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Digital Equipment Corp. VAX 4000

In this report:

Product Summary

Editor's Note
The VAXserver 4000 Model 300 system is designed for dedicated server applications, with lower cost licensing and service. Its server architecture is optimized for handling the heavy I/O associated with many distributed server applications. The system's I/O throughput, storage, and processing power make it an excellent choice as a database server in finance, insurance and manufacturing, as a compute and file server in engineering, and as a mail server in office environments.

Description
The system offers customers the CPU and I/O performance of a midrange system but does not require a computer room. It is offered in four computing styles—time share, server, high-availability dual-host, and realtime.

Strengths
Extends full compatibility to the rest of the VAX system family and its extensive library of applications software, along with easy integration into multivendor and distributed environments.

Limitations
Does not support ULTRIX.

Competition
VAX 4000 competitors include the Hewlett-Packard 3000 Model 932; IBM 9370; and IBM AS/400 (9406) Models B45, B50, and B70.

Vendor
Digital Equipment Corp. (DEC)
146 Main Street
Maynard, MA 01754-2571
(508) 493-5111

Price
Six base system configurations are available with prices ranging from $56,970 to $106,850.

GSA Schedule
Yes.

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Analysis

Product Strategy

Digital's VAX 4000 Model 300 is a leadership
VAX system that out performs its competitors in
the $75,000 to $250,000 market segment, a 13 bil-
lion dollar segment according to a January 1990
survey by a well-known west-coast research firm.
Offered as a general-purpose, server, high-
availability dual host, and realtime system, the
VAX 4000 Model 300 has price/performance that
outpaces its competition—IBM's AS/400 series,
the IBM 9370, and HP's 3000 Series 932.

With double the performance of the Mi-
croVAX 3800/3900, the VAX 4000 Model 300 fits
in the VAX family just above the performance of
the MicroVAX 3000 series and under the VAX
6000 series. The system has a processing speed of 8
VUPs, or 10 times the MicroVAX II's enhanced
I/O performance at 1600 I/Os per second, maxi-
mum storage capacity of 28G bytes, and maximum
memory of 128M bytes.

Because the new system is a VAX, it offers
full compatibility with the rest of the VAX system
family and its extensive library of application soft-
ware, along with easy integration into the multi-
vendor and distributed environments. Like other
VAX systems, the 4000 is an open system that can
grow and change to meet the needs of existing and
new applications, while maintaining a consistent
operating system, networking interfaces, and data-
base.

The DEC 4000 Client/Server Environment

In a client/server environment, users within a com-
puting community are provided with a consistent
set of network-based resources transparently
through the server. Digital Equipment Corpora-
tion's client server approach, for example, allows
users of personal computers, workstations, video
terminals, and systems in factories and laboratories
easy access and sharing of computing resources

they need from the network. Furthermore, transac-
tion processing systems can be distributed into
more responsive front-end systems isolated from
the more time-consuming transaction processing.
This approach lets customers get maximum use out
of their existing computing resources—whether for
a community of 10 users or of 10,000 users.

This client/server computing approach offers
all the functionality of a large, complex multiven-
dor network, with all the simplicity of a single sys-
tem. Users can access and share information and
use applications from throughout the network, re-
gardless of their location, or of the type of desktop
they're using. Software developers can write appli-
cations that can work anywhere on the network,
with other applications, and MIS can easily man-
age the overall computing environment as if it were
all in one room.

The VAX 4000 system is fully optimized as a
network server with up to 1600 disk I/O requests
per second. It delivers a 50 percent performance
improvement over the HP3000 Model 932 and
performance exceeding the IBM AS/400 Model
B70 at half the cost. In addition to its leadership
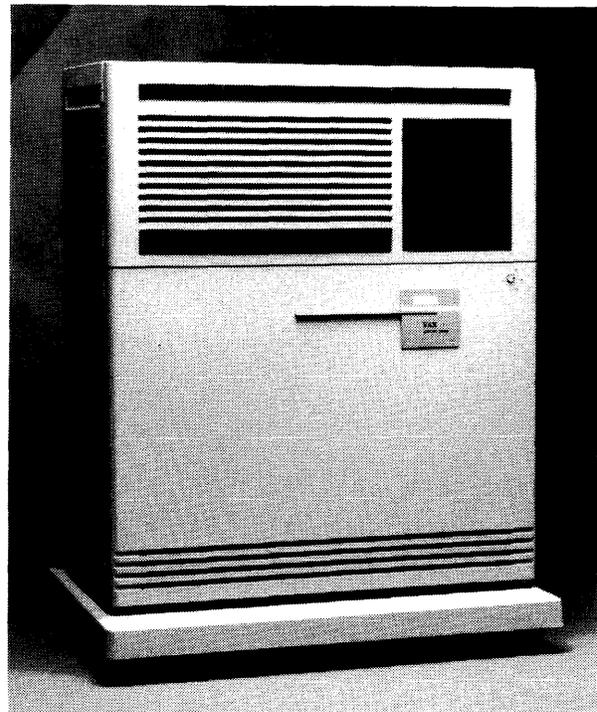
*Digital's VAX 4000 Model 300 with its excep-
tional CPU and I/O performance is ideal for
use as a server and distributed timesharing
system in offices, factories, warehouses, small
businesses, branch offices, and departments.*

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Table 1. System Comparison

Model	VAX 4000/300
System Characteristics	
Date of introduction	July 1990
Date of first delivery	July 1990
Operating system	VMS, VAXELN
Upgradable from	MicroVAX II, 3500/3600, and VAX-11/750/780/785
Upgradable to	Not applicable
MIPS	Approximately 8.0
CPU cycle time	28 ns
Memory	
Minimum capacity, bytes	32M
Maximum capacity, bytes	128M
Cache memory, bytes	2KB on the chip, 28 ns; 128KB on the board, 56 ns
Disk Storage	
Minimum capacity, bytes	381M
Maximum capacity, bytes	28G
Communications Protocols	Ethernet
Purchase Price (basic) ($)	56,970

client/server capabilities, the VAX 4000 is ideal for distributed production applications running in branch offices, departments, factories, distribution functions, and research and development laboratories.

Competitive Position

The VAX 4000-300 stands out against competitors in the area of cost of ownership. Besides its aggressive price/performance, a typical system, packaged in a pedestal enclosure with disks and options, consumes approximately 300 watts of power. It requires no special air-conditioning or computer room. Additionally, the small pedestal footprint and service access require less than 20 square feet of office space for a system containing 4G bytes of storage today, expandable to 28G bytes in the future.

Digital's VAX 4000 versus IBM's AS/400

VAX 4000 systems provide major advantages over the IBM AS/400 series, especially in the areas of growth, data integrity, price/performance, and high availability. Also, the VAX 4000 is designed for an office environment, while the larger AS/400 requires a computer room environment.

The unique packaging of the VAX 4000 provides significant cost savings and benefits to customers. The environmental requirements of the VAX 4000 Model 300 and a similarly configured IBM AS/400 Model B70 are significantly different.

The VAX 4000 is 20 percent of the Designed Office Standard for noise whereas the IBM AS/400 B70 is 250 percent of the standard and so it cannot be used in an office. A dual cabinet VAX 4000 consumes 473 watts of power versus 4,375 watts for the IBM AS/400 B70. The VAX 4000 uses only 7 percent of the floor space that an IBM AS/400 B70 uses. It is 12 percent of the AS/400 system's weight and requires 11 percent of the cooling costs.

Growth and Networking

Growth across the entire VAX family means a consistent operating system, networking interfaces, and database, while growth beyond the AS/400 requires an entirely new operating system environment.

Growth becomes an even more important issue when comparing the narrow performance band of the AS/400 to the wide-ranging extensions available with VAX systems. A VAX 4000-300 customer can comfortably upgrade to other VAX systems that are equal to 15 times the performance of the top-of-the-line AS/400 without conversion. An AS/400 customer faces significant conversion costs and duplication of staffs to support multiple operating environments.

Price/Performance

The online transaction processing (OLTP) performance of the VAX 4000-300 running the Transaction Processing Council Benchmark A has a speed of 22 transactions per second (TPS). It offers greater performance than the top-of-the-line AS/400 Model B70—at a price lower than the AS/400 Model B45 (127,000 versus $155,000).

High Availability

The VAX family of high-availability systems provide duplication of critical system components to minimize downtime. While the AS/400 line does not offer high availability, the VAX 4000 series offers multiple availability options. Dual-host VAX 4000-300 configurations are systems with virtually no point of failure. The VAX 4000 can also be linked to a fault-tolerant VAXft 3000

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Company Profile
Digital Equipment Corp.

Corporate Headquarters
146 Main Street
Maynard, MA 01754-2571
(508) 493-5111

In Canada
Digital Equipment of Canada, Ltd.
P.O. Box 13000, 100
Herzberg Road
Kanata, ON K2K 2A6
(613) 592-5111

Officers
President: Kenneth H. Olsen
Senior Vice President, Engineering, Manufacturing, and Product Marketing: John F. Smith
President and CEO, European Operations: Pier Carlo Falotti

Company Background
Year Founded: 1957
No. Employees: 125,000
No. Systems Sold (cumulative): More than 500,000

Led by Kenneth H. Olsen, three engineers founded Digital Equipment Corporation in 1957. Using their own money in addition to funding from a Boston venture-capital firm, they set up operations in an old brick wool mill in Maynard, MA.

Digital's first product was a set of electronic modules for computer test equipment. Three years after its founding, Digital introduced its first computer, the Programmed Data Processor Model 1, or PDP-1. In 1963, the company introduced its landmark PDP-8, the first successful minicomputer.

The PDP-8 established a whole new market for smaller computers and made Digital a rising star within an industry then dominated by mainframe vendors. Digital's smaller machines soon became a price/performance alternative to big mainframes and also introduced the concept of distributed processing.

In 1977, Digital introduced the VAX (virtual address extension) Series of 32-bit minicomputers, one of the most successful product launches in computer industry history. Since introducing the first VAX, the 11-780, Digital has continued to enhance the basic VAX architecture and VAX/VMS operating system with announcements of new and more powerful VAX models over the years.

The current VAX family consists of VAXstation desktop workstations; MicroVAX departmental systems; VAX 6000 Series medium-range systems; and VAX 9000 Series high-end mainframes.

In addition to the VAX family, Digital offers DECsystems which use reduced instruction set computing (RISC) technology and operate under ULTRIX, Digital's implementation of the UNIX operating system.

To support its systems, Digital offers disk, storage array, and solidstate memory products; optical disks; tape devices; and printers. Besides hardware and software, Digital offers a range of communications and networking products and services.

(fault-tolerant systems are designed to be fully redundant with no single point of failure).

HP 3000 Series 932 versus VAX 4000
The VAX 4000-300 system is positioned between Hewlett-Packard's HP3000/932 Series and the HP3000/949. While these systems are competitively priced, the VAX 4000 surpasses the HP machine in:

- Price performance—$127,000 and 21.6 TPS versus $130,000 and 13.6 for the HP3000/932

- Number of active users—124 for the VAX 4000 versus 75 for the 932

- Maximum memory—64M bytes versus 128M bytes for the VAX 4000

HP does not run the TPC Benchmark A with a TP monitor such as Digital's ACMS and DECforms, which adds software overhead to the customer's application. The following points illustrate where Digital has an advantage over HP:

- 4GL monitor and forms processor for ease of development

- TP forms server for customer growth

- Cross system transaction commitment for distributed transaction processing

- On-line query access to IBM databases

- Clustering for growth, high availability, and resource sharing

- OLTP development and support tools for ease of development and maintenance

HP lacks the growth and functionality provided by TP monitors like Digital's ACMS or DECintact that screen OLTP users from common user errors.

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Business Overview

Digital likes to characterize itself as the world's leading supplier of networked computer systems as well as a leader in systems integration. To remain a leader, particularly in these specific areas, the company believes it must support openness and industry standards to remain competitive in the 1990s. The company is a key participant in industry standards organizations such as the Open Systems Foundation (OSF), an industry group founded in 1988 to develop industry recognized specifications for UNIX. UNIX will be the standard operating system for users who prefer open systems rather than proprietary systems.

Network Application Support (NAS), a new Digital strategic direction addressing VAX compatibility and multivendor connectivity, will let users integrate desktop systems and large system resources involving both Digital and non-Digital systems.

In 1988, Digital introduced Enterprise Management Architecture (EMA), an integrated network management strategy.

Financial Profile

Digital continues to rank as the second largest U.S. computer company as measured by total revenues. While Digital enjoyed record revenue and profit growth through the 1980s—largely on the strength of its VAX platform and networking architecture—sales and profits have been sluggish within the last couple of years.

It is evident from the company's report of an 80 percent drop in earnings for the first quarter of 1991 that Digital continues to undergo pain. For the first quarter of fiscal 1991, ended September 30, Digital reported revenue of $3.09 billion, down 1.2 percent from $3.13 billion for the same period last year. Net income was $26.18 million, a staggering 82.6 percent drop from $150.78 million in the year-ago period.

Digital blamed the profit drop on an economy that is teetering on the brink of a recession and lower demand for high-margin products. Like major competitors, Digital continues to do better internationally.

In moves designed to reduce expenses, last summer Digital announced that it would begin shifting 4,000 manufacturing employees to other jobs and offered severance packages to 700 manufacturing and administrative employees.

Management Statement

Digital is making a $1.5 billion dollar investment toward new product development. According to the president's letter, Digital is "continuing to invest heavily in VAX and RISC-based systems and VMS and UNIX software." Within the next year, "Digital's strategy is to focus on the computing environment of the 1990s. Digital will offer the widest selection of technology and continue to make significant investments in R&D and new products in response to dynamically changing customer needs."

Lack of monitor functionality affects HP capabilities and flexibility in a number of additional areas that are required for commercial transaction processing. For example, the HP system does not recognize OLPT users as one system process, meaning that they cannot start or stop an application in an orderly fashion. HP customers must bring down their entire system to apply changes. A Digital solution allows customers to make changes such as forms enhancements without stopping daily operations. This capability is referred to as rolling updates.

Decision Points

When compared to IBM's AS/400, Digital's VAX 4000 offers 15 times the growth and networking capabilities with a common software environment, better price/performance, superior data integrity, and multiple high-availability options. In addition, the VAX 4000 has a higher capacity for maximum memory, disk space, and number of subscribers—with a lower cost of ownership.

The data integrity protection on an AS/400 system is probably its weakest attribute. The database objects (programs, files, libraries) are stored across multiple disks for system I/O performance. This improves performance at the risk of data reliability and recovery time. The recovery issue is so serious, and time consuming, that mission-critical information should not be stored on the machine.

The VAX 4000, on the other hand, combined with volume shadowing software offers much greater data protection. Dual-host configurations provide even higher levels of data reliability, while boosting performance and adding high system availability.

Table 2. Mass Storage

Model	RF30B-DA	RF31B-DA	RF71B-DA
Type	Winchester (ISE)	Winchester (ISE)	Winchester (ISE)
Characteristics			
Controller model	Internal	Internal	Internal
Drives per subsystem/controller	3	14	3
Formatted capacity per drive (megabytes)	150	381	400
Average seek time (ms.)	21	15.3	21
Average rotational/relay time (rpm)	3600	Vendor did not specify	3600
Average access time (ms.)	29.3	23.6	29.3
Data transfer rate (bps)	1.5M	4.0M	1.5M
Supported by System Models	300	300	300
Purchase Price (basic)	$7,400	$8,500	$9,400

The VAX 4000 also provides a better choice for customers considering HP systems, since it offers better price/performance, higher system capacity, easy growth and migration paths, advantageous networking and compatibility, multiple high-availability options, and superior system security.

The VAX 4000 provides a superior solution to these competitors and offers customers virtually unlimited growth without changing operating systems, dynamic networking and routing through DECnet, an extensive library of applications, easy integration into multivendor and distributed environments, lower cost of ownership, and compatibility with a family of systems that fall into a wide range of prices covering the desktop to large data centers.

Characteristics

System Overview

The Vax 4000 Model 300 system is a 32-bit pedestal system that has over twice the power of the MicroVAX 3800 and 3900. It provides two times the storage capacity, twice the memory, and significantly more I/O performance than the 3800/3900 systems. System throughput is increased by combining an 8-VUP, CMOS-based CPU with disk and Ethernet microprocessor adapters on the system module. This integrated system allows memory, Ethernet, and disk traffic to bypass the Q-bus, making

the full Q-bus bandwidth available for application processing. The new memory architecture provides a bandwidth of 40M bytes/sec.

The VAX 4000 Model 300 system comes in three configurations: multiuser, server, and realtime. The multiuser and server configurations run VMS software to accelerate installation and startup. The realtime configurations include VAXELN software.

System Specifications

Data Formats

Basic Format: 32-bit word.

Memory

Main Memory: The VAX 4000 300 offers 32 megabytes of random access memory (RAM) that can be expanded up to 128 megabytes in 32-megabyte increments.

Cache Memory: Cache memory is standard on the VAX 4000 with 2K bytes of 28-ns memory on the chip and 128K bytes of 56-ns memory on the board.

Central Processor

The system's high-speed throughput of 1600 I/Os per second and packaging the size of a two-drawer filing cabinet that fits right into an office, make it highly suitable as a server, a distributed network system, and for I/O intensive applications in small businesses, departments, branch offices, factories, and warehouses.

Two Digital Storage Systems Interconnect (DSSI) controllers implemented directly on the CPU module via two RISC microprocessors, each with the processing power of 10 MIPS, and an ethernet interface with another 10-MIP RISC chip, remove communications and disk I/O functions from the Q-bus. This ensures high-speed throughput and no bandwidth limitations.

The system can handle up to 28 storage devices—seven for each of the four DSSI adapters. New 381M-byte half-height (RF31s) are available, with a 1G-byte drive slated for the near future. Customers can also use Q-bus-based RA Series drives. For backup,

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users can choose the 297M-byte tape (TK70) or the new high-capacity 1.2G-byte Digital Audio Tape drive (TLZ04) for unattended backup.

The VAX 4000 Model 300 system's maximum memory of 128M bytes allows more applications to reside in primary memory, reducing paging and swapping for a higher system performance. The memory bus has a 40M-bytes-per-second bandwidth which increases data throughput and enhances system performance by supporting increased CPU power. The VAXserver 4000 Model 300 can connect the Apple Macintosh, IBM OS/2 PC, Compac PC, SUN UNIX workstations, and Digital VMS and ULTRIX workstations using DEC lanWORKS and the VMS/ULTRIX Connection software products, included with every VAXserver 4000. It can also support 60 to 90 diskless workstations in I/O intensive environments.

Dual-host configurations for high availability offer customers virtually no single point of failure with the addition of VAX/VMS Shadowing Phase II software, a second Ethernet, and an uninterruptable power supply. The VAX 4000 Model 300 will be used in a wide range of commercial applications across most industries particularly manufacturing, financial services, distribution, government, education, and medical.

VAX 4000 Easy System Upgrades

To help customers migrate to the performance of the VAX 4000, Digital has added four new migration paths to its popular Easy System Upgrade program. The new Easy System Upgrades provide hardware and software upgrades, plus one year of services for one low price. Additionally, Easy System Upgrades allow customers to keep existing systems, providing ample time for a smooth transition to the VAX 4000.

Each VAX 4000 Easy System Upgrade delivers the following components:

- Software Upgrades for all Digital VMS-layered software products (except ALL-IN-1),
- Built-in credit for old (existing) system,
- VAX 4000-300 system,
- VMS paid-up license,
- VMS and DECnet paid-up licenses,
- One year of standard hardware warranty,
- One year of software product services (except ALL-IN-1),
- Installation of new hardware, deinstallation of existing hardware, reconnection of CPU options
- One year "Keeper Option" providing up to 12 months to return existing hardware.

Easy System Upgrades provide cabinet upgrades for Digital customers demanding the power and performance of MicroVAX 3000, VAX 6000, and now the VAX 4000.

Rack-mountable VAX 4000 Model 300

The rack-mountable VAX 4000 Model 300 systems are identical to the pedestal-mounted systems with the exception of the rack-mountable BA441 system chassis. The following are key features of the rack-mountable chassis:

- Requires only 14 inches of vertical rack, cabinet, or enclosure space
- Conforms to standard 19-inch rack mounting specifications
- Functionality is identical to pedestal mounted VAX 4000 systems
- Multiuser VAX, VAXserver, and rtVAX (realtime) rack-mountable system versions are available
- Front-to-back cooling allows space-efficient vertical system stacking
- Slide equipped for easy servicing and configuring
- No computer room, air-conditioning, or special power required
- Can be installed in environmental cabinets for use in harsh environments
- Factory-installed operating system software for quick and easy startup

Input/Output Control

I/O on the VAX 4000 Model 300 is handled through two Digital Storage Systems Interconnect (DSSI) Controllers implemented directly on the CPU module via two RISC processors. These two controllers, each with 10 MIPS of processing power, and an ethernet interface with another 10-MIP RISC chip, remove communications and disk I/O functions from the Q-bus.

Two Q-bus systems in a dual-host configuration use RF-series storage devices, the DSSI bus, Ethernet, VMS, DECnet, and VAXcluster software to create dual paths to the ISEs. If one system in the configuration fails or is unavailable, users are still able to access data on all ISEs through the second system. Any VAX 4000 Model 300 or Q-bus VMS MicroVAX system can be included in a dual-host configuration.

Configuration Rules

The system's enclosure, the BA440, is designed for use in open workspace environments outside of the computer room. It provides four storage compartments the house ISEs and tape drives. The BA440 provides five dedicated slots for the system and memory modules and seven slots for Q-bus options. The enclosure's power supply and greater cooling capacity make this a very quiet system. Two separate hinged doors on the enclosure allow ease of access to system components, and a lock provides three levels of security. A built-in power supply automatically selects the correct voltage range for either 120-V or 240-V operation.

The DSSI ISEs available for the VAX 4000 Model 300 system are 5.25-inch storage devices that feature

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Table 3. Workstations

Model	VT 320	VT 330	VT 340	VT420	VT 1000
Display Parameters					
Max. chars./screen	3,168	3,168	3,168	3,840	3,168
Buffer capacity	19K characters	19K characters	19K characters	12K characters	1M byte ROM expandable to 4
Screen size (lines x chars.)	24 x 80 or 132	24 x 80 or 132	24 x 80 or 132	24/25/36/48/ x 80 or 132	24 x 80 or 132
Tilt/swivel screen	Optional	Standard	Standard	Standard	Standard
Symbol formation	7 or 12 x 7 dot matrix	8 or 9 x 11 (80 col.); 4 or 5 x 9 (132 col.)	8 or 9 x 11 (80 col.); 4 or 5 x 9 (132 col.)	7 or 12 x 7 dot matrix	8 or 9 x 11 (80 col.); 4 or 5 x 9 (132 col.)
Character phosphor	White, green, or amber	White, green, or amber	16 colors, 16 shades of grey	White, green, or amber	Monochrome
Total colors/no. simult. displayed	Not applicable	4 shades of grey	4,096/16	Not applicable	Not applicable
Keyboard Parameters					
Style	Typewriter	Typewriter	Typewriter	Typewriter	Typewriter
Character/code set	ASCII, NRCS, ISO Latin 1, Digital Special Graphics and supplemental	ASCII, NRCS, ISO Latin 1	ASCII, NRCS, ISO Latin 1	ASCII, NRCS, ISO Latin 1, Digital Special Graphics and supplemental	ASCII, NRCS, ISO Latin 1, Digital Special Graphics and supplemental
Detachable	Yes	Yes	Yes	Yes	Yes
Program function keys	15	15	15	15 shiftable to 30	15
Terminal Interface	DEC-423, RS-232-C	DEC-423, RS-232-C	DEC-423, RS-232-C	DEC-423, RS-232-C	DEC-423, RS-232-C
Purchace Price	$572	$1,795	$2,595	$629	$2,695 (15"); $3,395 (19")
Comments	1200 x 300 pixel resolution	800 x 500 pixel graphics array; supports split-screen viewing, ReGIS, Sixels, Tektronic 4010/4014	800 x 500 pixel graphics array; supports split screen viewing, ReGIS, Sixels, Tektronic 4010/4014	800 x 414 pixel resolution	DEC's windowing terminal for access to multiple applications in a network environment; 1024 x 864 resolution

dedicated intelligent controllers embedded in each device. These devices are housed in special mounting brackets for simplified installation in the new BA400 enclosures. The 381M-byte RF31 ISE with DSSI is designed to provide optimum performance on VAX 4000 Model 300 at 30 percent to 40 percent higher performance than the RF71 ISE disks.

With the VAX 4000 Model 300 system, the two DSSI adapters on the system module provide the ability to make two separate dual-host connections—a double DSSI dual-host configuration. The combination of this dual DSSI dual-host configuration and VMS Volume shadowing Phase II software offers an even higher level of data availability and redundancy capabilities once available only with CI-based VAXclusters.

Input/Output Units
Refer to Table 2 for mass storage devices, Table 3 for workstations, Table 4 for printers, and Table 5 for magnetic tape.

Magnetic Tape
The TK70 streaming cartridge tape drive is the entry-level backup drive available for the VAX 4000 Model 300. The 48-track TK70 employs a 5¼-inch form factor and features a streaming speed of 100 ips and density of 10,000 bpi. The TK70 uses 296M-byte, ½-inch CompacTape-II tape cartridges (developed by Digital in conjunction with the 3M Company) which hold the entire contents of the 280M-byte RA70 disk drive. The TK70 transfers data at 90K bytes per second and features ECC, CRC, and a read-after-write procedure to verify data.

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Table 4. Printers

MODEL	LPS20	LPS40 Plus	LG31	LP29	LG01/LG02
Type	Laser	Laser	Line dot-matrix	Band	Line dot-matrix
Speed	20 ppm	40 ppm	300 lpm	2,000 lpm	600 lpm
Bidirectional printing	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Paper size	7.5 to 11 in. wide; 10.5 to 17 in. long	7.5 to 11 in. wide; 10.5 50 17 in. long	4-16 in. wide, 3-20 in. long	3.50-18.75 in. wide, 3-20 in. long	4-16 in. wide, 3-20 in. long
Character formation	Electrophotographic	Electrophotographic	Dot matrix	Full	Dot matrix
Horizontal character spacing (char/inch)	Variable	Variable	5, 10, 12, 13.3	10	5, 10, 12, 15 (LGO1); 5, 10, 12, 13.3, 15, 16.7 (LG02)
Vertical line spacing (char/inch)	Variable	Variable	6, 8, 10	6 or 8	6, 8, 10 (LG01); 6, 8, 10, 12 (LG02)
Character set	29 resident typefaces	29 resident typefaces	64/96	96 ASCII or 64 uppercase	64 (data proc. mode)
Controller/Interface	Ethernet	Ethernet	EIA-232	Parallel	EIA-232/Parallel
Printer dimensions, in. (h x w x d)	50 x 37 x 27	40 x 60 x 28	46 x 29 x 40.6	49 x 35 x 49	38 x 33.5 x 22.3
Graphics capability	No	No	Sixel	No	LGO2 only (Sixel)
Purchase price	$24,045	$52,395	$8,390	$36,645	$11,539 (LGO1); $13,639 (LGO2)
Comments	Ethernet-based print server	Ethernet-based print server			LGO1 text printer upgradable to LGO2 text/ graphics printer

Additionally, the VAX 4000 supports the TU81-Plus tape subsystem, which is also employed by Digital's VAXBI-based VAX systems and UNIBUS PDP-11 computers. The TU81-Plus is designed for applications requiring sustained input/output, such as disk backup, data archiving, data interchange, and recording of data from high-speed test equipment. This PE/GCR unit features a 256K-byte buffer, 1600/6250 bpi recording densities, and a streaming speed of 75 ips. A nine-track unit that employs ½-inch tape, the TU81-Plus also features a 25-ips start/stop speed and storage capacities of 145M bytes in GCR mode and 40M bytes in PE mode. Data transfer speed is 468K bytes per second.

Communications

The variety of communications interfaces supported by the VMS operating system allows VAX systems to be connected to other VAX systems, to other Digital systems, and to other manufacturers' computer systems. Synchronous, point-to-point, and multipoint connections are supported for interprocessor communications.

Software

Operating System: Operating system for the VAX 4000 systems is the general-purpose VMS.

VMS
VMS (also known as VAX/VMS) is a general-purpose operating system that provides the environment for the concurrent execution of multiuser timesharing, batch, and time-critical applications. It also contains special features for VAXcluster support and provides programming tools, scheduling services, and protection mechanisms for multiuser program development.

VAXeln
VAXeln, which is not so much an operating system as a development tool and specialized runtime environment, acts as a compatible subsystem to the VMS operating system for development of applications in realtime control and distributed computing environments. It consists of development utilities for creating target applications and a runtime kernel of device drivers and service code

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Table 5. Magnetic Tape Equipment

Model	TK70E-AA	TLZ04-JA	TU81E-SA
Type	0.50-inch cartridge	4-mm. cartridge	0.50-inch reel-to-reel
Format			
Number of tracks	48	Vendor did not specify	9
Recording density (bpi)	10,000	Vendor did not specify	1,600/6,250
Recording mode	Serial, serpentine pattern	Digital Data Storage (DDS)	GCR/PE
Characteristics			
Controller model	Q-bus adapter	SCSI	Q-bus adapter
Storage capacity (bytes)	296M formatted	1.2G	145M (GCR); 40M (PE)
Tape speed (ips)	100 streaming	—	75/25
Data transfer rate (units per second)	125K bytes	183K bytes	468K bytes
Streaming technology	Yes	Yes	Yes
Supported by System Models	300	300	300
Purchase Price (basic) ($)	1,995	4,900	34,283
Comments		Helical scan rotating head	

A dash (—) in a column indicates that the information is unavailable from the vendor.

that becomes a part of each application. After development, VAXeln applications run standalone on VAX 4000 Model 300 target systems without the host operating system. VAXeln applications are written in an optimizing version of Pascal or C.

Database Management
The VAX 4000 employs the VAX database management or information management architecture, which is arranged in layers above the operating system.

Digital's DBMS products figure prominently in *DECtp*, a largely software-based systems environment that integrates facilities for developing distributed transaction processing applications: databases, storage systems, data interoperability products, transaction processing monitors, and support programs. These products run on most MicroVAX (including VAXstation) and VAX Systems. DECtp includes the following major software components:

- DECintact, a transaction processing (TP) monitor intended for high-volume applications requiring transaction integrity, application availability, and transaction system recovery.

- VAX Rdb/VMS, an enhanced version of Digital's relational database management system (RDBMS).

- VAX SQL, Digital's implementation of the Structured Query Language (SQL) database facility.

- VAX CDD/Plus Common Data Dictionary, which provides a single, logical repository for data definitions (metadata) and descriptions in a distributed environment.

- VAX Rally, a fourth-generation tool for VAX Rdb/VMS database applications.

- VAX DBMS, a general-purpose, Codasyl-compliant network database management system (DBMS) designed to handle high transaction volumes for numerous, concurrent users.

- VAX Data Distributor, which allows relational databases to be replicated across a distributed TP environment.

- VAX ACMS, an enhanced version of Digital's ACMS TP monitor and fourth-generation language facility.

- VAX TDMS, which enables TP system users to manage forms and other data presentation facilities by separating forms data from application code.

- DEClink software, which provides access to IBM databases. One component package, VAXlink, bridges Digital's Rdb/VMS data bases and IBM's IMS and VSAM structures so that data can be copied from IBM mainframes into distributed VMS environments. VIDA with IDMS/R, the other constituent DEClink package, allows users on a VAX system to log on to a central IBM system through an SNA gateway and use data in CA-IDMS/DB databases.

Other Software

Languages: Programming languages available for the VAX 4000 Model 300 include Ada, APL, Basic, Bliss-32, C, Cobol, Dibol, Digital Standard Mumps (DSM), Fortran, OPS5 (for artificial intelligence applications), Pascal, PL/1, RPG II, and Lisp.

Communications: Like the larger VAX systems, the VAX 4000 supports the *Digital Network Architecture (DNA)*, a set of protocols governing the format, control, and sequencing of message exchange for all DECnet implementations.

Network Applications Support (NAS)
As another part of its strategy for multivendor networking, Digital provides *Network Applications Support* (NAS) products that allow common access to services on DECnet/OSI networks. Those products provide application access, business communications, and information/resource sharing services for Digital's VT Series

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terminals, based on VAX Systems running either VMS or UNIX, Apple Macintosh microcomputers, and MS-DOS- and OS/2-based PCs. NAS provides common services across VMS and ULTRIX. For example, DECwindows allows users to access applications running on both operating systems. Digital's Compound Document Architecture (CDA) allows all types of data (including text and graphics) to be shared across VMS and ULTRIX systems.

Digital provides toolkits, documentation, and training for CDA application developers. Over time, the toolkit and documentation will become standard components of all VMS- and ULTRIX-32-based systems. The company has also published a manual of specifications for the Digital Document Interchange Format (DDIF); a technical description of CDA toolkit routines; and information on the CDA Converter, which is designed to simplify development of software converters.

Digital is committed to its NAS strategy for the 1990s and plans to announce new and enhanced NAS services to continually enhance the NAS platform.

Local Area VAX Cluster Phase II (also called LAVC 2) allows LAVCs to be connected over Ethernet to VAXclusters of VAX superminis and Hierarchical Storage Controllers (HSCs) linked by Digital's Computer Interconnect (CI). The workstations and supermicros thus have access to the far greater computational and storage facilities offered by the larger VAX systems.

LAVC 2 creates a so-called mixed interconnect VAXcluster in which the CI- and HSC-connected VAX systems service boot and I/O requests from the computers in the LAVC.

Remote System Manager (RSM), layered on top of Digital's DECnet software, is a central management facility for distributed systems. It permits a VAX 4000 or a VAX running RSM *server* software to perform system management functions for other VAX systems running RSM *client* software in an Ethernet LAN. The number of clients supported varies with the size, power, and storage of the server. According to Digital, the range runs from a minimum of 5 MicroVAX systems under a MicroVAX II server to a maximum of 40 VAXstations with a VAX server.

Because RSM software is layered over DECnet, it provides a complete range of DECnet functionality, including electronic mail, file transfer, network management, and multivendor interconnect capabilities.

The MicroVAXs support Digital's **Internet** products, which connect VMS-based Digital computers and Digital networks to systems built by IBM and other manufacturers.

DECnet/SNA Gateway-Channel Transport (CT) and Gateway-Synchronous Transport (ST) provide users of IBM's SNA with a network-to-network interface to Digital applications. Using either gateway, users can simultaneously perform large quantity processing functions, such as terminal emulation, file transfer, and mail and document exchange; they can also distribute applications between Digital and SNA systems.

Applications

More than 6,000 applications can run unmodified on the VAX 4000 Model 300 systems. Digital also relies heavily on third-party software vendors to provide specialized applications software for various industries and marketplaces. Digital enters into Cooperative Marketing Program (CMP) relationships with firms that are leading application solutions suppliers in specific vertical market segments. System Cooperative Marketing Program (SCMP) participants are OEMs that offer their applications products in combination with Digital hardware.

Operating Environment

The VAX 4000 Model 300 operates between 50 and 104 degrees Fahrenheit and within a humidity range of 20 to 80 percent (noncondensing). The physical and environmental specifications of the VAX 4000 are highlighted in the following tables.

Physical Specifications

Model	Height (in.)	Width (in.)	Depth (in.)	Weight (lb.)
300	27.1	20.8	17.7	145

Electrical Specifications

Model	Voltage	Amperage	Power Consumption (watts)
300	120/240	11.2/5.85	860

Support Services

Documentation: Hardware documentation is included with each VAX 4000. The documentation consists of owner and technical manuals. Documentation kits are optionally available for selected software packages; the kits include reference manuals, user's guides, and other instructional materials.

Training/Education: Digital maintains over 25 training centers worldwide. Courses covering both Digital-related and non-product-related topics are offered. A variety of instructional methods is used, including instructor-led courses and self-paced instruction. Digital's Educational Services division publishes a digest listing available courses four times a year. On-site training at the customer's installation can also be provided.

Warranty: The VAX 4000 Model 300, as well as all peripherals, are covered by a one-year warranty with different levels of service. The minimum option—List Price Warranty—features one year of "return to Digital" support for parts and one year of conformance warranty for software. The alternative System Warranty Support is offered at an increased price, and includes Basic Support Service. Standard Warranty Support prices are generally 10 to 20 percent higher than List Price Warranties. Warranty coverage can be extended for up to three years.

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Maintenance: Digital's Field Service organization offers both on-site and off-site support services for the MicroVAX Family. Services include the Basic Service Agreement, Recover-All service, and per-call service. Off-site maintenance is available through Digital's Customer Returns Center, Product Repair Center, and Digital Servicenters, which are all equipped with parts inventories, special diagnostic systems, and repair kits.

Pricing

Policy: Digital provides the VAX 4000 Model 300 systems on a purchase basis, with separately priced maintenance agreements. Leasing arrangements are available through Digital's U.S. Customer Finance Group.

Digital software is licensed rather than sold. Users purchase licenses and distribution rights separately.

The company provides a number of licensing options for VMS software, including Clusterwide licensing.

The price of a VAX System includes operating system and DECnet licenses. The PPL option for those products includes the initial license charge and 12 months of PPL fees for both products.

Digital offers a Volume Software Pricing program that allows users to acquire large numbers of licenses for a single product at a discount; options for a single software product run from 8-license to 160-license bundles.

Prices for VAX 4000 hardware and related software are provided in the following Equipment Prices.

NOTE: The prices listed are for Standard Warranty Support. List Warranty prices, which do not include Basic Service Support, are generally 10 to 20 percent less. Contact the manufacturer for more information on pricing and support.

Equipment Prices

		Standard Purchase Price ($)
VAX 4000 Model 300 Systems		
VMS Timesharing System	VAX 4000 Model 300; includes 32MB of memory, a 600-watt power supply, four storage bays for 5.25-inch storage devices, seven Q-bus backplane and three memory expansion slots, a DECnet-VAX license, and a choice of the VMS operating system or VAXELN target licenses. Prices for an RF31 disk drive and TK70 streaming tape have been added to this configuration	106,850
Dual-Host Timesharing System	VAX 4000 Model 300; includes 32MB of memory, a 600-watt power supply, four storage bays for 5.25-inch storage devices, seven Q-bus backplane and three memory expansion slots, a DECnet-VAX license, and a choice of the VMS operating system or VAXELN target licenses. Prices for an RF31 disk drive and TK70 streaming tape have been added to this configuration	233,230
VAXserver 4000 Model 300	VAX 4000 Model 300; includes 32MB of memory, a 600-watt power supply, four storage bays for 5.25-inch storage devices, seven Q-bus backplane and three memory expansion slots, a DECnet-VAX license, and a choice of the VMS operating system or VAXELN target licenses. Prices for an RF31 disk drive and TK70 streaming tape have been added to this configuration	75,410
Dual-Host Server	VAX 4000 Model 300; includes 32MB of memory, a 600-watt power supply, four storage bays for 5.25-inch storage devices, seven Q-bus backplane and three memory expansion slots, a DECnet-VAX license, and a choice of the VMS operating system or VAXELN target licenses. Prices for an RF31 disk drive and TK70 streaming tape have been added to this configuration	135,730
rtVAX 4000 Realtime System	VAX 4000 Model 300; includes 32MB of memory, a 600-watt power supply, four storage bays for 5.25-inch storage devices, seven Q-bus backplane and three memory expansion slots, a DECnet-VAX license, and a choice of the VMS operating system or VAXELN target licenses. Price does not include disk tape	56,970
Memory		
300	32MB ECC CMOS memory increment for VAX 4000 Model 300	25,000
Mass Storage		
RRF30-DA	150MB disk drive	7,400
RF31B-DA	381MB disk drive	8,500
RF71B-DA	400MB disk drive	9,400
Optical Disk		
RRD40-SA	600M-byte Compact Disk Read-Only Memory (CD-ROM) disk drive with cables; includes KRQ50 controller; uses one Q-bus slot	1,864

NA—Not applicable.
NC—No charge.

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		Standard Purchase Price ($)
Magnetic Tape		
TQK50-BA	TK50 controller with cables for BA123 enclosure	1,333
TBZ04-JA	1.2GB Digital Audio Tape (DAT) drive	4,900
TK70E-AA	296M-byte TK70 tape drive	1,995
TU81E-SA	TU81-Plus 1600/6250 bpi PE/GCR tape drive	34,283
Printers		
LA75-CA	32/42/125/250 cps dot matrix tabletop printer	835
LA324-CA	100/300 cps dot matrix printer	2,095
LJ252-CA	160 cps color dot matrix tabletop printer	1,750
LG02-DA	600 lpm text and graphics printer	13,639
LN03S-AA	LN03 Plus 8-ppm desktop graphics laser printer; includes 1M-byte RAM, Modern Gothic typeface, two toner cartridges, organic photoreceptor cartridge, AC power cord, toner collection bottle, 250 sheets of letter-size paper, and documentation	4,739
Workstations/Terminals		
VT320-AA	White text terminal with standard keyboard	572
VT330-AA	White graphics terminal with standard keyboard	1,795
VT340-AA	Color graphics terminal with standard keyboard	2,595

NA—Not applicable.
NC—No charge.

Software Prices

		License Fee ($)
Operating Systems		
QL-001A2-BK	VMS (1-40 user) for VAX 4000	33,750
QL-001A2-BZ	VMS unlimited license	45,000
QL-001A2-B4	VMS (41-Unlimited user) upgrade license	11,250
QL-001AC-BA	VMS File and Application Server license-bundled	NC
Database Management		
QL-898A9-JB	VAX Datatrieve	1,683
QL-899A9-JB	VAX DBMS	4,777
QL-D07A9-JB	VAX Rdb/ELN	1,401
QL-VCLA9-JB	VAX Rdb/VMS interactive	1,897
Communications		
QL-453A9-JB	DECnet/SNA VMS Remote Job Entry	301
QL-454A9-JB	DECnet/SNA VMS 3270 Terminal Emulation	301
QL-VEBA9-JB	DECnet/SNA VMS Data Transfer Facility Server	1,505
QL-112A9-JB	VAX 2780/3780 Protocol Emulator	1,450
Languages		
QL-100A9-JB	VAX Fortran	967
QL-126A9-JB	VAX Pascal	880
QL-114A9-JB	VAX PL/1	1,488
QL-015A9-JB	VAX C	890
QL-099A9-JB	VAX Cobol	1,488
QL-056A9-JB	VAX Ada	4,692
QL-020A9-JB	VAX APL	1,476
QL-095A9-JB	VAX Basic	991
QL-106A9-JB	VAX BLISS-32 Implementation Language	1,079
QL-A97A9-JB	VAXELN Ada	1,401
Utilities and Tools		
QL-YELA9-JB	VAX Disk stripping	372
QL-081A9-JB	VAX Encryption	372
QL-A86A9-JB	VAX Rally	5,208

NA—Not applicable.
NC—No charge. ■