
—	—	—	—	Control storage usage
\$190,000	Upgrade only, see below	\$188,000	\$279,000	PRICING & AVAILABILITY
Yes; check vendor	Yes; check vendor	Yes	Yes	Purchase of CPU with min. memory
Yes; check vendor	Yes; check vendor	Yes	Yes	Lease terms offered
Check vendor	Check vendor	Yes	Yes	Vendor's
—	—	—	—	Third party
1MB	1MB	.5MB	1MB	Lease of CPU with min. memory (1-yr.)
\$15,000	\$15,000	\$15,000	\$30,000	Memory increment size
Yes	Yes	Yes	Yes	Memory increment purchase
\$695/mo.	\$845/mo.	Yes	Yes	Vendor offered maintenance
\$86.00/hr.	\$86.00/hr.	Yes	Yes	Prime time
\$973/mo.	\$1,183/mo.	Yes	Yes	Additional hours
Third party available	Third party available	Weekend, holiday	Weekend, holiday	24 hour
—	—	—	—	Other plans
Cambex	Cambex	IPL Systems	IPL Systems	Manufacturer
Cambex	Cambex	Control Data	Control Data	Vendor
—	Note: Upgrade costs for 1636 to 1651; \$160,000 1641 to 1651; \$92,500	—	—	—

## All About Plug-Compatible Mainframes

MODEL	Control Data Omega 480-III	IPL 4436	IPL 4443	IPL 4446
<b>SYSTEM PARAMETERS</b>				
Date of introduction	1979	10/80	10/80	10/80
Date of first delivery	1979	4th Quarter 1980	2nd Quarter 1980*	3rd Quarter 1981
Number installed to date	100	Proprietary information	Proprietary information	Proprietary information
Production status	Active	Active	Active	Active
<b>Operating systems</b>				
DOS/VS	Yes	Yes	Yes	Yes
DOS/VSE	No	Yes	Yes	Yes
OS/VS1	Yes	Yes	Yes	Yes
SVS	Yes	Yes	Yes	Yes
MVS	Yes	Yes	Yes	Yes
VM/370	Yes	Yes	Yes	Yes
VM/SP	No	No	No	No
Others	No	No	No	No
<b>PROCESSING FEATURES</b>				
Virtual storage capability	Standard	Standard	Standard	Standard
<b>Processor arrangements</b>				
Uniprocessor	Yes	Yes	Yes	Yes
<b>Attached processor</b>				
Front end to	—	—	—	—
Back end to	—	—	—	—
Multiprocessor	—	—	—	—
Minimum in complex	—	—	—	—
Maximum in complex	—	—	—	—
Clock comparator	Standard	Standard	Standard	Standard
CPU timer	Standard	Standard	Standard	Standard
Control registers	Standard	Standard	Standard	Standard
CPU one-level addressing	Standard	Standard	Standard	Standard
Doubleword buffer	Standard	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard	Standard
Machine check handling	Standard	Standard	Standard	Standard
Multiple bus architecture	No	Standard	Standard	Standard
Storage protection	Standard	Standard	Standard	Standard
Time-of-day-clock	Standard	Standard	Standard	Standard
Channel command retry	Standard	Standard	Standard	Standard
Channel indirect addressing	Standard	Standard	Standard	Standard
Byte oriented operand feature	Standard	Standard	Standard	Standard
Extended precision floating point	Standard	Standard	Standard	Standard
High speed floating point	Standard	No	No	No
System/370 Universal Instruction set	Standard	Standard	Standard	Standard
Console audible alarm	Standard	Standard	Standard	Standard
Integrated console printer	No	Optional	Optional	Optional
Light pen	No	No	No	No
Remote console	No	No	No	No
Remote data link	No	Standard	Standard	Standard
Console file	Standard	Standard	Standard	Standard
CPU activity monitor	No	No	No	No
Extended control mode	Standard	Standard	Standard	Standard
Program event recording	Standard	Standard	Standard	Standard
Virtual machine assist	Standard	Standard	Standard	Standard
1401/1440/1460 compatibility	No	No	No	No
<b>OTHER FEATURES &amp; COMMENTS</b>		Over 170 systems installed worldwide by IPL licensees Control Data (Omega Series) and Olivetti. All systems support the IBM 4300 ECPS mode	System introduced as Control Data Omega 480-3 in March 1979. *First end user system installed May, 1980	



### All About Plug-Compatibles Mainframes

Control Data Omega 480-III	IPL 4436	IPL 4443	IPL 4446	MODEL
50	50	50	50	PROCESSOR PERFORMANCE Machine cycle time, nanoseconds Relative performance* To Performance of To Performance of Field Upgradable to
IBM 370 Model 158 1.9 IBM 4341-2 1.22 —	IBM 4331-2 1.5 — IPL 4443	IBM 4341-1 1.0 to 1.2 — IPL 4446	IBM 4341-2 1.0 to 1.2 — —	
Dynamic NMOS	Dynamic NMOS	Dynamic NMOS	Dynamic NMOS	MAIN STORAGE Storage type Checking Parity Error detection & correction No. of check bits per byte No. of check bits per word Read cycle, nanoseconds Write cycle, nanoseconds Bytes fetched per cycle Minimum capacity, bytes Maximum capacity, bytes Increment size, bytes Interleaving Minimum number of ways Maximum number of ways
Yes Yes — — 400 400 — 2M 8M 2M No — —  Yes — 100 — 8K 8K  — — 4 1 1 0  256 256 —  1.85M 50K — 5M No  Bipolar R/W 50 8 72K 144K —  \$360,000 Yes Yes Yes — 2MB \$60,000 Yes Yes Yes Weekend, holiday  IPL Systems Control Data	Yes Yes 1 4 500 500 8 1M 4M 1M No — —  No — — — — —  Yes ECL 100 4 8K 8K  — — 2 3 1 0  256 256 — No  2M 180K  11M No  ECL 20 36 16K 32K Instruction microcode, operating system assist  \$175,000 Yes Yes Yes \$4,600 (2-yr) 1MB \$15,700 Yes \$940/mo. Yes Yes Yes —  IPL IPL	Yes Yes 1 4 500 500 8 2M 8M 2M No — —  Yes ECL 100 4 8K 8K  — — 2 3 1 0  256 256 — No  2M 180K  11M No  ECL 20 36 16K 32K Instruction microcode, operating system assist  \$225,000 Yes Yes Yes \$5,565 (2-yr) 2MB \$31,400 Yes \$1,170/mo. Yes Yes Yes —  IPL IPL	Yes Yes 1 4 500 500 8 2M 8M 2M No — —  Yes ECL 100 4 16K 16K  — — 2 3 1 0  256 256 — No  2M 180K  11M No  ECL 20 36 16K 32K Instruction microcode, operating system assist  \$330,000 Yes Yes Yes — 2MB \$31,400 Yes — Yes Yes Yes —  IPL IPL	
				BUFFER (CACHE) STORAGE Storage type Cycle time, nanoseconds Bytes fetched per cycle Minimum capacity, bytes Maximum capacity, bytes
				I/O CHANNELS Selector channels standard Selector channels optional Block multiplexers standard Block multiplexers optional Byte multiplexers standard Byte multiplexers optional Subchannels per channel On a block multiplexer On a byte multiplexer On a selector Channel to channel adapter Maximum channel data rates Block multiplexer, bytes/sec. Byte multiplexer, bytes/sec. Selector channel, bytes/sec. Aggregate data rate, bytes/sec. Data Streaming
				CONTROL STORAGE Storage type Access time, nanoseconds Word size, bits Minimum number of words Maximum number of words Control storage usage
				PRICING & AVAILABILITY Purchase of CPU with min. memory Lease terms offered Vendor's Third party Lease of CPU with min. memory (1-yr.) Memory increment size Memory increment purchase Vendor offered maintenance Prime time Additional hours 24 hour Other plans  Manufacturer Vendor

## All About Plug-Compatibles Mainframes

MODEL	Magnuson M80 Model 31	Magnuson M80 Model 32	Magnuson M80 Model 42	Magnuson M80 Model 43
<b>SYSTEM PARAMETERS</b>				
Date of introduction	6/15/80	3/30/79	3/79	3/79
Date of first delivery	6/30/80	5/80	3rd Quarter 1981	3rd Quarter 1981
Number installed to date	—	—	—	—
Production status	Active	Active	Active	Active
<b>Operating systems</b>				
DOS/VS	Yes	Yes	Yes	Yes
DOS/VSE	Yes	Yes	Yes	Yes
OS/VS1	Yes	Yes	Yes	Yes
SVS	Yes	Yes	Yes	Yes
MVS	Yes	Yes	Yes	Yes
VM/370	Yes	Yes	Yes	Yes
VM/SP	No	No	Yes	Yes
Others	MVS/SE	MVS/SE	MVS/SE	MVS/SE
<b>PROCESSING FEATURES</b>				
Virtual storage capability	Standard	Standard	Standard	Standard
Processor arrangements				
Uniprocessor	Yes	Yes	Yes	Yes
Attached processor	—	—	—	—
Front end to	—	—	—	—
Back end to	—	—	—	—
Multiprocessor	—	—	—	—
Minimum in complex	—	—	—	—
Maximum in complex	—	—	—	—
Clock comparator	Standard	Standard	Standard	Standard
CPU timer	Standard	Standard	Standard	Standard
Control registers	Standard	Standard	Standard	Standard
CPU one-level addressing	No	Standard	Standard	Standard
Doubleword buffer	Standard	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard	Standard
Machine check handling	Standard	Standard	Standard	Standard
Multiple bus architecture	Standard	Standard	Standard	Standard
Storage protection	Standard	Standard	Standard	Standard
Time-of-day-clock	Standard	Standard	Standard	Standard
Channel command retry	Standard	Standard	Standard	Standard
Channel indirect addressing	Standard	Standard	Standard	Standard
Byte oriented operand feature	Standard	Standard	Standard	Standard
Extended precision floating point	Standard	Standard	Standard	Standard
High speed floating point	No	No	No	No
System/370 Universal Instruction set	Standard	Standard	Standard	Standard
Console audible alarm	Standard	Standard	Standard	Standard
Integrated console printer	Optional	Optional	Optional	Optional
Light pen	Standard	Standard	Optional	Optional
Remote console	Optional	Optional	Optional	Optional
Remote data link	Standard	Standard	Standard	Standard
Console file	Standard	Standard	Standard	Standard
CPU activity monitor	Standard	Standard	Standard	Standard
Extended control mode	Standard	Standard	Standard	Standard
Program event recording	Standard	Standard	Standard	Standard
Virtual machine assist	Standard	Standard	Standard	Standard
1401/1440/1460 compatibility	No	No	No	No
<b>OTHER FEATURES &amp; COMMENTS</b>	All systems have Cullinane IDMS data base manager available as option; also supported is MVS/SE Releases 1 and 2, MVS/SP Releases 1, 2, and 3			

### All About Plug-Compatible Mainframes

Magnuson M80 Model 31	Magnuson M80 Model 32	Magnuson M80 Model 42	Magnuson M80 Model 43	MODEL
100	100	50	50	PROCESSOR PERFORMANCE Machine cycle time, nanoseconds Relative performance* To Performance of To Performance of Field Upgradable to
IBM 4331-2 1.2	IBM 4331-2 1.5	IBM 4341-1 1.1	IBM 4341-1 1.3	
—	—	—	—	MAIN STORAGE Storage type Checking Parity Error detection & correction No. of check bits per byte No. of check bits per word Read cycle, nanoseconds Write cycle, nanoseconds Bytes fetched per cycle Minimum capacity, bytes Maximum capacity, bytes Increment size, bytes Interleaving Minimum number of ways Maximum number of ways
M80/32	M80/42	M80/43	M80/44	
Dynamic NMOS	Dynamic NMOS	Dynamic NMOS	Dynamic NMOS	BUFFER (CACHE) STORAGE Storage type Cycle time, nanoseconds Bytes fetched per cycle Minimum capacity, bytes Maximum capacity, bytes
—	—	—	—	
Yes	Yes	Yes	Yes	I/O CHANNELS Selector channels standard Selector channels optional Block multiplexers standard Block multiplexers optional Byte multiplexers standard Byte multiplexers optional Subchannels per channel On a block multiplexer On a byte multiplexer On a selector Channel to channel adapter Maximum channel data rates Block multiplexer, bytes/sec. Byte multiplexer, bytes/sec. Selector channel, bytes/sec. Aggregate data rate, bytes/sec. Data Streaming
1	1	1	1	
4	4	4	4	CONTROL STORAGE Storage type Access time, nanoseconds Word size, bits Minimum number of words Maximum number of words Control storage usage
600	600	700	700	
600	600	600	600	PRICING & AVAILABILITY Purchase of CPU with min. memory Lease terms offered Vendor's Third party Lease of CPU with min. memory (1-yr.) Memory increment size Memory increment purchase Vendor offered maintenance Prime time Additional hours 24 hour Other plans
8	8	8	8	
1M	1M	2M	2M	Manufacturer Vendor
8M	8M	16M	16M	
1M	1M	1M	1M	
No	No	No	No	
—	—	—	—	
—	—	—	—	
Yes	Yes	Yes	Yes	
Static TTL	Static TTL	Static ECL	Static ECL	
400	400	50	50	
8	8	4	4	
16K	16K	8K	16K	
32K	32K	16K	32K	
—	—	—	—	
—	—	—	—	
2	2	2	2	
3	3	13	13	
1	1	1	1	
2	2	15	15	
256	256	256	256	
256	256	256	256	
—	—	—	—	
Yes	Yes	Optional	Optional	
2.5M	3.3M	3M	3M	
500K	100K	100K	100K	
—	3.3M	—	—	
13.3M	13.3M	13.3M	13.3M	
No	Yes	Yes	Yes	
Static NMOS	Static NMOS	Static ECL	Static ECL	
45	45	35	35	
32	32	70	70	
48K	64K	8K	8K	
256K	256K	16K	16K	
Instruction microcode, operating system assist	Instruction microcode, operating system assist	Instruction microcode, operating system assist	Instruction microcode operating system assist	
\$135,000	\$170,000	\$210,000	\$270,000	
Yes	Yes	Yes	Yes	
—	—	—	—	
Yes	Yes	Yes	Yes	
\$5,244/mo.	\$6,528/mo.	\$7,715	\$9,463	
1MB	1MB	1MB	1MB	
\$15,700	\$15,700	\$15,700	\$15,700	
Yes	Yes	Yes	Yes	
Yes	Yes	Yes	Yes	
Yes	Yes	Yes	Yes	
Yes	Yes	Yes	Yes	
—	—	—	—	
Magnuson	Magnuson	Magnuson	Magnuson	
Magnuson	Magnuson	Magnuson	Magnuson	

## All About Plug-Compatibles Mainframes

MODEL	Magnuson M80 Model 44	Time Sharing Resources Model MEGA 1	Nanodata QMX 6333	Nanodata QMX 6336
SYSTEM PARAMETERS				
Date of introduction	11/80	3/1/79	5/19/80	5/19/80
Date of first delivery	3rd Quarter 1981	5/21/79	1st Quarter 1981	4th Quarter 1980
Number installed to date	—	Over 100	—	—
Production status	Active	Active	Active	Active
Operating systems				
DOS/VS	Yes	Yes	Yes	Yes
DOS/VSE	Yes	Yes	Yes	Yes
OS/VS1	Yes	Yes	Yes	Yes
SVS	Yes	Yes	Yes	Yes
MVS	Yes	Yes	Yes	Yes
VM/370	Yes	Yes	Yes	Yes
VM/SP	Yes	No	No	No
Others	MVS/SE	No	No	No
PROCESSING FEATURES				
Virtual storage capability	Standard	Standard	Standard	Standard
Processor arrangements				
Uniprocessor	Yes	Yes	Yes	Yes
Attached processor	—	—	—	—
Front end to	—	—	—	—
Back end to	—	—	—	—
Multiprocessor	—	—	—	—
Minimum in complex	—	—	—	—
Maximum in complex	—	—	—	—
Clock comparator	Standard	Standard	Standard	Standard
CPU timer	Standard	Standard	Standard	Standard
Control registers	Standard	Standard	Standard	Standard
CPU one-level addressing	Standard	No	Standard	Standard
Doubleword buffer	Standard	No	No	No
Interval timer	Standard	Standard	Standard	Standard
Machine check handling	Standard	Standard	Standard	Standard
Multiple bus architecture	Standard	Standard	Standard	Standard
Storage protection	Standard	Standard	Standard	Standard
Time-of-day-clock	Standard	Standard	Standard	Standard
Channel command retry	Standard	Standard	Standard	Standard
Channel indirect addressing	Standard	Standard	Standard	Standard
Byte oriented operand feature	Standard	Standard	Standard	Standard
Extended precision floating point	Standard	Standard	Standard	Standard
High speed floating point	No	No	No	No
System/370 Universal Instruction set	Standard	Standard	Standard	Standard
Console audible alarm	Standard	Standard	Standard	Standard
Integrated console printer	Optional	Optional	Optional	Optional
Light pen	Optional	Optional	No	No
Remote console	Optional	Optional	No	No
Remote data link	Standard	Standard	No	No
Console file	Standard	No	Standard	Standard
CPU activity monitor	Standard	Optional	Standard	Standard
Extended control mode	Standard	No	Standard	Standard
Program event recording	Standard	Standard	Standard	Standard
Virtual machine assist	Standard	No	No	No
1401/1440/1460 compatibility	No	No	No	No
OTHER FEATURES & COMMENTS		Software: TOTAL APL, SHELL, INSIGHT, GRAFIT, QED, MAIL, PPC, STATPAK, IBM-compatible or IBM software	All systems use multiple specialized processors for specific functions: Execution Processor, for all program activities; Service Proc- essor, for start-up and diagnostics; and Auxiliary Processor, for I/O and other functions	Available for all systems is the Nanodata Simplified Transaction Processor (NSTP), for on-line pro- gram development

All About Plug-Compatibles Mainframes

Magnuson M80 Model 44	Time Sharing Resources Model MEGA 1	Nanodata QMX 6333	Nanodata QMX 6336	MODEL
50	250	300	175	PROCESSOR PERFORMANCE Machine cycle time, nanoseconds Relative performance*
IBM 4341-2	IBM 370 Model 138	IBM 4331-1	IBM 4331-2	To
1.0	1	1.7	1.6	Performance of
—	IBM 4331	—	—	To
—	1 to 1.25	QMX 6336	QMX 6343	Performance of
—	—	—	—	Field Upgradable to
Dynamic NMOS	Dynamic NMOS	MOS	MOS	MAIN STORAGE Storage type
Yes	Yes	Yes	Yes	Checking
Yes	Yes	Yes	Yes	Parity
1	1	—	—	Error detection & correction
4	—	—	—	No. of check bits per byte
700	800	495	495	No. of check bits per word
600	800	495	495	Read cycle, nanoseconds
8	4	8	8	Write cycle, nanoseconds
2M	512K	512K	1M	Bytes fetched per cycle
16M	4M	2M	4M	Minimum capacity, bytes
1M	256K	512K; 1M	512K; 1M	Maximum capacity, bytes
No	No	No	No	Increment size, bytes
—	—	—	—	Interleaving
—	—	—	—	Minimum number of ways
—	—	—	—	Maximum number of ways
Yes	No	No	No	BUFFER (CACHE) STORAGE Storage type
Static ECL	—	—	—	Cycle time, nanoseconds
50	—	—	—	Bytes fetched per cycle
4	—	—	—	Minimum capacity, bytes
16K	—	—	—	Maximum capacity, bytes
32K	—	—	—	I/O CHANNELS
—	0	—	—	Selector channels standard
—	6	—	—	Selector channels optional
5	0	1	2	Block multiplexers standard
10	0	1	2	Block multiplexers optional
1	1	1	1	Byte multiplexers standard
15	—	—	—	Byte multiplexers optional
256	—	256	256	Subchannels per channel
256	256	256	256	On a block multiplexer
—	256	—	—	On a byte multiplexer
Optional	No	No	No	On a selector
3M	—	2M	2M	Channel to channel adapter
100K	64K	20K	50K	Maximum channel data rates
—	1.4M	—	—	Block multiplexer, bytes/sec.
13.3M	5M	4M	8M	Byte multiplexer, bytes/sec.
Yes	No	No	No	Selector channel, bytes/sec.
Static ECL	PROM	—	—	Aggregate data rate, bytes/sec.
35	55	—	—	Data Streaming
70	80	—	—	CONTROL STORAGE Storage type
8K	6K	94K	94K	Access time, nanoseconds
16K	8K	120K	120K	Word size, bits
Instruction microcode, operating system assist	Instruction microcode, diagnostics	Instruction microcode, operating system assist	Instruction microcode, operating system assist	Minimum number of words
\$297,000	\$62,400	\$98,490	\$163,224	Maximum number of words
Yes	Yes	Yes	Yes	Control storage usage
Yes	Yes	Yes	Yes	PRICING & AVAILABILITY Purchase of CPU with min. memory
—	—	—	—	Lease terms offered
\$10,756	\$2,184	—	—	Vendor's
1MB	256 KB	512KB; 1MB	512KB; 1MB	Third party
\$15,700	\$7,000	\$6,300; \$12,600	\$6,300; \$12,600	Lease of CPU with min. memory (1-yr.)
Yes	Yes	Yes	Yes	Memory increment size
Yes	—	—	—	Memory increment purchase
Yes	—	—	—	Vendor offered maintenance
Yes	—	—	—	Prime time
—	Offsite concept	—	—	Additional hours
—	—	—	—	24 hour
—	—	—	—	Other plans
Magnuson	Two Pi	Nanodata	Nanodata	Manufacturer
Magnuson	Time Sharing Resources	Nanodata	Nanodata	Vendor

## All About Plug-Compatibles Mainframes

MODEL	Nanodata QMX 6343	NAS AS/3000N	NAS AS/3000	NAS AS/5000N
<b>SYSTEM PARAMETERS</b>				
Date of introduction	5/19/80	Jan. 1980	Jan. 1980	Sept. 1980
Date of first delivery	2nd Quarter 1981	Jan. 1980	Jan. 1980	Sept. 1980
Number installed to date	—	Proprietary	Proprietary	—
Production status	Active	Active	Active	Active
Operating systems				
DOS/VS	Yes	Yes	Yes	Yes
DOS/VSE	Yes	Yes	Yes	Yes
OS/VS1	Yes	Yes	Yes	Yes
SVS	Yes	Yes	Yes	Yes
MVS	Yes	Yes	Yes	Yes
VM/370	Yes	Yes	Yes	Yes
VM/SP	No	Yes	Yes	Yes
Others	No	No	No	No
<b>PROCESSING FEATURES</b>				
Virtual storage capability	Standard	Standard	Standard	Standard
Processor arrangements				
Uniprocessor	—	Yes	Yes	Yes
Attached processor	—	—	—	—
Front end to	—	—	—	—
Back end to	—	—	—	—
Multiprocessor	Yes	—	—	—
Minimum in complex	2	—	—	—
Maximum in complex	2	—	—	—
Clock comparator	Standard	Standard	Standard	Standard
CPU timer	Standard	Standard	Standard	Standard
Control registers	Standard	Standard	Standard	Standard
CPU one-level addressing	Standard	Standard	Standard	Standard
Doubleword buffer	No	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard	Standard
Machine check handling	Standard	Standard	Standard	Standard
Multiple bus architecture	Standard	Standard	Standard	Standard
Storage protection	Standard	Standard	Standard	Standard
Time-of-day-clock	Standard	Standard	Standard	Standard
Channel command retry	Standard	Standard	Standard	Standard
Channel indirect addressing	Standard	Standard	Standard	Standard
Byte oriented operand feature	Standard	Standard	Standard	Standard
Extended precision floating point	Standard	Standard	Standard	Standard
High speed floating point	No	No	No	No
System/370 Universal Instruction set	Standard	Standard	Standard	Standard
Console audible alarm	Standard	Standard	Standard	Standard
Integrated console printer	Optional	Standard	Standard	Standard
Light pen	No	Standard	Standard	Standard
Remote console	No	Standard	Standard	Standard
Remote data link	No	Standard	Standard	Standard
Console file	Standard	Standard	Standard	Standard
CPU activity monitor	Standard	Standard	Standard	Standard
Extended control mode	Standard	Standard	Standard	Standard
Program event recording	Standard	Standard	Standard	Standard
Virtual machine assist	No	Standard	Standard	Standard
1401/1440/1460 compatibility	No	Standard	Standard	Standard
<b>OTHER FEATURES &amp; COMMENTS</b>				

## All About Plug-Compatibles Mainframes

Nanodata QMX 6343	NAS AS/3000N	NAS AS/3000	NAS AS/5000N	MODEL
175	115	115	92	PROCESSOR PERFORMANCE Machine cycle time, nanoseconds Relative performance*
IBM 4341-1	IBM 4341-1	IBM 4341-1	IBM 4341-1	To
1.0	1.0	1.2 to 1.3	1.2	Performance of
—	—	—	—	To
—	AS/3000	—	AS/5000E, AS/5000	Performance of
				Field Upgradable to
MOS	NMOS	NMOS	NMOS	MAIN STORAGE
Yes	Yes	Yes	Yes	Storage type
Yes	Yes	Yes	Yes	Checking
—	1	1	1	Parity
—	—	—	—	Error detection & correction
495	920	920	460	No. of check bits per byte
495	690	690	460	No. of check bits per word
8	8	8	8	Read cycle, nanoseconds
1M	2M	2M	2M	Write cycle, nanoseconds
4M	4M	8M	8M	Bytes fetched per cycle
512K; 1M	1M	1M	1M	Minimum capacity, bytes
No	No	No	No	Maximum capacity, bytes
—	—	—	—	Increment size, bytes
—	—	—	—	Interleaving
				Minimum number of ways
				Maximum number of ways
No	Bipolar ECL	Bipolar ECL	Bipolar ECL	BUFFER (CACHE) STORAGE
—	230	230	184	Storage type
—	8	8	8	Cycle time, nanoseconds
—	8K	16K	8K	Bytes fetched per cycle
—	8K	16K	8K	Minimum capacity, bytes
				Maximum capacity, bytes
—	—	—	—	I/O CHANNELS
—	—	—	—	Selector channels standard
4	4	4	5	Selector channels optional
4	—	—	4	Block multiplexers standard
1	1	1	1	Block multiplexers optional
0	—	—	2	Byte multiplexers standard
				Byte multiplexers optional
256	256	256	256	Subchannels per channel
256	256	256	256	On a block multiplexer
—	—	—	—	On a byte multiplexer
No	No	No	Yes	On a selector
				Channel to channel adapter
2M	1.5M	1.5M	1.5M	Maximum channel data rates
50K	100K	100K	100K	Block multiplexer, bytes/sec.
				Byte multiplexer, bytes/sec.
12M	5.5M	5.5M	6.75M	Selector channel, bytes/sec.
No	No	No	Yes	Aggregate data rate, bytes/sec.
				Data Streaming
—	Bipolar ECL	Bipolar ECL	Bipolar ECL	CONTROL STORAGE
—	10 to 20	10 to 20	10 to 20	Storage type
—	72	72	72	Access time, nanoseconds
94K	8K	8K	16K	Word size, bits
120K	8K	8K	16K	Minimum number of words
Instruction microcode, op-	Instruction microcode, op-	Instruction microcode, op-	Instruction microcode, op-	Maximum number of words
erating system assist	erating system assist	erating system assist	erating system assist	Control storage usage
\$235,891	\$325,000	\$425,000	\$335,000	PRICING & AVAILABILITY
Yes	Yes	Yes	Yes	Purchase of CPU with min. memory
Yes	Yes	Yes	Yes	Lease terms offered
—	—	—	—	Vendor's
—	—	—	—	Third party
512KB; 1MB	Check vendor	Check vendor	Check vendor	Lease of CPU with min. memory (1-yr.)
\$6,300; \$12,600	1MB	1MB	1MB	Memory increment size
Yes	\$50,000	\$50,000	\$50,000	Memory increment purchase
\$591/mo.	Yes	Yes	Yes	Vendor offered maintenance
—	\$1,550/mo.	\$1,650/mo.	\$1,800/mo.	Prime time
—	—	—	—	Additional hours
—	\$2,280/mo.	\$2,425/mo.	\$2,646/mo.	24 hour
—	—	—	—	Other plans
Nanodata	NAS	NAS	NAS	Manufacturer
Nanodata	NAS	NAS	NAS	Vendor

### All About Plug-Compatible Mainframes

MODEL	NAS AS/5000E	NAS AS/5000	NAS AS/7000N
<b>SYSTEM PARAMETERS</b>			
Date of introduction	Sept. 1980	Jan. 1980	Jan. 1980
Date of first delivery	Sept. 1980	Jan. 1980	2nd Quarter 1980
Number installed to date	—	—	—
Production status	Active	Active	Active
<b>Operating systems</b>			
DOS/VS	Yes	Yes	Yes
DOS/VSE	Yes	Yes	Yes
OS/VS1	Yes	Yes	Yes
SVS	Yes	Yes	Yes
MVS	Yes	Yes	Yes
VM/370	Yes	Yes	Yes
VM/SP	Yes	Yes	Yes
Others	No	MVS/SP	MVS/SP
<b>PROCESSING FEATURES</b>			
Virtual storage capability	Standard	Standard	Standard
<b>Processor arrangements</b>			
Uniprocessor	Yes	Yes	Yes
Attached processor	—	—	—
Front end to	—	—	—
Back end to	—	—	—
<b>Multiprocessor</b>			
Minimum in complex	—	—	—
Maximum in complex	—	—	—
Clock comparator	Standard	Standard	Standard
CPU timer	Standard	Standard	Standard
Control registers	Standard	Standard	Standard
CPU one-level addressing	Standard	Standard	Standard
Doubleword buffer	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard
Machine check handling	Standard	Standard	Standard
Multiple bus architecture	Standard	Standard	Standard
Storage protection	Standard	Standard	Standard
Time-of-day-clock	Standard	Standard	Standard
Channel command retry	Standard	Standard	Standard
Channel indirect addressing	Standard	Standard	Standard
Byte oriented operand feature	Standard	Standard	Standard
Extended precision floating point	Standard	Standard	Standard
High speed floating point	No	No	No
System/370 Universal Instruction set	Standard	Standard	Standard
Console audible alarm	Standard	Standard	Standard
Integrated console printer	Standard	Standard	Standard
Light pen	Standard	Standard	Standard
Remote console	Standard	Standard	Standard
Remote data link	Standard	Standard	Standard
Console file	Standard	Standard	Standard
CPU activity monitor	Standard	Standard	Standard
Extended control mode	Standard	Standard	Standard
Program event recording	Standard	Standard	Standard
Virtual machine assist	Standard	Standard	Standard
1401/1440/1460 compatibility	Standard	Standard	No
<b>OTHER FEATURES &amp; COMMENTS</b>			



### All About Plug-Compatible Mainframes

NAS AS/5000E	NAS AS/5000	NAS AS/7000N	MODEL
92	92	72	PROCESSOR PERFORMANCE Machine cycle time, nanoseconds Relative performance* To Performance of To Performance of Field Upgradable to
IBM 4341-1 1.5 to 1.6 — — AS/5000	IBM 3031 1.2 — — —	IBM 3032 1.0 to 1.2 — — AS/7000	
NMOS	NMOS	NMOS	MAIN STORAGE Storage type Checking Parity Error detection & correction No. of check bits per byte No. of check bits per word Read cycle, nanoseconds Write cycle, nanoseconds Bytes fetched per cycle Minimum capacity, bytes Maximum capacity, bytes Increment size, bytes Interleaving Minimum number of ways Maximum number of ways
Yes Yes 1 — 460 460 8 2M 8M 1M No — —	Yes Yes 1 — 460 460 8 2M 8M 1M No — —	Yes Yes 1 — 360 360 8 2M 8M 2M Yes 4 4	
Bipolar ECL 184 8 32K 32K — — 5 4 1 2 256 256 — Yes 1.5M 100K — 6.75 Yes	Bipolar ECL 184 8 32K 32K — — 5 4 1 2 256 256 — Yes 1.5M 100K — 6.75M Yes	Bipolar ECL 144 8 16K 16K — — 5 1 1 1 256 256 — Yes 1.9M 100K — 11M No	BUFFER (CACHE) STORAGE Storage type Cycle time, nanoseconds Bytes fetched per cycle Minimum capacity, bytes Maximum capacity, bytes  I/O CHANNELS Selector channels standard Selector channels optional Block multiplexers standard Block multiplexers optional Byte multiplexers standard Byte multiplexers optional Subchannels per channel On a block multiplexer On a byte multiplexer On a selector Channel to channel adapter Maximum channel data rates Block multiplexer, bytes/sec. Byte multiplexer, bytes/sec. Selector channel, bytes/sec. Aggregate data rate, bytes/sec. Data Streaming
— — 5 4 1 2 256 256 — Yes 1.5M 100K — 6.75 Yes	— — 5 4 1 2 256 256 — Yes 1.5M 100K — 6.75M Yes	— — 5 1 1 1 256 256 — Yes 1.9M 100K — 11M No	
Bipolar ECL 10 to 20 72 16K 16K Instruction microcode, operating system assist \$500,000 Yes Yes — Check vendor 1MB \$50,000 Yes \$1,900/mo. — \$2,793/mo. —	Bipolar ECL 10 to 20 72 16K 16K Instruction microcode, operating system assist \$600,000 Yes Yes — Check vendor 1MB \$50,000 Yes \$2,190/mo. — \$3,200/mo. —	Bipolar ECL 10 to 20 99 6K 6K Instruction microcode, operating system assist \$1,100,000 Yes Yes — Check vendor 2MB \$100,000 Yes \$5,445/mo. — \$8,000/mo. —	CONTROL STORAGE Storage type Access time, nanoseconds Word size, bits Minimum number of words Maximum number of words Control storage usage  PRICING & AVAILABILITY Purchase of CPU with min. memory Lease terms offered Vendor's Third party Lease of CPU with min. memory (1-yr.) Memory increment size Memory increment purchase Vendor offered maintenance Prime time Additional hours 24 hour Other plans
— — 5 4 1 2 256 256 — Yes 1.5M 100K — 6.75 Yes	— — 5 4 1 2 256 256 — Yes 1.5M 100K — 6.75M Yes	— — 5 1 1 1 256 256 — Yes 1.9M 100K — 11M No	
NAS NAS	NAS NAS	NAS NAS	Manufacturer Vendor

\*As rated by the PCM vendor.

## All About Plug-Compatible Mainframes

MODEL	NAS AS/7000	NAS AS/7000 DPC	NAS AS/9000
<b>SYSTEM PARAMETERS</b>			
Date of introduction	Jan. 1980	Jan. 1980	Sept. 1980
Date of first delivery	2nd Quarter 1980	2nd Quarter 1980	4th Quarter 1980
Number installed to date	—	—	—
Production status	Active	Active	Active
Operating systems			
DOS/VS	Yes	No	No
DOS/VSE	Yes	No	No
OS/VS1	Yes	No	Yes
SVS	Yes	No	No
MVS	Yes	Yes	No
VM/370	Yes	Yes	Yes
VM/SP	No	Yes	Yes
Others	MVS/SP	MVS/SP	MVS/SP
<b>PROCESSING FEATURES</b>			
Virtual storage capability	Standard	Standard	Standard
Processor arrangements			
Uniprocessor	Yes	—	Yes
Attached processor	—	—	—
Front end to	—	—	—
Back end to	—	—	—
Multiprocessor	—	Yes	—
Minimum in complex	—	2	—
Maximum in complex	—	2	—
Clock comparator	Standard	Standard	Standard
CPU timer	Standard	Standard	Standard
Control registers	Standard	Standard	Standard
CPU one-level addressing	Standard	Standard	Standard
Doubleword buffer	Standard	Standard	Standard
Interval timer	Standard	Standard	Standard
Machine check handling	Standard	Standard	Standard
Multiple bus architecture	Standard	Standard	Standard
Storage protection	Standard	Standard	Standard
Time-of-day-clock	Standard	Standard	Standard
Channel command retry	Standard	Standard	Standard
Channel indirect addressing	Standard	Standard	Standard
Byte oriented operand feature	Standard	Standard	Standard
Extended precision floating point	Standard	Standard	Standard
High speed floating point	Standard	Standard	Standard
System/370 Universal Instruction set	Standard	Standard	Standard
Console audible alarm	Standard	Standard	Standard
Integrated console printer	Standard	Standard	Standard
Light pen	Standard	Standard	Standard
Remote console	Standard	Standard	Standard
Remote data link	Standard	Standard	Standard
Console file	Standard	Standard	Standard
CPU activity monitor	Standard	Standard	Standard
Extended control mode	Standard	Standard	Standard
Program event recording	Standard	Standard	Standard
Virtual machine assist	Standard	Standard	Standard
1401/1440/1460 compatibility	No	No	No
<b>OTHER FEATURES &amp; COMMENTS</b>			

### All About Plug-Compatible Mainframes

NAS AS/7000	NAS AS/7000 DPC	NAS AS/9000	MODEL
72	72	40	PROCESSOR PERFORMANCE Machine cycle time, nanoseconds Relative performance* To Performance of To Performance of Field Upgradable to
IBM 3032 1.2 — AS/7000 DPC	IBM 3033U 1.0 — No	IBM 3033U 1.8 to 2.2 — No	
NMOS	NMOS	NMOS	MAIN STORAGE Storage type Checking Parity Error detection & correction No. of check bits per word Read cycle, nanoseconds Write cycle, nanoseconds Bytes fetched per cycle Minimum capacity, bytes Maximum capacity, bytes Increment size, bytes Interleaving Minimum number of ways Maximum number of ways
Yes Yes 1 — 360 360 8 4M 16M 2M Yes 4 4	Yes Yes 1 — 360 360 8 4M 16M 2M Yes 4 4	Yes Yes 1 — 320 320 32 8M 16M 2M Yes 8 8	
Bipolar ECL 144 8 16K 16K	Bipolar ECL 144 8 64K/CPU 64K/CPU	Bipolar ECL 40 8 64K 64K	BUFFER (CACHE) STORAGE Storage type Cycle time, nanoseconds Bytes fetched per cycle Minimum capacity, bytes Maximum capacity, bytes
— — 6 6 2 2	— — 10 2 2 2	— — 10 4 2 —	
256 256 — Yes	256 256 — Yes	256 256 — Yes	I/O CHANNELS Selector channels standard Selector channels optional Block multiplexers standard Block multiplexers optional Byte multiplexers standard Byte multiplexers optional Subchannels per channel On a block multiplexer On a byte multiplexer On a selector Channel to channel adapter Maximum channel data rates Block multiplexer, bytes/sec. Byte multiplexer, bytes/sec. Selector channel, bytes/sec. Aggregate data rate, bytes/sec. Data Streaming
1.9M 100K — 21M No	1.9M 100K — 21M No	1.9M 100K — 24M Yes (3rd Qtr. 1981)	
Bipolar ECL 10 to 20 99 6K 6K Instruction microcode, operating system assist	Bipolar ECL 10 to 20 99 6K 6K Instruction microcode, operating system assist	Bipolar ECL 5.5 160 16K 16K Instruction microcode, operating system assist	CONTROL STORAGE Storage type Access time, nanoseconds Word size, bits Minimum number of words Maximum number of words Control storage usage
\$1,525,000 Yes Yes — Check vendor 2MB \$100,000 Yes \$6,355/mo. — \$9,340/mo. —	\$2,350,000 Yes Yes — Check vendor 2MB \$100,000 Yes \$8,165/mo. — \$12,000/mo. —	\$3,950,000 Yes Yes — Check vendor 2MB \$80,000 Yes — \$17,000/mo. —	
NAS NAS	NAS NAS	Hitachi NAS	PRICING & AVAILABILITY Purchase of CPU with min. memory Lease terms offered Vendor's Third party Lease of CPU with min. memory (1-yr.) Memory increment size Memory increment purchase Vendor offered maintenance Prime time Additional hours 24 hour Other plans  Manufacturer Vendor

\*As rated by the PCM vendor.