DEC VAXstations

MANAGEMENT SUMMARY

UPDATE: *Based on the same hardware architecture and operating system software as the MicroVAX II, the VAX-stations were formerly covered in the "DEC MicroVAX II" report in Datapro Reports on Minicomputers. With the introduction of the low-end VAXstation 2000, and because of rapid growth in the technical workstation market, the VAXstations now warrant coverage in this separate, new report. Because of compatibility between the VAXstations and the MicroVAXs, as well as the VAX superminicomputers, this report frequently refers the reader to information provided in reports on those systems.*

From its inception in 1981, the technical workstation market has grown very rapidly. Much of the activity in this market can be attributed to intelligent, technically sophisticated users who have clearly defined needs and who are ready, willing, and able to exchange manual design methods for an electronic design screen. In addition to being greeted by receptive users, the technical workstation emerged into a market at a time when much of the groundwork for its implementation was already being laid in other computing sectors: standards were being established, powerful off-the-shelf microprocessors and networking products were becoming available, and departmental processing was becoming a trend. Thus, bringing the technical workstation to market has been a directed effort rather than a haphazard approach of trying to figure out by whom and how it could be used.

By the time Digital Equipment Corporation introduced the VAXstation II in 1985, the industry leaders—Apollo Computer and Sun Microsystems, who together now have a little over 50 percent of the market—had already been ▷

The VAXstations are technical workstations that can be used in standalone, networked, or clustered configurations. The systems are software compatible with Digital's MicroVAX II and 2000, and with the company's VAX superminis.

MODELS: VAXstation II, VAXstation II/GPX, VAXstation 2000.
MEMORY: 2MB to 16MB.
DISK CAPACITY: 0 or 42MB to 477MB.
WORKSTATIONS: Up to 3 monitors.
PRICE:$10,125 to $63,395 (base configuration prices).

CHARACTERISTICS

VENDOR: Digital Equipment Corporation (DEC), 146 Main Street, Maynard, Massachusetts 01754-2571. Telephone (617) 897-5111.

CANADIAN ADDRESS: Digital Equipment of Canada, Ltd., P.O. Box 13000, 100 Herzberg Road, Kanata, Ontario, K2K 2A6. Telephone (613) 592-5111.

DATA FORMAT

BASIC UNIT: 32-bit word.

INTERNAL CODE: ASCII for text-oriented data; binary for calculations.

MAIN STORAGE

Memory is dynamic parity MOS RAM. Main memory cycle time is 400 nanoseconds. Main memory increments are ▶

Digital Equipment Corporation's VAXstation 2000 is a desktop technical workstation designed for use in networked and clustered configurations, especially for technical computing in corporate environments. The workstation runs Digital's proprietary MicroVMS operating system and MicroVMS Workstation Software or the Unix-derivative Ultrix-32m and Ultrix-32w workstation software.

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CHART A. SYSTEM COMPARISON

MODEL	VAXstation II	VAXstation II/GPX	VAXstation 2000
SYSTEM CHARACTERISTICS			
Date of introduction	May 1985	January 1986	February 1987
Date of first delivery	—	March 1986	—
Microprocessor type	MicroVAX 78032	MicroVAX 78032	MicroVAX 78032
Microprocessor cycle time	200 ns	200 ns	200 ns
Operating system	MicroVMS, Ultrix-32m	MicroVMS, Ultrix-32m	MicroVMS, Ultrix-32m
Upgradable from	Not applicable	Not applicable	Not applicable
Upgradable to	Not applicable	Not applicable	Not applicable
Number of serial/parallel I/O ports	—	—	—
Number of expansion slots	8	8 (BA23); 12 (BA123)	0
MEMORY			
Minimum capacity (bytes)	2M	5M	4M
Maximum capacity (bytes)	16M	16M	6M
DISK STORAGE			
Minimum capacity (bytes)	71M	0 or 71M	0 or 44M
Maximum capacity (bytes)	477M	477M	142M
NUMBER OF WORKSTATIONS	1	3	1
COMMUNICATIONS PROTOCOLS	DECnet, TCP/IP, Ethernet, SNA, X.25	DECnet, TCP/IP, Ethernet, SNA, X.25	DECnet, TCP/IP, Ethernet, SNA, X.25

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

▷determined. It would have been difficult for Digital to successfully enter this market if the company were not already well established in engineering and scientific computing environments, the primary markets for technical workstations at that time. Most of the demand for VAXstations has come from Digital's large installed base of technical users. Digital has also led the way in the move toward departmental processing, maintaining a focus on producing compatible systems with good connectivity features that allow intersystem communication within Digital and multivendor enviroments. Intended for use in small workgroups, the VAXstations are a logical downward extension of Digital's departmental systems strategy. Based on the MicroVAX II—the industry's leading supermicrocomputer—the VAXstations are both software and hardware compatible with the entire line of Digital supermicros and superminicomputers, enabling the workstations to fit into existing Digital departmental computing environments.

Digital's current workstation offerings include the VAXstation II, the VAXstation II/GPX, and the VAXstation 2000. The VAXstation II, which supports a monochrome monitor, is suitable for applications such as Computer-Aided Software Engineering (CASE), data acquisition and laboratory analysis, and desktop publishing.

The VAXstation II/GPX, which supports either monochrome or color monitors, an 8-plane or up to three 4-plane graphics co-processors, and up to three users, is suitable for traditional Computer-Aided Design/Manufacturing/Engineering (CAD/CAM/CAE) applications.

Because of its low cost, the VAXstation 2000, equipped with a GPX-compatible graphics co-processor, is suitable for users who cannot afford the more expensive Digital workstations. The VAXstation 2000 is intended for business environments where several workstations may be required for applications such as financial analysis. The VAXstation 2000 is also highly suitable for configuration in ▷

▶1MB, 2MB, and 4MB on the VAXstation II, 2MB and 4MB on the VAXstation II/GPX, and 2MB on the VAXstation 2000. Like all VAX and MicroVAX systems, the VAXstations provide up to 4GB of virtual memory space.

PROCESSING COMPONENTS

The VAXstations utilize the same MicroVAX 78032 CPU, MicroVAX 78132 Floating Point Unit (FPU), and VAX instruction set as the MicroVAX II. A description of these processing units and the implementation of the instruction set are provided in the "DEC MicroVAX II and 2000" report in *Datapro Reports on Minicomputers*.

The VAXstation II/GPX also features the GPX graphics co-processor, which offloads text and graphics computations from the CPU. The GPX graphics co-processor provides a display list interface that supports a range of raster operations in hardware, including bit-blt with rotation, fractional scaling, and Boolean operations; vector and text drawing; hardware clipping, tiling (stippling), and pattern fill; and smooth scrolling in both vertical and horizontal planes. The graphics co-processor also resolves conflicts resulting from the interaction of multiple video processes, such as CRT refresh, scrolling, and screen updates with new data. The GPX processor operates at speeds up to 560M bits per second.

The GPX graphics co-processor is closely coupled to the double-buffered video memory. Graphic information is stored in video memory rather than in the system memory or on the disk, resulting in faster text and graphics drawing speeds. The co-processor can also independently access display list instructions in virtual memory using Direct Memory Access (DMA).

The GPX graphics co-processor offers either four or eight planes of display memory. The four-plane system has a display capability of 16 simultaneous colors from a palette of 16 million on a color monitor, or 16 simultaneous shades of gray on a monochrome monitor. The eight-plane system has a display capability of 256 simultaneous colors from a palette of 16 million. Each plane is a 1K-by-1K-by-2 video bit-map display. The "2" indicates an off-screen page that stores occluded or predrawn images.

The VAXstation 2000 utilizes a graphics co-processor that is based upon and performs the same graphics functions as ▶

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▷existing Local Area VAXclusters (LAVCs)—an interconnected group of up to 13 MicroVAXs, VAXstations, or VAXs—increasing the number of user seats, in a localized configuration, at a much lower cost.

COMPETITIVE POSITION

Though it comes in a distant fourth, with about eight percent of the market, Digital is counted among the top five technical workstation vendors. The market shares of the top three vendors—Apollo Computer, Sun Microsystems, and Hewlett-Packard, each with roughly 25 percent of the market—have jelled, but are far from fixed. There is still room, particularly at the low-end, for Digital and fifth-ranked IBM to elbow their way in and increase their own market shares, especially within their own installed bases. The top five vendors are now engaged in a price/performance ratio tug-of-war, trying to win sales by dropping prices on existing models, introducing new low-end models, and increasing performance at the upper end of their product lines.

In light of the growing competition between IBM and Digital in the departmental systems arena, it is important that these two vendors offer systems that compete with each other, even more so than with systems from the top three contenders. Digital must continue to challenge IBM, and IBM must leave no gaps through which Digital can further infiltrate the corporate environment. The RT PC, particularly the recently enhanced models, is IBM's defense against Digital for technical computing in corporate environments, Digital's newest targets. Also, because IBM's traditional markets—personal computers and mainframes—have matured, it is important that IBM seek out new markets to increase its sales. Unfortunately for IBM, the RT PC is yet another system that is incompatible with the rest of the company's product line. However, it does act as a doorstop, keeping opportunities open in the technical workstation arena until higher-end PS/2 models that run Unix are available.

Most of the sales opportunities today are to be found at the low end of the workstation market, but it is here that Digital faces the most competition. Digital's purpose in introducing the low-end VAXstation 2000 is to attract sales from users who cannot afford a more expensive VAXstation model, and hence might purchase a low-end system from a competitor. By offering an inexpensive alternative, Digital may undercut sales on its higher-end workstations, but may also sell enough of the lower priced models to make up the difference. Most of the demand for the VAXstation 2000 will come from Digital's large installed base; however, the system also provides an inexpensive way for new users to gain entry into the VAX product line.

It is interesting to note that in March of this year when Digital raised prices on the MicroVAX II System Building Blocks and MicroVMS operating system—raising the price of large configurations by up to 40 percent—prices remained unchanged on the VAXstation hardware, and the price of the two-user MicroVMS license for the VAXsta- ▷

▶the GPX graphics co-processor. The VAXstation 2000 graphics co-processor is packaged on a daughter card that is tightly coupled to the single system board.

System electronics require four boards on the VAXstation II and II/GPX, but have been reduced to one board on the VAXstation 2000 by using a large-scale integration and proprietary standard cell and surface mount technologies.

INPUT/OUTPUT CONTROL

I/O on the VAXstation II and II/GPX is handled through the 22-bit extended Q-bus (also called the Q22), which provides a common communications path for the data, address, and control information passed among the CPU, memory, and device interfaces. The Q-bus provides 22-bit addressing and four interrupt levels and performs block mode DMA data transfers on a bandwidth of up to 3MB per second.

The VAXstation 2000, like the MicroVAX 2000, is based on a busless architecture and has no expansion slots. It is equipped with a modified Small Computer Systems Interface (SCSI) port designed to connect the expansion cabinet housing a TK50 tape drive and additional disk drive.

CONFIGURATION RULES

The Vaxstation II is a multiwindowing, multiprocessing, single-user graphics station. The CPU, FPU, and other components are housed in a BA23 or BA123 pedestal enclosure. The VAXstation II includes a graphics subsystem and 19-inch, 60 Hz monochrome monitor with 864 vertical by 1024 horizontal pixel resolution. It can support up to 16MB of main memory and 477MB of disk storage (through three 159MB RD54 disks); the DEQNA Ethernet interface is standard.

The VAXstation II is available in the following configurations:

- The entry-level VAXstation II/RC is housed in the BA23 enclosure with 3MB of memory, a TK50 95MB tape drive, a 71MB RD53 Winchester disk, DEQNA, VMS or Ultrix, and workstation software licenses, a three-button mouse, and display monitor. A 5MB configuration is also available.

- The VAXstation II is housed in the BA123 enclosure with 5MB of memory, a TK50 tape drive, an RD53 Winchester disk, DEQNA, VMS or Ultrix, and workstation software licenses, a three-button mouse, and display monitor. A 5MB configuration is also available.

- The Ada Workstation is housed in the BA23 enclosure with 2MB of memory, a TK50 tape drive, an RD53 Winchester disk, DEQNA, a VAX/Ada license, VMS and workstation software licenses, three-button mouse, and display monitor.

- The Artificial Intelligence Workstation is housed in the BA123 enclosure with 5MB of memory, the TK50 tape drive, an RD53 Winchester disk, DEQNA, VAX/Lisp license, VMS and workstation software licenses, a three-button mouse, and display monitor.

- The VAXstation II System Building Blocks in both the BA23 and BA123 enclosures include 1MB of memory.

The VAXstation II/GPX comes with a 4-plane (BA23 enclosure) or 8-plane (BA123 enclosure) graphics co-processor; a 19-inch gray-scale or color monitor (the latter capable ▶

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CHART B. DISK/DISKETTE DEVICES

MODEL	RX33	RX50	RD32	RD53	RD54
Type	Diskette	Dual Diskette	Winchester	Winchester	Winchester
Size (inches)	5.25	5.25 per diskette	5.25	5.25	5.25
Number of surfaces	2 per diskette	1 per diskette	—	—	—
Formatted capacity per drive (bytes)	1.2M	818K (409K per diskette)	42.8M	71M	159M
Interface/controller	—	RQDX3	ST412/506	RQDX3	RQDX3
Number of drives per interface/controller	—	—	—	—	—
Average access time	—	264 ms	48.3 ms	38.3 ms	38.3 ms
Data transfer rate	500K bps	250K bps	5M bps	625KB/sec.	625KB/sec.
Sectors/tracks per surface	160 per diskette	80 tracks/diskette	—	—	—
Bytes per sector/track	512/sector	512/sector	512/sector	512/sector	512/sector

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

tions was cut in half, from $2,000 to $1,000. Digital can afford to increase prices on the MicroVAX II and not suffer an extreme loss of sales because it is such a popular system. Demand for the VAXstations, however, is not nearly as great. With other vendors dropping prices to increase their price/performance ratios, Digital must follow suit to keep its workstation products competitive.

The leading vendor's product that offers the VAXstation 2000 the most competition is the Sun Microsystem's 3/100 Model 75. Both workstations run a Unix-based operating system. Digital's Ultrix-32m is based on AT&T's Unix System V, while Sun is in the process of integrating both Unix System V and the Berkeley version in its SunOS operating system, enabling the Sun workstations to run software written for both versions of Unix. The advantage of this additional software support, however, can be counterbalanced by the large base of VMS-based software that runs on the VAXstation 2000. The VAXstation 2000 supports up to 6MB of memory and 142MB of disk storage. The 3/100 Model 75 supports up to 8MB of memory and 142MB of disk storage. A VAXstation 2000 configured with 4MB of memory, monochrome monitor, 71MB of disk storage, and a 95MB tape drive is priced at $19,820. A similarly configured 3/100 Model 75 is priced at $20,400, delivering twice the power of the Digital offering for a modest price differential.

The VAXstation 2000 must compete not only with products from IBM and established workstation vendors, but eventually with Intel 80386-based personal computers which will be flooding the market. The systems do not pose an immediate threat because an operating system is not yet available that takes full advantage of the power of the 80386 chip. The 80386-based systems currently do have the advantage of being able to access the huge base of MS-DOS-and PC-DOS-based software, but since the VAXstation 2000 also has a very good software base to draw upon, software availability will not be a chief determining factor in choosing between a VAXstation and an 80386-based workstation. Once again, users will base their purchase decisions on price/performance factors. Since the PCs implement industry-standard, off-the-shelf processing components, they are cheaper to design and build and, hence, will be sold at lower prices than the VAXstation 2000.

ADVANTAGES AND RESTRICTIONS

Because the VAXstations are based on MicroVAX II architecture, they offer the same advantages as the Micro-

of displaying 256 colors from a palette of over 16 million); keyboard and mouse; the DEQNA Ethernet interface; disk; tape; and MicroVMS or Ultrix-32m operating system and workstation software licenses. Memory is expandable to 16MB; up to 477MB of disk storage can be configured through three 159MB RD54 disks in a deskside enclosure. The GPX supports up to three users each requiring a graphics co-processor. The VAXstation II/GPX is available in the following configurations:

- The 2-user, 8-plane system, in the BA123 enclosure, includes 5MB of memory, an RD53 disk, a TK50 tape drive, two color monitors, two keyboards, two mice, two 8-plane graphics co-processors, Ultrix-32m operating system and Ultrix-32w workstation software licenses, and DEQNA.

- The 3-user, 4-plane system, in the BA123 enclosure, includes 5MB of memory, an RD53 disk, a TK50 tape drive, three color monitors, three keyboards, three mice, three 4-plane graphics co-processors, Ultrix-32m operating system and Ultrix-32w workstation software licenses, and DEQNA.

- The gray-scale system, in the BA23 enclosure, includes 5MB of memory, an RD53 disk, a TK50 tape drive, one monochrome monitor, one keyboard, one mouse, one 4-plane graphics co-processor, Ultrix or MicroVMS and workstation software licenses, and DEQNA.

- The entry-level 4-plane color system is the same as the gray-scale system but includes a color rather than a monochrome monitor.

- The entry-level 8-plane color system, in the BA123 enclosure, includes 5MB of memory, an RD53 disk, a TK50 tape drive, one color monitor, one mouse, one keyboard, an 8-plane graphics co-processor, Ultrix or MicroVMS and workstation software licenses, and DEQNA.

- The extended 5MB color system, in the BA123 enclosure, includes 5MB of memory, a 159MB RD54 disk, a TK50 tape drive, one color monitor, one keyboard, one mouse, an 8-plane graphics co-processor, Ultrix or MicroVMS and workstation software licenses, and DEQNA.

- The extended 9MB color system, in the BA123 enclosure, includes 9MB of memory, a 159MB RD54 disk, a TK50 tape drive, one color monitor, one keyboard, one mouse, an 8-plane graphics co-processor, Ultrix or MicroVMS and workstation software licenses, and DEQNA.

- The diskless 4-plane system, in the BA23 enclosure, includes 5MB of memory, one color monitor, one mouse, one keyboard, 4-plane graphics co-processor, MicroVMS, Local Area VAXcluster (LAVC), DECnet, and workstation software licenses, and DEQNA.

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CHART C. WORKSTATIONS

MODEL	VR260	VR290
DISPLAY PARAMETERS		
Max. chars./screen	—	—
Buffer capacity	—	—
Screen size (lines x chars.)	—	—
Tilt/swivel screen	Standard	Standard
Symbol formation	—	—
Character phosphor	—	—
Total colors/no. simult. displayed	16 simultaneous shades of gray	16 million/ 16 (4-plane), 256 (8-plane)
KEYBOARD PARAMETERS		
Style	Typewriter	Typewriter
Character/code set	ASCII	ASCII
Detachable	Yes	Yes
Program function keys	20	20
TERMINAL INTERFACE	—	—
COMMENTS	1,024 x 864 pixel resolution, 78 pixels per inch	1,024 x 864 pixel resolution, 78 pixels per inch

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

▷VAX systems including software compatibility and limited peripheral compatibility with the entire VAX line of computer systems. The VAXstations also inherit the same restrictions from the comparable MicroVAX model. Please refer to the "DEC MicroVAX II and 2000" report in *Datapro Reports on Minicomputers* for a full description of these advantages and restrictions.

As for their capabilities as technical workstations, the VAXstations offer all the basic requirements for adequate workstation functionality: a dedicated 32-bit microprocessor; graphics I/O device support (i.e., mouse and tablet); graphics co-processors on the GPX and 2000; multivendor networking capabilities based in industry-standard Ethernet, and large amounts of disk storage. The particular advantages that may be cited in addition to these basic elements include the ability to be clustered with larger VAX systems, drawing upon the VAXs' additional processing power and storage capacity. Less expensive diskless models of the VAXstation 2000 and II/GPX can be added to existing LAVCs, increasing the processing power and number of user seats without the added cost of disk storage local to each workstation.

The VAXstations support not only general networking and communications standards, but also Sun's Network File System (NFS), which allows different hardware and networks to communicate with each other, thus enabling the VAXstations to coexist in multivendor environments.

Restrictions that can be noted are lack of color monitor support and a graphics co-processor on the VAXstation II, limiting its display capabilities. The VAXstation II is an old model and is outperformed by other workstations on the market; it will probably be replaced by a new workstation model that offers more functionality. All the workstations lack 3-dimensional graphics, limiting their use in some applications, such as solids modeling and simulation. Competitors, like Prime Computer, are now offering 3-D workstations. □

• The diskless 8-plane system has the same features as the diskless 4-plane system, but includes an 8-plane rather than a 4-plane graphics co-processor.

The VAXstation 2000 is housed in a compact system box but maintains hardware and software compatibility with the larger VAXstation members. The VAXstation 2000 is available as a base system to which options must be added. The base system includes 4MB or 6MB of memory (6MB is the maximum memory supported), a 19-inch monochrome monitor, a ThinWire Ethernet interface, and the MicroVMS or Ultrix-32m and -32w operating system, windowing software, DECnet, and LAVC licenses.

The VAXstation 2000 supports the following options:

• A keyboard.

• A pointing device (mouse or tablet).

• Two half-height storage devices, i.e., the 1.2MB RX33 diskette drive and 42MB RD32 disk drive (only one of each may be configured and both must be housed in the system box), or one full-height storage device, i.e., the 71MB RD53 disk drive.

• The TK50 tape drive, available only in the BA40A expansion adapter.

• A second RD53 disk may also be added; it requires the BA40A expansion adapter. The BA40A expansion adapter houses both a TK50 tape drive and an RD53 disk drive.

A fully configured VAXstation 2000 includes 6MB of memory, two RD53 disk drives, a TK50 tape drive, monitor, keyboard, and mouse. As specified above, the fully configured system requires the BA40A expansion adapter to house the tape drive and second disk drive.

A diskless VAXstation 2000 is supported only in a VMS LAVC environment. Ultrix and standalone MicroVMS configurations require a local disk drive. Since Ultrix software is available on tape, Ultrix systems that are not networked require a TK50. Ultrix systems without a TK50 must be networked to another Ultrix system running RSM V1.1 to support downline loading of the operating system.

A MicroVMS system without a TK50 or RX50 must be networked to another VMS system running RSM V1.1 to support downline loading of the operating system.

According to Digital, a VAXstation 20000 color monitor, requiring a 4-plane graphics co-processor, will be available soon. ▶

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CHART D. PRINTERS

MODEL	LA50	LA75	LA210	LN03	LN03 Plus
Type	Dot-matrix	Dot-matrix	Dot-matrix	Laser	Laser
Speed	50/100 cps	32/42/125/250 cps	40/240 cps; 80 cps opt.	8 ppm	8 ppm
Bidirectional printing	Yes	Yes	Yes	Not applicable	Not applicable
Paper size	4.5 to 10 in. wide	4.25 to 10 in. wide	3.5 to 14.9 in. wide	8.5 x 11 in.	8.5 x 11 in.
Character formation	13 x 9/7 x 9 dot-matrix	36 x 18/36 x 17/24 x 9/12 x 9 dot-matrix	33 x 18/7 x 9 dot-matrix; 33 x 9 opt.	300 x 300 dots/in.	300 x 300 dots/in.
Horizontal character spacing (char./inch)	10, 12, 16.5 or 5, 6, 8.25	10, 12, 16.5, 17.1, or 5, 6, 8.25, 8.55	Variable	Variable	Variable
Vertical line spacing (lines/inch)	2, 3, 4, 6, 8, 12	2, 3, 4, 6, 8, 12	Variable	Variable	Variable
Character set	96 ASCII, others	U.S. ASCII, 8 others	94 ASCII; Courier, VT100 line-drawing std.; others opt.	ASCII; 16 resident Courier/Elite fonts	ASCII, technical; 17 resident fonts
Controller/Interface	RS-232-C	RS-423	RS-232-C std.; Centronics parallel opt.	RS-232-C	RS-232-C
No. of printers per controller/interface	1	1	1	1	1
Printer dimensions, in. (h x w x d)	5 x 15.7 x 11.2	4.8 x 16.8 x 13.6	5 x 21.5 x 13.5	15 x 21 x 23.5	15 x 21 x 23.5
Graphics capability, dots per inch	72 x 180	180 x 144	132 x 72	Not applicable	300 x 300
Comments		Built-in LA50, LA100, LA210, IBM Proprinter emulation	Compatible with IBM PC, PC XT, PC AT	Prints in landscape and portrait modes	Provides bit-mapped, Tektronix 4010/4014-compatible graphics

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

► A specialized, MicroVAX-based realtime system, *VAXlab*, is offered for laboratory data acquisition and experiment control in midrange to high-performance applications. Two of the four versions are based on VAXstation configurations:

- VAXlab/VS2, a high-resolution, multiwindow graphics workstation built on the VAXstation II.

- VAXlab/GPX, based on the VAXstation/GPX 8-plane color graphics workstation.

Each VAXlab system includes a CPU/FPU; 5MB of main memory; 71MB RD53 disk; TK50 streaming tape drive; Ethernet interface; distribution panels for attachment of I/O connections to realtime devices; realtime clock; MicroVMS operating system; DECnet end-node license; and Graphical Kernel System (GKS) software. Also included is Labstar software for realtime I/O; scientific plotting; mathematical, statistical, and signal processing operations; and system management. A variety of analog-to-digital, digital-to-analog, and parallel digital options can be added.

INPUT/OUTPUT UNITS

Refer to Chart B for disk and diskette devices, to Chart C for workstations, and to Chart D for printers.

OTHER PERIPHERALS: The TK50 streaming tape drive is a ½-inch cartridge unit that uses CompacTape cartridges, developed by Digital in conjunction with 3M Company; a single cartridge can back up any of the Winchester disks used on a VAXstation. This Q-bus drive, which uses a microprocessor-based controller, has a maximum storage capacity of 95MB and achieves read/write speed of 75 ips in streaming mode. The TK50 has a peak data transfer rate of 62.5KB per second (45 KB per second for user data). Recording density is 6667 bpi. The TK50 also features read-after-write operation and emulation of reel-to-reel tape drive operation.

The LCG01 color printer is an inkjet color graphics device that provides output on paper and transparencies. It provides print resolution of 154 dots per inch, a print rate of approximately two minutes per copy, and up to 216 shades. Interfaces available for the LCG01 are RS-232-C, RS-422,

and 20 ma. The printer supports ReGIS, GIDIS, NAPLPS, and BIT MAP IMAGE (color pixel format) graphics protocols.

The LVP16 color graphics plotter is a desktop, six-pen device that draws on plain paper or transparencies. It is compatible with the HP-GL graphics protocol and prints graphics at 15 inches per second. An RS-232-C interface is standard.

The three-button mouse features X and Y relative displacement and a 100 pulses per inch output rate. The system also supports an option digitizing tablet with light pen or cross-haired puck.

COMMUNICATIONS

Via the DEQNA Ethernet interface, the VAXstations can be connected to local and wide area networks and share resources with systems running VMS and Unix, and systems running on SNA and X.25 networks. It operates at 10M bps and is supported under DECnet Phase IV software. DEQNA allows a system to communicate with up to 1,023 addressable devices on an Ethernet LAN.

Also configurable on the VAXstation family is the H4005 Ethernet Transceiver, detailed in the "VAX 8000 Systems" report in *Datapro Reports on Minicomputers.*

SOFTWARE

The VAXstations run the MicroVMS and Ultrix-32m operating systems which are described in the "DEC Micro-VAX II and 2000" report in *Datapro Reports on Minicomputers.* The MicroVMS operating system is based on the same architecture as VAX/VMS, which runs on the VAX superminis. Consequently, the VAXstations run the same system and applications software as the larger VAX computers without recompilation or relinking, subject to the limitations of peripheral support.

MicroVMS Workstation Software (VWS) is a layered product for MicroVMS or VAX/VMS which provides graphics support for the VAXstations. VWS provides multiple, overlapping windowing capabilities; VT220 emulation with tech- ►

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▶ nical character set; TEK4014 emulation; a mouse-based interface for window manipulation; a graphics programming interface; a device driver interface to graphics hardware; and hard copy graphics support.

On standalone VAXstations, VWS runs on the MicroVMS operating system. On VAXstations configured in an LAVC, VWS runs on the VAX/VMS operating system.

The Unix-derived Ultrix-32w workstation software features windowing and graphics capabilities.

The windowing facilities of Ultrix-32w are provided by X-Window, an enhanced version of the package developed by MIT's Project Athena and the MIT Laboratory for Computer Science. A network-based system, X-Window provides Unix-based workstation users with remote graphics windowing. Users can run applications on remote Ultrix nodes and have the graphics output presented transparently on their local workstations. X-Window also supports multiple view ports that can overlap and run even while occluded by another window.

The workstation software features a GKS library that includes a high-level graphics and text programming interface; ANSII standard level 0b is provided, with GKS output directed through the windowing system. VT102 and Tektronix 4014 emulators running through the X-Window server allow many applications to run unchanged in a windowed environment. A low-level graphics programming interface allows direct procedural access to hardware for customized applications requiring higher graphics speeds.

Ultrix-32w is a modular system, providing developers with access to the workstation's capabilities at any one of several levels. Depending upon performance needs, users can interface an application directly to the driver, to the hardware-level graphics library, to the window server, or to the GKS module.

The VAXstations support the same data base management, communications, applications, tools and utilities, and languages as the MicroVAX II. Descriptions of the software supported are provided in the "DEC MicroVAX II and 2000" report in *Datapro Reports on Minicomputers*. Some programs, such as the Remote System Manager (RSM), allow a VAXstation to function as a client but not as a server in a distributed processing environment. Unless noted, details on the software referenced in this section are also the same as those presented in the "DEC VAX 8000 Systems" report in *Datapro Reports on Minicomputers*. Further details on VAX and MicroVAX software can be found in the *Datapro Directory of Software* and the *Datapro Directory of Microcomputer Software*.

OPERATING ENVIRONMENT

The VAXstation II and II/GPX are housed in the same BA23 and BA123 enclosures as the MicroVAX II. The dimensions and operating environments of these system units are described in the "DEC MicroVAX II and 2000" report in *Datapro Reports on Minicomputers*.

The dimensions of the VAXstation 2000 are the same as for the MicroVAX 2000 and are also given in the report cited above. However, the operating environment differs slightly. The operating temperatures for the VAXstation 2000 range from 60 to 90 degrees Fahrenheit (15.5 to 35.5 degrees Celsius) at 40 to 80 percent relative humidity, noncondensing.

SUPPORT SERVICES

DOCUMENTATION: With each VAXstation, the user must order documentation (and installation diagnostics) on TK50 tape or RX50 diskette media. 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 equipment-related and nonproduct-related topics are offered. A variety of instructional methods are 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 VAXstations, as well as all peripherals, are covered by a one-year warranty. Warranty coverage may be extended for up to three years.

MAINTENANCE: Digital's Field Service organization offers both on-site and off-site support services for the VAXstation II and II/GPX. Standard on-site services include the Basic Service Agreement, the extended DECservice Agreement, 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. Details of Digital's service programs and of software support services available are provided in the "DEC VAX 8000 Systems" report in *Datapro Reports on Minicomputers*.

Two types of integrated service are offered on the VAXstation 2000. Basic System Service is offered on systems used as LAVC boot nodes or as standalone systems. Basic Node Service is offered on systems used as LAVC nodes only. Both plans provide Onsite Basic Hardware Service, Right to Use Updates, Digital Software Information Network, and Hardware and Software Telephone Support through the System Administrator. Basic System Service is slightly more expensive than Basic Node Service.

PRICING

POLICY: Digital provides the VAXstations 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. Customers ordering Ultrix-32m and -32w software receive a Unix binary license directly from Digital.

Digital's Volume Software Pricing and VAX Software Portfolio programs are available for VAXstation users. A description of these programs is provided in the "DEC MicroVAX II and 2000" report in *Datapro Reports on Minicomputers*.

Prices for VAXstation hardware and related software are provided in the following list. ▶

DEC VAXstations

EQUIPMENT PRICES

		Basic Service (Monthly) ($)	DECserv. (Monthly) ($)
	Purchase Price ($)		

VAXSTATION II

Each VAXstation II includes a Micro VAX II CPU and Floating-Point Unit; a high-resolution 19-inch monitor; multiwindowing software; VAX GKS/00 application programming interface; VT100 and Tektronix 4014 terminal emulation; DEQNA Ethernet interface; and three-button mouse

VAXstation II System Building Blocks (SBBs)

		Purchase Price ($)	Basic Service (Monthly) ($)	DECserv. (Monthly) ($)
VS210-A2(A3)	Includes BA23 enclosure and 1MB of main memory	17,750	183	218
VS215-A2(A3)	Includes BA123 enclosure and 1MB of main memory	20,800	193	230

VAXstation II Configurations

		Purchase Price ($)	Basic Service (Monthly) ($)	DECserv. (Monthly) ($)
SU-LV55B-EK(EN)	Includes BA123 enclosure; 5MB of main memory (1MB on CPU board and one 4MB MS630-BB memory board); RD53 71MB fixed disk; TK50 95MB tape; RX50 diskette; DEQNA Ethernet controller; video graphics subsystem; keyboard; mouse; monochrome monitor; Ultrix-32m and Ultrix-32w licenses	30,500	F/S	F/S
SU-LV55H-EK(EN)	Includes BA23 enclosure; 2MB of main memory (1MB on CPU board and one 1MB MS630-AA memory board); RD53 71MB fixed disk; TK50 95MB tape; DEQNA Ethernet controller; video graphics subsystem; keyboard; mouse; monochrome monitor; Ultrix-32m and Ultrix-32w licenses	26,000	F/S	F/S
SV-LV55B-EK(EN)	Includes BA123 enclosure; 5MB of main memory (1MB on CPU board and one 4MB MS630-BB memory board); RD53 71MB fixed disk; TK50 95MB cartridge tape; MicroVMS 1-2 user license, and workstation software license	30,500	F/S	F/S
SV-LV55H-EK(EN)	Sames as SV-LV55B-EK(EN), but with 2MB of main memory (1MB with CPU and one MS630-AA 1MB memory board)	26,000	300	357

Ada Workstation

		Purchase Price ($)	Basic Service (Monthly) ($)	DECserv. (Monthly) ($)
SV-LV55J-EK(EN)	Same as SV-LV55B-EK(EN), but includes Ada and related software licenses	39,300	318	379
SV-LV55E-EK(EN)	Same as SV-LV55B-EK(EN), but includes 2MB memory, Ada, and related software licenses	—	—	—

Artificial Intelligence Workstation

		Purchase Price ($)	Basic Service (Monthly) ($)	DECserv. (Monthly) ($)
SV-LV55F-EK(EN)	Same as SV-LV55B-EK(EN), but includes 9MB of main memory (1MB with CPU and two 4MB MS630-BB memory boards) and VAX Lisp license	42,300	369	439

VAXSTATION II/GPX

VAXstation II/GPX SBBs

		Purchase Price ($)	Basic Service (Monthly) ($)	DECserv. (Monthly) ($)
VS265-A2(A3)	Gray-scale system; includes MicroVAX II CPU/FPU, BA23 enclosure, mouse, monochrome monitor, 4-plane graphics co-processor; requires power cord, documentation/diagnostics software, mass storage, keyboard, operating system license, main memory	13,800	181	215
VS265-B2(B3)	Color system; same as VS265-B2(B3), but includes color monitor	14,800	215	256
VS270-A2(A3)	Gray-scale system; includes MicroVAX II CPU/FPU, BA123 enclosure, mouse, monochrome monitor, 8-plane graphics co-processor; requires power cord, documentation/diagnostics software, keyboard, operating system license, and main memory	23,395	230	274
VS270-B2(B3)	Color system; same as VS270-A2(A3), but includes color monitor	25,595	264	314

VAXstation II/GPX Configurations

		Purchase Price ($)	Basic Service (Monthly) ($)	DECserv. (Monthly) ($)
SU-LV55W-EK(EN)	Gray-scale system; includes MicroVAX II CPU/FPU BA23 enclosure, 5MB of main memory (1MB with CPU and one MS630-BB 4MB memory board), RD53 71MB fixed disk, TK50 95MB cartridge tape, DEQNA Ethernet controller, 4-plane graphics co-processor, keyboard, mouse, monochrome monitor, and Ultrix-32 and Ultrix-32W binary licenses	24,995	F/S	F/S

F/S—Contact Digital Field Service.
NA—Not applicable.
NC—No charge.
*Basic Node Service
**Basic System Service

DEC VAXstations

		Purchase Price ($)	Basic Service (Monthly) ($)	DECserv. (Monthly) ($)
► SU-LV55Y-EK(EN)	Same as SU-LV55W-EK(EN), but includes color monitor	25,995	F/S	F/S
SU-LV55U-EK(EN)	Entry-level 8-plane color system; same as SU-LV55Y-EK(EN), but with BA123 enclosure and 8-plane graphics co-processor	39,950	F/S	F/S
SU-LV55R-EK(EN)	Two-user, 8-plane color system; same as SU-LV55U-EK(EN), but includes two 8-plane graphics co-processors	48,700	604	719
SU-LV59B-EK(EN)	MicroVAX II CPU/FPU; BA123 enclosure; 5MB of main memory (1MB with CPU and one MS630-BB 4MB memory board); BA123 enclosure; RD54 159MB fixed disk; TK50 95MB cartridge tape; DEQNA Ethernet Controller; 8-plane graphics co-processor, keyboard; mouse, color monitor, and Ultrix-32 and Ultrix-32W binary licenses	44,595	F/S	F/S
SU-LV59C-EK(EN)	Same as SU-LV59B-EK(EN), but with 16MB of memory (two MS630-CA 8MB boards) and two RD54 159MB fixed disks	58,595	F/S	F/S
SU-LV59D-EK(EN)	Same as SU-LV59C-EK(EN), but including Lisp license	63,395	F/S	F/S
SV-LV55U-EK(EN)	Color system; includes MicroVAX II CPU/FPU, BA123 enclosure, 5MB of main memory (1MB on CPU board and one 4MB MS630-BB memory board), RD53 71MB fixed disk, TK50 95MB tape, DEQNA Ethernet controller, 8-plane graphics co-processor, keyboard, mouse, color monitor, and MicroVMS operating system and workstation software licenses	39,950	F/S	F/S
SV-LV55W-EK(EN)	Gray-scale system; includes MicroVAX II CPU/FPU, BA23 enclosure, 5MB of main memory (1MB on CPU board and one 4MB MS630-BB memory board), RD53 71MB fixed disk, TK50 95MB tape, DEQNA Ethernet controller, 4-plane graphics co-processor, keyboard, mouse, monochrome monitor, and MicroVMS operating system and workstation software licenses	24,995	F/S	F/S
SV-LV55Y-EK(EN)	Color system; same as SV-LV55W-EK(EN), but with color monitor	25,995	F/S	F/S
SV-LV59B-EK(EN)	Color system; includes MicroVAX II CPU/FPU, BA123 enclosure, 5MB of main memory (1MB on CPU board and one 4MB MS630-BB memory board), RD54 159MB fixed disk, TK50 95MB tape, DEQNA Ethernet controller, 8-plane graphics co-processor, keyboard, mouse, color monitor, and MicroVMS operating system and workstation software licenses	44,595	F/S	F/S
SV-LV59C-EK(EN)	Color system; includes MicroVAX II CPU/FPU, BA123 enclosure, 16MB of main memory (two MS630-CA 8MB memory boards), two RD54 159MB fixed disks, TK50 95MB tape, DEQNA Ethernet controller, 8-plane graphics co-processor, keyboard, mouse, color monitor, and MicroVMS operating system and workstation software licenses	58,595	F/S	F/S
SV-LV59D-EK(EN)	Same as SV-LV59C-EK(EN), but also includes Lisp license	63,395	F/S	F/S
SV-LVXGA-EK(EN)	Diskless color system; includes MicroVAX II CPU/FPU, pedestal enclosure, 5MB of main memory, 4-plane graphics co-processor, 19-inch color monitor, Ethernet controller, mouse/keyboard, MicroVMS operating system and workstation software licenses, and DECnet and Local Area VAXcluster software licenses	19,000	F/S	F/S
SV-LVXGB-EK(EN)	Same as diskless color system above, but with 8-plane graphics co-processor	23,000	F/S	F/S

VAXSTATION 2000

VS450-DA(D3)	MicroVAX II CPU/FPU; 4MB of main memory; 19-in. monochrome monitor; ThinWire Ethernet interface; T-connector and terminators; English hardware documentation; and VMS, windowing, software, DECnet, and LAVC licenses	10,125	*107	**130
VS450-EA(E3)	Same as VS450-DA(D3) except with 6MB of memory	12,125	*107	**130
VS450-FA(F3)	Same as VS450-DA(D3) except with Ultrix-32m and -32w rather than VMS	10,125	*107	**130
VS450-GA(G3)	Same as VS450-FA(F3) but with 6MB or memory	12,195	*107	**130

VAXLAB

LABVX-BB(BC)	VAXlab/VS2; VAXstation II-based configuration	33,455	389	463
LABVX-CA(CB)	VAXlab/GPX; VAXstation II/GPX-based configuration	45,680	460	548

VAXLAB REALTIME OPTIONS

ADV11-DA	50KHz, DMA 16-channel, 12-bit resolution analog-to-digital converter	1,995	40	48
AAV11-DA	300KHz, DMA 2-channel, 12-bit resolution digital-to-analog converter	1,995	54	45
AXV11-C	25KHz, 16-channel, analog-to-digital converter with 2-channel digital-to-analog; 12 bits	1,295	32	38
KWV11-C	Programmable realtime clock, 16-bit counter, two Schmitt triggers	895	25	30
DRV11-J	64-bit user-configurable parallel digital interface	490	9	11
DRV11-WA	DMA 16-bit input/output parallel digital interface	990	9	11

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**Basic System Service

DEC VAXstations

		Purchase Price ($)	Basic Service (Monthly) ($)	DECserv. (Monthly) ($)
MEMORY				
MS630-AA	1MB memory increment	360	18	21
MS630-BA	2MB memory increment	1,500	36	43
MS630-BB	4MB memory increment	1,350	72	86
MS630-CA	8MB parity memory increment	2,650	64	76
GRAPHIC INPUT DEVICES				
VSXXX-AA	Mouse	175	NC	NC
VSXXX-BA	Tablet with stylus and puck	995	8	10
LK201-LA/MA	Keyboard	200	NA	NA
MASS STORAGE				
RQDX3-AA/BA	RQDX3 controller for RD53 disk; for BA23(AA) or BA123(BA) enclosure; cables and distribution panel (for Model BA) included	2,040	16	19
RQDX3-M	Q-bus controller without cables; for use when replacing existing RQDX2 controllers (cables can be reused)	1,990	16	19
RQDXE-AA	Dual-height disk drive bus extender for use with RQDX2 or RQDX3 controller in a BA23 enclosure and for external disk	250	NA	NA
RQDXE-FA	Dual-height disk drive bus extender for use with RQDX2 or RQDX3 controller and disk in BA23-CC expander enclosure	250	NA	NA
RX33-A	1.2MB diskette drive	750	8	10
RX50A-AA/BA	RX50 800KB dual diskette drive with cables for BA23(AA) or BA123(BA) enclosure	1,000	8	10
RX50-AA	RX50 800KB dual diskette drive	1,000	8	10
RX50-D	RX50 800KB dual diskette drive mounted in desktop enclosure with I/O cable	1,800	20	24
RX50-R	RX50 800KB dual diskette drive for mounting in 19-inch standard equipment rack	1,800	20	24
RD32-A	42MB Winchester disk drive	2,300	20	24
RD53-A	RD53 71MB, 5¼-in. Winchester disk drive	3,800	38	45
RD53-AA/BA	RD53 71MB drive with cables for BA23(AA) or BA123(BA) enclosure	3,800	19	23
RD53-DA/DB	RD53 71MB drive mounted in desktop enclosure with I/O cables	4,400	38	45
RD53-EA	71MB Winchester disk drive for MicroVAX 2000	3,800	38	45
RD53-FA/F3	71MB Winchester disk in expansion box for MicroVAX 2000	5,050	38	45
RD53-RA/RB	RD53 71MB drive in 19-inch standard equipment rack; requires H9302 enclosure	4,650	38	45
RD54-DA/DB/RA/RB	RD54 159MB Winchester disk drive	7,900	63	75
MAGNETIC TAPE				
TQK50-AA	TK50 controller with cables for BA23 enclosure	1,100	8	10
TQK50-AB	Q22 controller for TK50-D/R in BA23 enclosure	1,100	8	10
TQK50-BA	TK50 controller with cables for BA123 enclosure	1,100	8	10
TQK50-BB	Q22 controller for TK50-D/R in BA123 enclosure	1,100	8	10
TK50-AA	TK50 95MB cartridge streaming tape drive	2,800	22	26
TK50-DA/DB	TK50 desktop tape drive	3,400	22	26
TK50-RA/RB	TK50 rackmount tape drive	3,400	22	26
TK50Z-FA/F3	TK50 in expansion box for VAXstation 2000	4,495	30	36
BA40A-AA	Expansion Adapter for VAXstation 2000	1,200	NA	NA
PRINTERS				
LA50-RA	LA50 50-/100-cps dot-matrix tabletop printer with push tractor feed and 110 VAC power supply	795	8	10
LA50-RB/RC	Same as LA50-RA, but with 220 VAC (Model RB) or 240 VAC (Model RC) power supply	715	8	10
LA120-DA	LA120 180-cps dot-matrix printer; for 1- to 6-part forms	2,900	34	40
LA210-AA	LA210 40-/80-/240-cps dot-matrix printer	1,595	28	33
LA21X-BT	Bidirectional tractor for LA210	245	NA	NA
LA21X-SF	Single-tray sheet feeder for LA210	595	NA	NA
LN03-AA	LN03 8-ppm laser printer; includes two toner cartridges, organic photo receptor cartridge, AC power cord, toner collection bottle, 250 sheets of letter-size paper, and documentation	3,495	49	58
LN03S-AA	LN03 Plus 8-ppm desktop graphics laser printer; includes 1MB RAM, Modern Gothic type face, two toner cartridges, organic photo receptor cartridge, AC power cord, toner collection bottle, 250 sheets of letter-size paper, and documentation	4,995	56	67
LN03S-UA	Graphics board to upgrade LN03 to LN03 Plus	1,595	7	8
LPS40-AA	Print Server 40, 40-ppm Ethernet printer with power cord	47,900	775	923
LVP16-AA	Graphics pen plotter with documentation and supplier	2,095	10	12

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*Basic Node Service
**Basic System Service

DEC VAXstations

		Purchase Price ($)	Basic Service (Monthly) ($)	DECserv. (Monthly) ($)
COMMUNICATIONS/NETWORKING				
DHV11-M	DHV11 eight-line asynchronous DMA multiplexer; requires cable	1,520	15	18
DZQ11-M	DZQ11 four-line asynchronous multiplexer; requires cable	760	11	13
DPV11-M	DPV11 single-line synchronous interface; requires cable	719	14	17
DMV11-M	DMV11 single-line synchronous interface; requires cable	2,125	41	49
DMV11-N	Integral modem interface	1,800	41	49
H4005	Ethernet/IEEE 802.3 transceiver	300	4	5
DESTA-AA	Thinwire Ethernet station adapter	275	4	5
DSRVB-AA	8-line DECserver 200	3,625	28	33
DSRVA-AA	8-line DECserver 100	3,537	30	36
DEQNA-M	DEQNA Ethernet-to-Q-bus high-performance synchronous communications controller; requires cable	2,500	15	18

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**Basic System Service

SOFTWARE PRICES

		License Fee ($)
OPERATING SYSTEM		
Q4001-CZ	MicroVMS 2-user license for VAXstation II	1,000
Q8001-CZ	MicroVMS 2-user license for VAXstation 2000	1,000
COMMUNICATIONS		
Q8D04-UZ	DECnet end license for VAXstation 2000	500
Q4D04-UZ	DECnet end license for VAXstation II and II/GPX	681
Q8D05-UZ	DECnet full license for VAXstation 2000	855
Q4D05-UZ	DECnet full license for VAXstation II and II/GPX	1,710
Q8D09-UZ	DECnet end node to full license upgrade for VAXstation 2000	620
Q4D09-UZ	DECnet end node to full license upgrade for VAXstation II and II/GPX	1,235
Q8363-UZ	DECnet/SNA 3270 for VAXstation 2000	375
Q4363-UZ	DECnet/SNA 3270 for VAXstation II and II/GPX	500
Q8455-UZ	DECnet/SNA Application Programming Interface (API) for VAXstation 2000	300
Q4455-UZ	DECnet/SNA Application Programming Interface (API) for VAXstation II and II/GPX	400
Q8022-U2	DECnet/SNA Advanced Program-to-Program Communications (APPC) for VAXstation 2000	450
Q4022-UZ	DECnet/SNA Advanced Program-to-Program Communications (APPC) for VAXstation II and II/GPX	450
Q8454-UZ	DECnet/SNA Terminal Emulator (TE) for VAXstation 2000	150
Q4454-UZ	DECnet/SNA Terminal Emulator (TE) for VAXstation II and II/GPX	150
Q8453-UZ	DECnet/SNA RJE for VAXstation 2000	150
Q4453-UZ	DECnet/SNA RJE for VAXstation II and II/GPX	200
Q8452-UZ	DECnet/SNA Gateway Management for VAXstation 2000	75
Q4452-UZ	DECnet/SNA Gateway Management for VAXstation II and II/GPX	225
Q8042-UZ	DECnet/SNA DISOSS Document Exchange Facility (DDXF) for VAXstation 2000	225
Q4042-UZ	DECnet/SNA DISOSS Document Exchange Facility (DDXF) for VAXstation II and II/GPX	300
Q8044-UZ	DECnet/SNA Printer Emulator (PrE) for VAXstation 2000	150
Q4044-UZ	DECnet/SNA Printer Emulator (PrE) for VAXstation II and II/GPX	200
Q4111-UZ	DECnet/SNA 2780/3780 Protocol Emulator for VAXstation II and II/GPX	1,125
Q4112-UZ	DECnet/SNA 3271 Protocol Emulator for VAXstation II and II/GPX	1,500
Q8B12-UZ	VAX VIDA for VAXstation 2000	2,625
Q4B12-UZ	VAX VIDA for VAXstation II and II/GPX	3,500
Q8ZCE-UZ	Local Area VAXcluster for VAXstation 2000	500
Q4ZCE-UZ	Local Area VAXcluster for VAXstation II and II/GPX	1,000
DATA BASE MANAGEMENT		
Q8898-UZ	Datatrieve for VAXstation 2000	1,230
Q4898-UZ	Datatrieve for VAXstation II and II/GPX	1,230
Q8897-UZ	Common Data Dictionary (CDD) for VAXstation 2000	341
Q4897-UZ	Common Data Dictionary (CDD) for VAXstation II and II/GPX	341
Q8800-UZ	Forms Management Systems (FMS) for VAXstation 2000	620
Q4800-UZ	Forms Management System (FMS) for VAXstation II and II/GPX	620
Q8D07-UZ	Rdb/ELN Development license for VAXstation 2000	1,125
Q4D07-UZ	Rdb/ELN Development License for VAXstation II and II/GPX	1,500
Q4D08-UZ	Rdb/ELN Run Time Option (RTO) for VAXstation II and II/GPX	250
Q8354-UZ	Rdb/Micro VMS for VAXstation 2000	1,770

DEC VAXstations

		License Fee ($)
Q4354-UZ	Rdb/MicroVMS for VAXstation II and II/GPX	1,770
Q8357-UZ	Rdb/MicroVMS Remote for VAXstation 2000	205
Q4357-UZ	Rdb/MicroVMS Remote for VAXstation II and II/GPX	205
Q8358-UZ	Rdb/MicroVMS Run Time Option (RTO) for VAXstation 2000	683
Q4358-UZ	Rdb/MicroVMS Run Time Option (RTO) for VAXstation II and II/GPX	683

LANGUAGES

Q4018-UZ	Dibol for VAXstation II and II/GPX	830
Q8130-UZ	DSM (Digital Standar Mumps) for VAXstation 2000	1,350
Q4130-UZ	DSM (Digital Standard Mumps) for VAXstation II and II/GPX	5,400
Q8100-UZ	Fortran for VAXstation 2000	775
Q4100-UZ	Fortran for VAXstation II and II/GPX	775
Q8917-UZ	Lisp for VAXstation 2000	2,400
Q4917-UZ	Lisp for VAXstation II and II/GPX	4,800
Q8126-UZ	Pascal for VAXstation 2000	709
Q4126-UZ	Pascal for VAXstation II and II/GPX	709
Q8114-UZ	PL/1 for VAXstation 2000	1,195
Q4114-UZ	PL/1 for VAXstation II and II/GPX	1,195
Q863I-UZ	RPG II for VAXstation 2000	473
Q4631-UZ	RPG II for VAXstation II and II/GPX	630
Q8056-UZ	Ada for VAXstation 2000	3,735
Q4056-UZ	Ada for VAXstation II and II/GPX	3,735
Q8020-UZ	APL for VAXstation 2000	1,195
Q4020-UZ	APL for VAXstation II and II/GPX	1,195
Q8095-UZ	Basic for VAXstation 2000	795
Q4095-UZ	Basic for VAXstation II and II/GPX	795
Q8106-UZ	Bliss-32 for VAXstation 2000	866
Q4106-UZ	Bliss-32 for VAXstation II and II/GPX	866
Q8015-UZ	C for VAXstation 2000	709
Q4015-UZ	C for VAXstation II and II/GPX	709
Q8099-UZ	Cobol for VAXstation 2000	1,195
Q4099-UZ	Cobol for VAXstation II and II/GPX	1,195
Q8913-UZ	OPS5 for VAXstation 2000	1,500
Q4913-UZ	OPS5 for VAXstation II and II/GPX	3,000

UTILITIES AND TOOLS

Q8425-UZ	Application Development Environment (ADE) for VAXstation 2000	405
Q4425-UZ	Application Development Environment (ADE) for VAXstation II and II/GPX	540
Q8451-UZ	DECor for VAXstation 2000	900
Q4451-UZ	DECor for VAXstation II and II/GPX	1,200
Q8310-UZ	DECalc for VAXstation 2000	510
Q4310-UZ	DECalc for VAXstation II and II/GPX	510
Q8038-UZ	DECtype for VAXstation 2000	300
Q4038-UZ	DECtype for VAXstation II and II/GPX	300
Q8007-UZ	DEC/CMS (Code Management System) for VAXstation 2000	1,301
Q4007-UZ	DEC/CMS (Code Management System) for VAXstation II and II/GPX	1,301
Q8500-UZ	DEC/MMS (Module Management System) for VAXstation 2000	315
Q4500-UZ	DEC/MMS (Module Management System) for VAXstation II and II/GPX	420
Q8143-UZ	DECshell for VAXstation 2000	712
Q4143-UZ	DECshell for VAXstation II and II/GPX	712
Q8810-UZ	GKS/Ob for VAXstation 2000	900
Q8706-UZ	TDMS for VAXstation 2000	620
Q4706-UZ	TDMS for VAXstation II and II/GPX	620
Q8375-UZ	VAXELN Toolit for VAXstation 2000	1,000
Q8382-UZ	VAX-11 RSX for VAXstation 2000	600
Q4382-UZ	VAX-11 RSX for VAXstation II and II/GPX	800 ∎