

DEC MicroVAX II

MANAGEMENT SUMMARY

UPDATE: *Since this report first appeared, Digital Equipment has added Local Area VAXcluster capabilities for the MicroVAX II and VAXstation II products; introduced the high-performance VAXstation II/GPX, along with Unix windowing software; and increased the main memory and auxiliary storage offerings for the MicroVAX II product line.*

In marketing the MicroVAX II and derivative products, Digital Equipment employs a pyramidal strategy, with the multiuser systems targeted toward a broad range of technical and commercial applications and the VAXstations targeted toward more specific applications within that general range.

For instance, the MicroVAX II is marketed for computer-aided design and manufacturing (CAD/CAM), laboratory research, process control and factory automation, office automation, educational computing, electronic publishing, and general-purpose computing. The company views the system as installable in a range of office- or department-level computing environments. For example, it intends entry-level systems to be used for such tasks as realtime data acquisition or process control in Ethernet environments. Slightly larger (four- to eight-user) configurations can be used by work groups or teams in small businesses or branch offices, or in distributed data processing/LAN environments by small groups within larger organizations. Larger configurations supporting up to 48 users can be employed as departmental systems. A high-end configuration, supporting up to 1.8GB of disk, can be employed for both computation- and storage-intensive applications like CAD and seismic analysis.

The MicroVAX II is both a multiuser supermicro system and a platform for Digital's extensive line of VAXstation II workstations. The MicroVAX II-based systems, designed for a range of commercial and technical applications, can be used in stand-alone, networked, or clustered configurations. The systems are software-compatible with Digital's line of VAX superminis.

MODELS: MicroVAX II.
MEMORY: 2MB to 16MB.
DISK CAPACITY: 31MB to 1.8GB.
WORKSTATIONS: Up to 48.
PRICE: \$12,000 to \$63,395 (base configuration prices).

CHARACTERISTICS

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

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

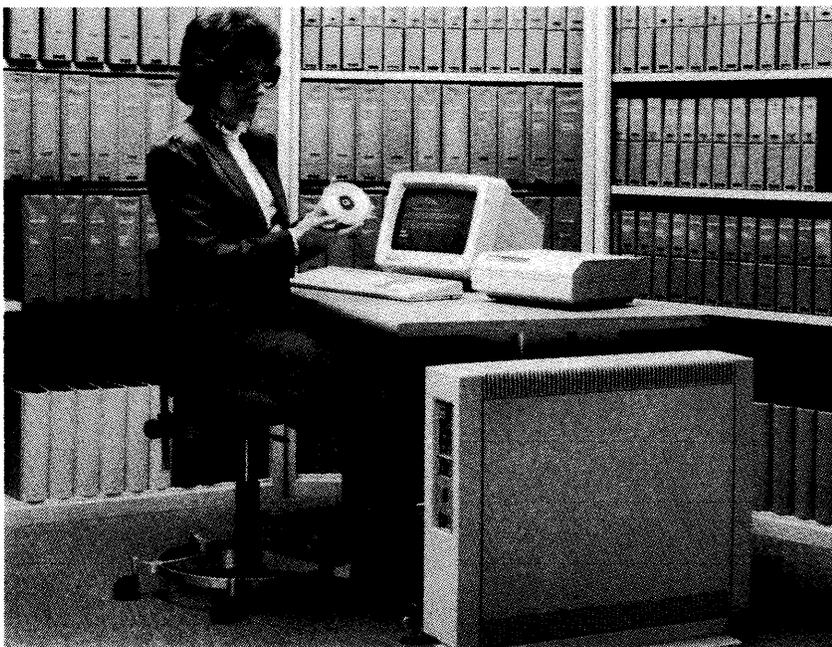
DATA FORMAT

BASIC UNIT: 32-bit word.

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

MAIN STORAGE

Memory is dynamic MOS RAM. Main memory cycle time is 400 nanoseconds. Main memory increments are 2MB, ▶



Digital Equipment Corporation's MicroVAX II is available in three types of enclosures (pictured is the BA23 floorstanding box). It serves both as a multiuser supermicro for work group, departmental, and small organization computing, and as the basis for a line of high-performance workstations. The system runs under either Digital's proprietary MicroVMS operating system or the Unix-derivative Ultrix-32m.

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CHART A. SYSTEM COMPARISON

MODEL	MicroVAX II
SYSTEM CHARACTERISTICS	
Date of introduction	May 1985
Date of first delivery	June 1985
Microprocessor type	MicroVAX 78032
Microprocessor cycle time	200 ns
Operating system	MicroVMS, Ultrix-32m
Upgradable from	MicroVAX I, MicroPDP-11
Upgradable to	Not applicable
Number of serial/parallel I/O ports	Up to 49 serial
Number of expansion slots	7 (BA23); 11 (BA123); 13 (H9642)
MEMORY	
Minimum capacity (bytes)	2M
Maximum capacity (bytes)	16M
DISK STORAGE	
Minimum capacity (bytes)	31M
Maximum capacity (bytes)	1.8G
NUMBER OF WORKSTATIONS	Up to 48
COMMUNICATIONS PROTOCOLS	Async; sync; DDCMP (DEC-net); Ethernet; SNA; X.25; 2780/3780; 3271; TCP/IP; LU6.2

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

➤ The workstation products, especially the VAXstation II/GPX, are aimed toward high-productivity professionals for specialized applications, such as computer-aided engineering and software development (CAE and CASE), computer-aided publishing, and artificial intelligence development.

Even more specialized MicroVAX II-based systems are offered for more esoteric, but nonetheless critical, applications. For example, the recently announced realtime VAXlab systems—based variously on multiuser MicroVAX IIs or on VAXstations—are offered for applications such as acoustic research, experiment control and analysis, image processing, and medical imaging.

In short, Digital aims the MicroVAX II and derivatives at a full range of applications in small and medium-sized environments.

The last year's product introductions can only help Digital's MicroVAX II products to compete in all target areas. The Local Area VAXcluster software enables MicroVAX II and VAXstation systems, centered around a server and linked through Ethernet, to share storage facilities and other resources; moreover, it allows data sharing at the record (rather than the file) level, so multiple users can have concurrent read/write access. Because disk storage can be centralized, diskless stations and systems (which Digital has also added) can be configured in the cluster, permitting enhanced security. The new scheme also provides transparent connectivity with larger VAX systems and with other Local Area VAXclusters over Ethernet, adding further dimensions to the strong intersystem communications that Digital already offers.

The introduction of the VAXstation II/GPX is also highly significant, for it endows Digital with more advanced color ➤

➤ 4MB, and 8MB. Like all VAX systems, the MicroVAX II provides up to 4GB of virtual memory space.

PROCESSING COMPONENTS

The MicroVAX II features a single-board CPU centered around the MicroVAX 78032, a Digital-designed and manufactured ZMOS (double-metal NMOS) chip. The 78032 features 32-bit internal and external data paths, 200-nano-second cycle time, two-stage pipelined architecture, and instruction prefetch. The chip also includes its own 20MHz clock generator and demand-paged virtual memory management. The 78032 provides sixteen 32-bit general registers, 31 interrupt levels, and 1GB of physical address space. The 78032 has a TTL-compatible interface.

Also on the CPU board is the MicroVAX 78132, a chip-level floating-point unit (FPU) that handles F (single-precision), D (double-precision), and G (extended-range double-precision) floating-point data types. The 78132 also accelerates integer multiply and divide functions.

Like larger VAX systems, the MicroVAX II features a 304-instruction set, although differently implemented. On the MicroVAX II, 175 instructions are implemented in the 78032 and 70 in the 78132; 59 instructions are emulated in software macrocode. The emulated instructions, including the 128-bit H floating-point data format and some character strings and packed decimals, are reportedly those which are most complex but least frequently used.

Digital claims that, depending upon the application, the 78032 and 78132 in conjunction deliver between 70 and 110 percent of the performance of the VAX-11/780 supermini, with an average of 90 percent. (That is, 0.7 to 1.1 MIPS, with an average of 0.9 MIPS).

In addition to the CPU and FPU, the MicroVAX II CPU board includes 1MB of integral main memory, memory expansion control, console serial line unit, 64KB of ROM containing power-up diagnostics and bootstrap program, and a Q-bus interface containing an 8,000-entry map for virtual-to-physical I/O address translation. Digital's older MicroVAX I can be field upgraded to the MicroVAX II. Digital's MicroPDP-11 computers, which employ the same BA23, BA123, and H9642 enclosures as the MicroVAX II, can be upgraded to the MicroVAX II.

INPUT/OUTPUT CONTROL

I/O on the MicroVAX II 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.

CONFIGURATION RULES

The MicroVAX II comes in a choice of three enclosures: the BA23, a pedestal or rackmount box with eight module slots and two slots dedicated for 5¼-inch mass storage devices; the BA123, a caster-mounted floorstanding enclosure with 12 module slots and five slots for mass storage; and a cabinet system employing a 14-slot modified H9642 cabinet (the type used for larger VAX computers) containing two BA23 enclosures and providing space for two RA-class disks.

The MicroVAX II is available in five basic Standard System packages:

- An Ethernet-node single-user configuration. It constitutes an entry-level Ethernet node and features 2MB of main memory, a single serial line unit, a 31MB RD52 Win- ➤

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▷ functionality and high-resolution gray-scale capabilities—which it needs to compete with color and gray-scale stations offered by workstation rivals Sun Microsystems and Apollo Computer. The VAXstation II/GPX—initially released with the Unix-based Ultrix-32m operating system but now also supporting Digital's proprietary MicroVMS—combined with the addition of the sophisticated Ultrix-32w workstation software with advanced windowing, signals Digital's increased commitment to the Unix environment for single-user technical computing. Although the VMS-based Local Area VAXcluster demonstrates Digital's continuing commitment to its proprietary environment, the company obviously also realizes that the Unix environment is critical in the workstation arena—especially since Sun, a principal rival, is so heavily involved in development of Unix products for workstations.

The introduction of the 8MB main memory board and the RD54 159MB Winchester are seemingly small but significant events. The new board increases the main memory capacity of the MicroVAX II and VAXstation II/GPX to 16MB (from the previous high of 9MB), increasing suitability for larger, memory-intensive applications. The new 5¼-inch disk, intended to bridge the gap between the 71MB RD53 disk and the 14-inch, 456MB RA81 Winchester, available only in larger MicroVAX II configurations, is particularly valuable to the VAXstation II/GPX; it enables that station to support up to 477MB of auxiliary storage (versus the 213MB previously configurable), bringing the system's disk capacity into a closer competitive balance with that provided by Sun and Apollo stations.

COMPETITIVE POSITION

In its multiuser incarnation, the MicroVAX II competes against a wide range of supermicro and low-end supermini systems. In the last year, however, Digital has come more directly into competition with IBM systems as Digital's star has risen and IBM's has flickered. Initially, the MicroVAX II primarily took on the System/36 in the departmental arena, but now IBM's RT PC and low-end 9370 are aimed into the same application areas as the Digital machine.

The MicroVAX II is most likely to come up against the RT PC, which only supports 18 terminals, in smaller configurations. The 1.6-to-2.1-MIPS RT PC has a definite advantage in price/performance over the MicroVAX II, which performs at a maximum of 1.1 MIPS. A basic RT PC 6150 Model 25 configuration, including 2MB of memory, a 70MB disk, and a keyboard, prices out at \$14,050, or \$6,690 per MIPS. A MicroVAX II system package with 2MB of memory and a 71MB disk costs \$26,335, or \$23,940 per MIPS. That disparity in price, while real, is somewhat deceptive, for the Digital configuration also includes a 95MB streaming tape drive and a 4-line multiplexer, as well as the integral MicroVAX 78132 Floating-Point Unit. If an Advanced Floating-Point Accelerator, streaming tape drive, and four-port RS-232-C adapter—representing an additional \$4,645—are added into the RT PC configuration, the price per MIPS for the IBM ▷

▶ chester disk subsystem, an 800KB RX50 dual floppy disk subsystem, and an Ethernet adapter, all housed in the BA23 pedestal enclosure. Up to 12 additional modem/data serial lines and one memory module can be added; additional networking options can also be selected.

- A four-user configuration intended for team or work-group computing. It features 5MB of main memory, a 71MB RD53 Winchester disk, a 95MB TK50 streaming cartridge tape drive, five serial lines (one console terminal and four modem/data), and a BA23 pedestal enclosure. Another main memory module, eight more modem/data serial lines, and networking options can be added.
- An eight-user system intended for larger work groups. This configuration includes nine serial lines (one console terminal and eight modem/data); 12 more modem/data serial lines can be added. Also included in this configuration are 5MB of main memory, an RD53 disk, a TK50 streaming tape drive, an Ethernet adapter, and the BA123 cabinet. Two more RD53 disks or one RD53 and one RX50 diskette can be added, along with one more main memory module. Line printer and additional networking options can also be selected.
- A 16-user departmental system. This package features nine serial lines (one console terminal and eight modem/data), 9MB of main memory, three RD53 disks, a TK50 streaming tape drive, an Ethernet adapter, and the BA123 cabinet. One more main memory module can be configured, as can 12 more modem/data serial lines. Networking and line printer options may also be added.
- A departmental system for storage-intensive applications. Housed in the 40-inch modified H9642 cabinet, this configuration includes nine serial lines (one console terminal and eight modem/data), 16MB of main memory, a KDA50 disk controller (for RA60 and RA81 disks), a TK50 streaming tape drive, and an Ethernet interface. Purchasers must choose either an RA60 205MB removable or RA81 456MB Winchester disk as a system device, and must also select an operating system license.

This configuration can support up to 1.8GB of disk storage. (One option is a 1.368GB three-RA81 subsystem in a separate cabinet enclosure.) A TS05 tape drive can be configured if RA81 disks are chosen. Up to 40 more modem/data serial lines can be configured (fewer if RD53 and RX50 devices are also selected as options). Line printer and networking options can also be attached.

Standard systems require selection of a MicroVMS, Ultrix-32m, or VAXELN license.

The MicroVAX II is also available in various BA23-, BA123-, and H9642-based System Building Block (SBB) configurations, which require selection of specific CPU packages, mass storage devices, and software licenses. Selections from console terminal and communications/networking menus are optional. Users must select either a MicroVMS, Ultrix-32m, or VAXELN operating system license.

Digital also offers a range of high-performance workstations based on the MicroVAX II: VAXstation II, VAXstation II/GPX, and VAXstation II/RC.

VAXstation II is a multiwindow, multiprocessing, single-user graphics station. The CPU, Floating-Point Unit, 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 9MB of main memory and 213MB of disk storage (through three 71MB RD53 disks); a DECnet/Ethernet ▶

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CHART B. DISK/DISKETTE DEVICES

MODEL	RX50	RD52	RD53	RD54	RA60	RA81
Type	Dual diskette	Winchester	Winchester	Winchester	Removable	Winchester
Size (inches)	5.25 per diskette	5.25	5.25	5.25	14	14
Number of surfaces	1 per diskette	—	—	—	6	7
Formatted capacity per drive (bytes)	818K (409K per diskette)	31M	71M	159M	205M	456M
Interface/controller	RQDX3	RQDX3	RQDX3	RQDX3	KDA50	KDA50
Drives per interface/controller	—	—	—	—	4	4
Average access time	264 ms	57.5 ms	38.3 ms	38.3 ms	50 ms	36.3 ms
Data transfer rate	250K bps	625KB/sec.	625KB/sec.	625KB/sec.	1.98MB/sec.	2.2MB/sec.
Sectors/tracks per surface	80 tracks/ diskette	—	—	—	1600 tracks	2496 tracks
Bytes per sector/track	512/sector	512/sector	512/sector	512/sector	512/sector	512/sector

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➤ system rises to \$8,902. However, that is still a great deal lower than the Digital system price.

On the other hand, IBM's 9373 Model 20 is a good deal pricier than the MicroVAX II. The basic 9373 system configuration, consisting only of the CPU and 4MB of main memory, is priced at \$31,000; a basic MicroVAX II configuration with a 71MB disk, 95MB streaming tape, and 4-line multiplexer costs only \$21,280.

The VAXstation II/GPX also competes against the RT PC in workstation configurations, for the IBM system can be employed as a workstation platform. As implied previously, however, the most vigorous competition for the VAXstation II/GPX comes from Sun Microsystems' Sun 3 family and Apollo's Domain systems. Especially against the 2-MIPS Sun 3-160—a close competitor—the VAXstation II/GPX looks overpriced. A \$44,595 VAXstation II/GPX package with integral floating-point unit, 5MB of main memory, a 159MB disk, 95MB streaming tape drive, 8-plane graphics co-processor, and color monitor prices out to \$40,540 per MIPS. A similar Sun 3-160 color system includes 8MB of memory, floating-point co-processor, 142MB disk, 60MB tape, and monitor and costs \$31,500—a mere \$15,750 per MIPS.

MIPS—and price per MIPS—are not everything, of course. Those who buy Digital products also buy into a sophisticated and reliable support structure. But Digital would be well advised to cut its prices in order to compete most effectively with its primary workstation and multiuser challengers.

ADVANTAGES AND RESTRICTIONS

The MicroVAX II affords numerous advantages to both first-time and current Digital users. The software compatibility provided under the VMS environment protects users' application investments, allowing MicroVAX II users to move up to VAX 8000 systems as their needs increase, and permitting VAX 8000 users to install smaller departmental systems on which their software can run unchanged. In addition, the choice of MicroVMS and Ultrix-32m operating systems allows users to employ either a traditional realtime system or a timesharing Unix system, depending upon their computing needs.

➤ LAN interface is standard. Special packages for artificial intelligence work and Ada programming are available. MicroVMS or Ultrix-32m operating system and workstation software licenses must be chosen.

VAXstation II/GPX (Graphics Extension) employs the MicroVAX II CPU with Digital's GPX accelerator chip set as a graphics co-processor; according to Digital, the VAXstation II/GPX provides the same functionality as the plain-vanilla VAXstation II, but offers increased speed and graphics functionality. The station comes with a 4-plane (BA23 enclosure) or 8-plane (BA123 enclosure) graphics coprocessor; a 19-inch gray-scale or color monitor (the latter capable of displaying 256 colors from a palette of over 16 million); keyboard and mouse; Ethernet interface; disk; tape; and MicroVMS or Ultrix-32m operating system and workstation software licenses. Memory is expandable to 9MB; up to 477MB of disk storage can be configured through three 159MB RD54 disks in a deskside enclosure.

VAXstation II/RC is an entry-level, packaged workstation targeted toward primary applications in electronics, mechanical computer-aided design (MCAD), software development, computer-aided software engineering (CASE), and technical publishing. The configuration includes 3MB or 5MB of main memory, a 19-inch monochrome monitor, 71MB RD53 disk and controller, TK50 95MB streaming tape drive, Ethernet interface, video subsystem, and standard keyboard and mouse; MicroVMS or Ultrix-32 licenses are included. The system's 5-slot backplane is nonexpandable.

A specialized, MicroVAX-based realtime system, *VAXlab*, is offered for laboratory data acquisition and experiment control in midrange to high-performance applications. It comes in four versions:

- VAXlab/STD, a multiuser packaged system built on the MicroVAX II in a BA123 enclosure.
- VAXlab/RM, a rackmount multiuser packaged system built on the MicroVAX II in a BA23 enclosure.
- 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/Floating-Point Unit; 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 software. Also included is Labstar software for realtime I/O; scientific plotting;

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CHART C. WORKSTATIONS

MODEL	VT220	VT240	VT241
DISPLAY PARAMETERS			
Max. chars./screen	3168	3168	3168
Buffer capacity	—	—	—
Screen size (lines x chars.)	24 x 80 or 132	24 x 80 or 132	24 x 80 or 132
Tilt/swivel screen	Tilt standard	Standard	Standard
Symbol formation	7 x 10 dot-matrix	8 x 10 dot-matrix	8 x 10 dot-matrix
Character phosphor	White, green, or amber	White, green, or amber	P4
Total colors/no. simult. displayed	Not applicable	Not applicable	—
KEYBOARD PARAMETERS			
Style	Typewriter	Typewriter	Typewriter
Character/code set	ASCII, Digital Special Graphics, and Supplemental	ASCII, Digital Special Graphics, and Supplemental	ASCII, Digital Special Graphics, and Supplemental
Detachable	Yes	Yes	Yes
Program function keys	15	15	15
TERMINAL INTERFACE	RS-232-C, RS-423, and 20 ma std.	RS-232-C, RS-423, and 20 ma std.	RS-232-C, RS-423, and 20 ma std.
COMMENTS		800 x 240 pixel graphics array	800 x 240 pixel graphics array; includes color monitor

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

➤ The MicroVAX II has upgradability advantages for MicroPDP-11 users. Because the two lines of systems use the same BA23, BA123, and H9642 enclosures (the same “form factors,” to use Digital’s term), MicroPDP-11 users can perform board swaps to convert their systems to MicroVAX IIs if they find that they need extra power in the same amount of space. Also, the MicroVAX II’s support for Q-bus and some Unibus peripherals (such as the RA60 and RA81 disks and the TU81-Plus tape) provides an additional boon for MicroPDP-11 or even Unibus PDP-11 users who want to upgrade to MicroVAX power; they can transfer their peripherals, rather than purchase new ones. Similarly, the support by some MicroVAX II configurations of the RA60 and RA81 disk drives and the TU81-Plus tape—peripherals also employed by the VAX 8000 superminis—allows transfer of peripherals by users who want to move up to a full-fledged VAX 8000 system.

On the subject of peripherals, Digital needs to develop larger disk drives to keep the MicroVAX II competitive. The 456MB RA81 is the largest drive available for the MicroVAX II; that is overpowered, for example, by the 824MB 9335 DASD offered on IBM’s 9373, a direct competitor. That drive allows the 9373 to handle up to 6.5GB of disk, more than three times that available on the MicroVAX II.

Digital’s Volume Software Pricing and VAX Software Portfolio programs are also advantageous. The former allows multiple-system users to acquire software licenses at substantial bulk discounts; the latter permits users to license aggregations of software products for a good deal less than they would pay if the license for each product were purchased individually.

USER REACTION

Digital Equipment Corporation declined to provide us with a list of users we could contact for evaluations of MicroVAX II performance. However, we were able to locate a MicroVAX II user affiliated with a transportation ➤

➤ 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 MicroVAX II or 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/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 TS05 9-track streaming tape drive is supported on larger, H9642-based MicroVAX II configurations. The TS05 features a 1600-bpi recording density, speeds of 25/100 ips, and a 40KB/160KB-per-second data transfer rate. One TS05 can be attached per controller.

Additionally, the MicroVAX II supports the TU81-Plus tape subsystem, which is also employed by Digital’s VAXBI-based VAX 8000 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 data from high-speed test equipment. This PE/GCR unit features a 256KB cache buffer, 1600-/6250-bpi recording densities, and a streaming speed of 75 ips.

The CD (Compact Disk) Reader system is a read-only laser disk drive employing a compact, removable 600MB optical disk called a CDROM (Compact Disk Read Only Memory). The disk itself is 4.7 inches (120 mm) in diameter. The drive’s average access time is 1.5 seconds; average data transfer rate is 150KB per second.

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. ➤

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CHART D. PRINTERS

MODEL	LA50	LA75	LA100	LA120	LA210	LQPO2
Type	Dot-matrix	Dot-matrix	Dot-matrix	Dot-matrix	Dot-matrix	Daisywheel
Speed	50/100 cps	32/42/125/250 cps	40/240 cps; 80 cps opt.	180 cps	40/240 cps; 80 cps opt.	32 cps
Bidirectional printing	Yes	Yes	Yes	Yes	Yes	Yes
Paper size	4.5 to 10 in. wide	4.25 to 10 in. wide	Up to 14.9 in. wide	3 to 15 in. wide	3.5 to 14.9 in. wide	Up to 15 in. wide
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.	7 x 7 dot-matrix	33 x 18/7 x 9 dot-matrix; 33 x 9 opt.	Full
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	5, 6, 6.6, 8.25, 10, 12, 13.2, 16.5	5, 6, 6.6, 8.25, 10, 12, 13.2, 16.5	Variable	Variable
Vertical line spacing (lines/inch)	2, 3, 4, 6, 8, 12	2, 3, 4, 6, 8, 12	2, 3, 4, 6, 8, 12	2, 3, 4, 6, 8, 12	Variable	Variable (includes proportional) ASCII
Character set	96 ASCII, others	U.S. ASCII, 8 others	Courier-10 or Orator-10 std.; others opt.	94 ASCII, APL	94 ASCII; Courier, VT100 line-drawing std.; others opt.	RS-232-C
Controller/Interface	RS-232-C	RS-423	RS-232-C std.; 20 ma opt.	RS-232-C	RS-232-C std.; Centronics parallel opt.	RS-232-C
No. of printers per controller/interface	1	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	7 x 22 x 16	33.5 x 27.5 x 21.7	5 x 21.5 x 13.5	7 x 25 x 16
Graphics capability, dots per inch	72 x 180	180 x 144	132 x 72	Not applicable	132 x 72	Yes; opt.
Comments		Built-in LA50, LA100, LA210, IBM Proprinter emulation	Keyboard send/receive terminal		Compatible with IBM PC, PC XT, PC AT	

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➤ concern in the Southwest. He had recently installed a Local Area VAXcluster.

The user said that he had originally purchased the MicroVAX II to replace a VAX-11/780; he found that the MicroVAX II provides as much power for lower acquisition and maintenance costs. The conversion from the VAX-11/780, he said, required absolutely no software changes; he was also able to port some peripherals to the new system from the old one.

He now has several MicroVAX IIs configured in the Local Area VAXcluster, which, he said, provides the functionality of a VAX 8550—a midrange supermini—for far lower cost. He uses a MicroVAX II configured with two 456MB RA81 disk drives as a boot, or central, node; another node has two more RA81s in case the boot node fails.

When asked if he would recommend the MicroVAX II to a prospective purchaser, this user said that he definitely would. "I can't see anybody in the industry having anything to compete with it," he said, singling out the Local Area VAXcluster as a solid vehicle for system growth: "If you need more power, just add another MicroVAX II." □

➤ 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.

DECtalk, a speech synthesis unit, converts standard ASCII text into speech output; it employs an RS-232-C interface and features modular telephone connections that allow users to access a data base with a standard Touch-tone telephone.

COMMUNICATIONS

The MicroVAX II products support the DZQ11 and DHV11 asynchronous interfaces; the DPV11 and DMV11 synchronous interfaces; and the DEQNA Ethernet interface. Details on those Q-bus communications devices, which are also supported by Q-bus-based Digital PDP-11 systems, are provided in the "Communications Control" section of the "DEC PDP-11 Family" report in DATAPRO REPORTS ON MINICOMPUTERS.

Also configurable on the MicroVAX II family is the H4005 Ethernet Transceiver, detailed in the "Communications Control" section of the "VAX 8000 Systems" report in DATAPRO REPORTS ON MINICOMPUTERS.

In addition to baseband Ethernet connection, to which the H4005 is relevant, Digital provides an alternative ThinWire scheme, which provides full Ethernet capability for personal computers, workstations, and low-end systems in offices and other local work areas. ThinWire Ethernet permits connection of up to 30 stations in one 185-meter (202-yard) segment.

The ThinWire Ethernet scheme allows the MicroVAX II to be networked to Digital's MS-DOS-based VAXmate personal computer. The VAXmate includes DECnet/Thinwire Ethernet support; through a server, this PC can store and access files on MicroVAX (and VAX) systems. (The VAXmate can participate in networks including VAXs, MicroVAXs, other VAXmates, DEC Rainbows, and IBM PC ATs and PC XTs running Digital's DECnet software.)

The ThinWire Ethernet Station Adapter (DESTA) allows connection of a single Ethernet station to ThinWire Cabling through the DEQNA controller. The DESTA has one 15-pin connector port that allows it to be mounted in or near the ➤

DEC MicroVAX II

CHART D. PRINTERS (Continued)

MODEL	LQP03	LN03	LN03 Plus	LG01/LG02	LXY12/22	LPS40
Type	Daisywheel	Laser	Laser	Matrix	Dot-matrix printer/plotter	Laser
Speed	25/34 cps	8 ppm	8 ppm	280/600 lpm	300/600 lpm	40 ppm
Bidirectional printing	—	Not applicable	Not applicable	—	No	Not applicable
Paper size	8.5 x 11 in.	8.5 x 11 in.	8.5 x 11 in.	4-16 in. wide; 3-20 in. long	—	7.5-11 in. wide; 10.5-17 in. long
Character formation	Full	300 x 300 dots/in.	300 x 300 dots/in.	120 x 144/60 x 72 dots/in.	Variable	Electrophotographic
Horizontal character spacing (char./inch)	Variable	Variable	Variable	Variable	Variable	Variable
Vertical line spacing (lines/inch)	Variable (includes proportional)	Variable	Variable	—	—	Variable
Character set	ASCII	ASCII; 16 resident Courier/Elite fonts	ASCII, technical; 17 resident fonts	Multiple	96 ASCII; 192 opt.	29 resident typefaces
Controller/Interface	RS-232-C	RS-232-C	RS-232-C	LP11 or RS-232-C	RS-232-C	—
No. of printers per controller/interface	1	1	1	—	—	—
Printer dimensions, in. (h x w x d)	7.75 x 20.75 x 15.25	15 x 21 x 23.5	15 x 21 x 23.5	38 x 33.5 x 22.3	46.5 x 30 x 24.3	40.4 x 60 x 28.4
Graphics capability, dots per inch	Yes; opt.	Not applicable	300 x 300	LG02 only	Yes	300 x 300
Comments	Prints in landscape and portrait modes	Prints in landscape and portrait modes	Provides bit-mapped, Tektronix 4010/4014-compatible graphics	LG01 text printer upgradable to LG02 text/graphics printer	LXY12 plots at 16.7 in./min., LXY22 at 33.3 in./min.	Ethernet print server subsystem

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

► Ethernet station and a second port for connection to the ThinWire Ethernet cable. The DESTA contains Ethernet transceiver (IEE 802.3) logic and provides transceiver functionality; it is powered from the controller.

SOFTWARE

The MicroVMS operating system is based on the same architecture as VAX/VMS, which runs on the VAX superminis. Consequently, the MicroVAX computers run the same system and applications software as the larger VAX computers without recompilation or relinking, subject to the limitations of peripheral support. Unless noted, details on the software products referenced in this section are the same as those presented in the "Software" section of 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 SYSTEM: *MicroVMS* is a specially packaged version of the VAX/VMS operating system that runs on Digital's VAX superminis. It is a general-purpose operating system that provides the environment for the concurrent execution of multiuser timesharing, batch, and time-critical applications.

MicroVMS allows an absolute limit of 8,192 concurrent processes. It requires a minimum of 1MB of physical memory. MicroVMS includes routines found in VAX/VMS for backup, copy, rename, delete, and edit functions. Programming aids include macro and object libraries, assembler, debugger, and system programming utilities.

Ultrix-32m, based on Berkeley 4.2 BSD Unix with 4.3 BSD enhancements, is an implementation of the Ultrix-32 operating system that runs on VAX superminis. Ultrix-32m uses two command language interfaces: Unix Version 7 Bourne Shell and Berkeley C Shell. The C programming language and additional programming tools are also provided. Ultrix-32m provides kernel configuring capability, allowing the user to add and remove device drivers to match the hardware configuration.

Ultrix-32m is compatible at the source, object, and executable image levels with Ultrix-32. Source programs written in the C language and containing no architectural dependencies are compatible among Ultrix-32m, Digital's Ultrix-11 (for the PDP-11 family), and AT&T's Unix System V. Ultrix-32m is fully syntax-compatible with the Bourne Shell script of Berkeley 4.2 Unix, Ultrix-11, and AT&T Unix System V, as well as with DEC's VAX/VNX products, which provide Unix-like operations for systems running under VAX/VMS. It is also syntax-compatible with the C Shell script on Ultrix-32 and Ultrix-11 systems.

The Unix-derived *Ultrix-32w* workstation software, used by the VAXstation II and VAXstation II/GPX families, 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 Graphical Kernel System (GKS) library that includes a high-level graphics and text programming interface; ANSI 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.

DEC MicroVAX II

► **VAXELN**, which is not so much an operating system as a development tool and specialized runtime environment, acts as a compatible subsystem to the MicroVMS 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 that becomes a part of each application. After development, VAXELN applications run standalone on MicroVAX target systems without the host operating system. VAXELN applications are written in an optimizing version of Pascal or C.

DATA BASE MANAGEMENT: The MicroVAX II employs the VAX data base management or information management architecture, which is arranged in layers above the operating system. On the top layer, the MicroVAX II languages and *Forms Management System (FMS)* provide a user interface for interactive and language-callable video forms. On the next level, the *Common Data Dictionary (CDD)* integrates the other components of the architecture. The CDD provides a facility for storing logical data definitions. Also on this level are the *Datatrieve* high-level and distributed data access facilities.

On the lowest level are the two *Rdb* relational data base management systems. *Rdb/ELN* is used in dedicated or distributed VAXELN environments; *Rdb/MicroVMS* runs on purely MicroVMS-based systems.

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

COMMUNICATIONS: Like the larger VAX systems, the MicroVAX II supports the *Digital Network Architecture (DNA)*, a set of protocols governing the format, control, and sequencing of message exchange for all DECnet implementations. (Further information on DNA is included in the "Communications Control" section of the "DEC VAX 8000 Systems" report in DATAPRO REPORTS ON MINICOMPUTERS.)

DECnet-VAX permits suitably configured MicroVMS- and VMS-based systems to participate as routing or end nodes in DECnet computer networks. It offers task-to-task communications, file transfer, downline system and task loading, network command terminals, and network resource-sharing capabilities through DNA protocols.

DECnet-Ultrix is a Phase IV Ethernet-based end-node implementation of the Digital Network Architecture for the Ultrix-32m operating system. It allows communications among Digital systems using DNA protocols, as well as communications, including electronic mail, with non-Digital systems using TCP/IP protocols. It allows data and file transfers between Ultrix- and VMS-based systems, and also permits DECnet and TCP/IP protocols to share system resources.

Local Area VAXcluster software allows the interconnection through Ethernet of up to 13 MicroVAX II and VAXstation II client systems with a central MicroVAX or VAX server. The server manages the system software—VMS, DECnet, and Ethernet—in a shared, central file system. The Local Area VAXcluster creates a unified system, allowing all participating nodes to remain independent while equally sharing resources, such as disks, tapes, and printers, and to employ a single, distributed file system that manages access of files at the record level. Through those functions, a Local Area VAXcluster provides the participating computers with the same services available on the high-performance VAXclusters that serve the VAX 8000 and VAX-11 series.

A single system manager can perform all necessary management functions for all members of a Local Area VAXcluster from any member system. Utilities are provided to allow the manager to add, delete, and manage the client systems.

Server systems supporting large disks can be employed, permitting workstation users to access and share data and applications that cannot be stored locally. The client systems can be diskless, allowing the central server to maintain all data locally and to manage data and file backups to enhance system security and reduce individual management tasks.

Local Area VAXclusters also permit integration of terminal servers, allowing users who do not require workstations to access the data and resources of the cluster transparently across Ethernet.

Remote System Manager (RSM), layered on top of Digital's DECnet software, is a central management facility for distributed systems. It permits a MicroVAX II or VAX running RSM server software to perform system management functions for MicroVAX II and VAXstation II 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 five MicroVAX II systems under a MicroVAX II server to a maximum of 40 VAXstation IIs with a VAX 8600 or 8800 server.

RSM supports central software installation and updating; provides a facility for the system manager to keep libraries of software required for particular applications; and supports central file backup, allowing the system manager to perform file backups over the network for multiple client systems. Central queuing and print services are also provided.

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

The MicroVAX II and VAXstations support Digital's *Internet* products, which provide interconnection of MicroVMS-based Digital computers and Digital networks to systems built by IBM and other manufacturers. Members of the Internet group, prefixed DECnet/SNA, are: Gateway; DISOSS Document Exchange Facility (DDXF); Advanced Program-to-Program Communications/LU6.2 Programming Interface (APPC); Application Programming Interface (API); Printer Emulator (PrE); 2780/3780 Protocol Emulator; and 3271 Protocol Emulator. Those products are discussed in detail in the "Communications Software" section of the "DEC VAX 8000 Systems" report in DATAPRO REPORTS ON MINICOMPUTERS.

Also available are two other access products: *DECnet/SNA RJE Facility*, which allows a MicroVAX II to function as a remote SNA batch workstation, and *DECnet/SNA 3270 Terminal Emulator*, which provides access to 3270 programs, principally those executing under IMS or CICS.

VMS/SNA layered software enables individual MicroVAX systems and VAXstations to connect directly to an IBM SNA network; it does not require a gateway or participation in a DECnet environment. With VMS/SNA, a MicroVAX or VAXstation system appears to the SNA network as a Physical Type 2 cluster controller. Among other functions, a Digital system can exchange documents and electronic mail messages between the MicroVMS operating system and DISOSS, and can implement distributed application programs that run between MicroVMS and IBM systems. According to Digital, VMS/SNA complements the DECnet/SNA Gateway, supporting many of the same access

DEC MicroVAX II

► routines and user interfaces; applications written for VMS/SNA can be migrated to the Gateway with no changes to software.

VAX/VMS Services for MS-DOS is a software product that allows a MicroVAX (or a larger VAX) to act as a server for a group of VAXmate PCs in a DECnet Thinwire network. The product allows resource-sharing between VMS and MS-DOS and permits server-based licensing of MS-DOS applications. (Through server-based licensing, Digital licenses applications for a specific number of users on a single server; only one license per server need be purchased, rather than one license per user.)

VAX VIDA is a software component in a VAX- or MicroVAX-IBM interconnect system; it permits access to IBM mainframe data bases. VIDA conforms to a read-only subset of the Digital Standard Relational Interface (DSRI) architecture. Users can access IBM data through products such as Datatrieve, Rdb/VMS utilities and embedded Data Manipulation Language, and other layered products that use DSRI to access data. VIDA uses Digital's SNA Gateway products to communicate with software from Cullinet Software, Inc. running on the IBM mainframe. The Cullinet software accesses the data from the IBM mainframe data base and sends it across the SNA Gateway to the MicroVAX user's application software. The accessed data can also be stored in a MicroVAX data base or file.

APPLICATIONS: A range of applications and special-purpose products is available directly from Digital for the MicroVAX II and VAXstations. The *WPS-Plus* document processing system and the *ALL-IN-1* integrated office system (which incorporates WPS-Plus) are principal office automation systems. Detailed information on those two office products is contained in DATAPRO REPORTS ON OFFICE AUTOMATION.

Also available are *A-to-Z* software, a group of general-purpose application and office packages, and the *VTX* videotex system. Special-purpose products include *DECshell*, *Code Management System (CMS)*, *Application Development Environment (ADE)*, *DECcalc*, and *VAX GKS/0b* (for graphics).

Two interdependent tools are the *VAX Language-Sensitive Editor* and the *VAX Source Code Analyzer*. The former is a multilanguage, multiwindow, screen-oriented editor designed for program development and maintenance. The latter product, which works in conjunction with the Language-Sensitive Editor, allows software developers to cross-reference, navigate, and analyze an entire software system, rather than just individual components.

VAX-11 RSX allows MicroVAX II and VAXstation systems to run and develop programs for the RSX-11 operating systems that run on Digital's PDP-11 minicomputers.

Digital also offers third-party applications packages for VAX systems. The company's External Applications Software (EAS) Library service acquires software from third parties and makes it available through the company's software distribution channels. Software is tested by Digital for operation, documentation, and ease of installation prior to being included in the EAS Library. Software products from the EAS Library are sold on an "as is," unsupported basis, although the author of the software may offer a separate maintenance agreement.

Digital is also involved in two types of cooperative marketing agreements with a range of software vendors. In a Cooperative Marketing Program (CMP), Digital and the independent software vendor combine forces in sales calls, trade shows, and technical demonstrations, and recommend each other's products to prospective buyers. Digital has

CMPs with vendors in the petroleum/geotechnical, investment management, Unix-based office automation, and human resources management (payroll/personnel) application areas, among others.

System Cooperative Marketing Programs (SCMPs) are agreements through which Digital works with OEMs to market, demonstrate, and sell turnkey systems incorporating Digital hardware and the vendors' products. Digital's SCMP program encompasses manufacturing resource planning (MRP), mechanical computer-aided design (MCAD), electronic computer-aided engineering (CAE), and health care/medical information management.

OPERATING ENVIRONMENT

The BA123 enclosure of the MicroVAX II measures 24.5 inches high by 13 inches wide by 27.5 inches deep (62.2 by 33 by 70 cm); it is mounted on casters. The BA23 box measures 24.5 by 10 by 28.5 inches (62.2 by 25.4 by 72.4 cm). The modified H9642 is a 40-inch cabinet. Power requirements are 120 VAC, single-phase, 60 Hz, 88 to 128 VRMS, 47 to 63 Hz. Maximum running current is 12 amp for the BA123 and 6 amp for the BA23; maximum power consumption is 690 watts for the BA123 and 345 watts for the BA23. MicroVAX II operating temperatures range from 59 to 90 degrees Fahrenheit (15 to 32 degrees Celsius), at 20 to 80 percent humidity, noncondensing.

SUPPORT SERVICES

DOCUMENTATION: With each MicroVAX II and 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.

MAINTENANCE: Digital's Field Service organization offers both on-site and off-site support services for MicroVAX II products. 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 "Support" section of the "DEC VAX 8000 Systems" report in DATAPRO REPORTS ON MINICOMPUTERS.

PRICING

POLICY: Digital provides MicroVAX II and VAXstation 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. Customers ordering Ultrix-32m and Ultrix-32w workstation software receive a Unix binary license directly from Digital. ►

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► 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.

Another program, VAX Software Portfolio, allows users to obtain software development and information management products for a flat fee per month per system under an annually renewable agreement. The fee is lower than a cumulative fee based on a separate charge for each product license. Individual licensing applies even to systems connected in Local Area VAXclusters.

Three development portfolios are offered under this program. The base portfolio contains 29 products, including language compilers, software development tools, and information management facilities. The extended portfolio adds specialized languages, such as Ada, OPS5, Lisp, VAX Cobol Generator, and VIDA. The runtime-only portfolio—available only for the MicroVAX II—comprises a runtime library for use with applications developed under Digital's ACMS, DBMS, VAX/Rdb, and other data management products.

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

EQUIPMENT PRICES

		Purchase Price (\$)	Basic Service (Monthly) (\$)	DECserv. (Monthly) (\$)
MICROVAX II SYSTEM BUILDING BLOCKS (SBBs)				
630QB-A2(A3)	MicroVAX II CPU/Floating-Point Unit; 1MB of main memory; BA 123 enclosure	16,200	95	113
630QE-A2(A3)	MicroVAX II CPU/Floating-Point Unit; 1MB of main memory; H9642 enclosure	20,500	100	119
630QY-A2(A3)	MicroVAX II CPU/Floating-Point Unit; 1MB of main memory; BA23 pedestal enclosure	12,150	84	100
630QZ-A2(A3)	MicroVAX II CPU/Floating-Point Unit; 1MB of main memory; BA23 rack-mount enclosure	12,000	84	100
MICROVAX II SYSTEM PACKAGES				
DH-630Q1-D2(D3)	MicroVAX II CPU/Floating-Point Unit; 2MB of main memory (1MB with CPU and one MS630-AA 1MB memory board); BA23 pedestal enclosure; RD52 31MB Winchester disk; RX50 800KB dual diskette; DEQNA Ethernet controller	23,515	160	190
DH-630Q1-DA	Same as DH-630Q1-D2(D3), but with documentation/diagnostics software kit	23,815	160	190
DH-630Q2-D2(D3)	MicroVAX II CPU/Floating-Point Unit; 2MB of main memory; (1MB with CPU and one MS630-AA 1MB memory board); RQDX3 disk controller; RD53 71MB Winchester disk drive; TK50 95MB cartridge tape drive; DZQ11 4-line multiplexer	26,335	198	236
DH-630Q2-DA	Same as DH-630Q2-D2(D3), but with documentation/diagnostics software kit	26,635	198	236
DH-630Q2-F2(F3)	Same as DH-630Q2-D2(D3), but with 5MB of main memory (1MB with CPU and one MS630-BB 4MB memory board)	21,280	252	300
DH-630Q2-FA	Same as DH-630Q2-F2(F3), but with documentation/diagnostics software kit	21,580	252	300
DH-630Q3-E2(E3)	MicroVAX II CPU/Floating-Point Unit; 5MB of main memory (1MB with CPU and one MS630-BB 4MB memory board); RQDX3 disk controller; RD53 71MB Winchester disk drive; RX50 800KB dual diskette drive; TK50 95MB cartridge tape drive; DHV11 8-line multiplexer	31,650	247	294
DH-630Q3-EA	Same as DH-630Q3-E2(E3), but with documentation/diagnostics software kit	31,950	247	294
DH-630Q3-F2(F3)	Same as DH-630Q3-E2(E3), but excluding RX50 diskette and including DEQNA Ethernet/Q-bus adapter	29,130	281	335
DH-630Q3-FA	Same as DH-630Q3-F2(F3), but with documentation/diagnostics software kit	29,430	281	335
DH-630Q4-E2(E3)	MicroVAX II CPU/Floating-Point Unit; 9MB of main memory (1MB with CPU and two MS630-BB 4MB memory boards); BA 123 enclosure; three RD53 71MB Winchester disk drives; TK50 95MB cartridge tape drive; DHV11 8-line multiplexer	44,020	429	511
DH-630Q4-EA	Same as DH-630Q4-E2(E3), but with documentation/diagnostics software kit	44,320	429	511
DH-630Q4-F2(F3)	Same as DH-630Q4-E2(E3), but with one MS630-CA 8MB memory board in place of two MS-630-BB; also includes DEQNA Ethernet/Q-bus adapter	42,400	349	415
DH-630Q4-FA	Same as DH-630Q4-F2(F3), but with documentation/diagnostics software kit	42,700	349	415
DH-630Q4-H2(H3)	MicroVAX II CPU/Floating-Point Unit; 9MB of main memory (1MB with CPU and one MS630-CA 8MB memory board); BA 123 enclosure; two RD54 159MB Winchester disk drives; TK50 95MB cartridge tape drive; DHV11 8-line multiplexer; DEQNA Ethernet/Q-bus adapter	45,100	361	430
DH-630Q4-HA	Same as DH-630Q4-H2(H3), but with documentation/diagnostics software kit	45,400	361	430 ►

F/S—Contact Digital Field Service.
 NA—Not applicable.
 NC—No charge.

DEC MicroVAX II

Purchase Price (\$)	Basic Service (Monthly) (\$)	DECserv. (Monthly) (\$)
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► MICROVAX II SYSTEM PACKAGES (Continued)

DH-630Q5-E2(E3)	MicroVAX II CPU/Floating-Point Unit; 9MB of main memory (1MB with CPU and two MS630-BB memory boards); two BA23 enclosures and H9642 cabinet; KDA50 disk controller; TK50 95MB cartridge tape drive; DHV11 8-line multiplexer; DEQNA Ethernet/Q-bus adapter; requires RA60 or RA81 disk	44,205	358	426
DH-630Q5-EA	Same as DH-630Q5-E2(E3), but with documentation/diagnostics software kit	44,505	358	426
DH-630Q5-F2(F3)	MicroVAX II CPU/Floating-Point Unit; 16MB of main memory (1MB with CPU and two MS630-CA 8MB memory boards); H9642 cabinet; KDA50 disk controller; TK50 95MB cartridge tape drive; DHV11 8-line multiplexer; DEQNA Ethernet/Q-bus adapter; requires RA60 or RA81 disk	42,205	339	404
DH-630Q5-FA	Same as DH-630Q5-F2(F3), but with documentation/diagnostics software kit	42,505	339	404
—	Local Area VAXcluster configuration; includes MicroVAX II CPU/FPU, 5MB of main memory, RD53 71MB disk (for local paging and swapping), and DEQNA Ethernet interface	19,900	—	—
—	Diskless compute server for Local Area VAXcluster; includes MicroVAX II CPU/FPU, 16MB of main memory, and DEQNA Ethernet interface	24,400	—	—
—	Fully configured Local Area VAXcluster system; includes MicroVAX II CPU/FPU, 16MB of main memory, RA81 456MB disk, TU81-Plus tape drive, and MicroVMS, DECnet, and Local Area VAXcluster software licenses	94,855	—	—

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

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

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)	Same as SV-LV55B-EK(EN), but with 2MB of main memory (1MB with CPU and one MS630-AA 1MB memory board)	26,000	F/S	F/S

Ada Workstation

SV-LV55J-EK(EN)	Same as SV-LV55B-EK(EN), but includes Ada and related software licenses	39,300	318	379
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Artificial Intelligence Workstation

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
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VAXSTATION II/GPX

VAXstation II/GPX SBBs

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 ►
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F/S—Contact Digital Field Service.
 NA—Not applicable.
 NC—No charge.

DEC MicroVAX II

		Purchase Price (\$)	Basic Service (Monthly) (\$)	DECserv. (Monthly) (\$)
▶ VAXstation II/GPX SBBs (Continued)				
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, BA 123 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				
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
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 BA 123 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	718
SU-LV59B-EK(EN)	MicroVAX II CPU/FPU; BA 123 enclosure; 5MB of main memory (1MB with CPU and one MS630-BB 4MB memory board); BA 123 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, BA 123 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, BA 123 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, BA 123 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
—	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	19,995	—	—
—	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	19,995	—	—
—	Same as diskless color system above, but with 8-plane graphics co-processor	23,995	—	—
VAXSTATION II/RC				
SU-LV55N-EK(EN)	MicroVAX II CPU/FPU; BA23 encl.; 3MB of main memory (1MB on CPU board and one 2MB MS630-BA 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; nonexpandable 5-slot backplane	14,995	175	208 ▶

F/S—Contact Digital Field Service.

NA—Not applicable.

NC—No charge.

DEC MicroVAX II

		Purchase Price (\$)	Basic Service (Monthly) (\$)	DECserv. (Monthly) (\$)
▶ VAXSTATION II/RC (Continued)				
SU-LV55P-EK(EN)	MicroVAX II CPU/FPU; BA23 encl.; 5MB of main memory (1MB on CPU board and one MS630-BB4MB 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; nonexpandable 5-slot backplane	16,995	198	236
SV-LV55N-EK(EN)	MicroVAX II CPU/FPU; BA23 encl.; 3MB of main memory (1MB on CPU board and one MS630-BA 2MB memory board); RD53 71MB fixed disk; TK50 95MB tape; DEQNA Ethernet controller; video graphics subsystem; keyboard; mouse; monochrome monitor; MicroVMS operating system and workstation software licenses; nonexpandable 5-slot backplane	14,995	175	208
SV-LV55P-EK(EN)	MicroVAX II CPU/FPU; BA23 encl.; 5MB of main memory (1MB on CPU board and one MS630-BB 4MB memory board); RD53 71MB fixed disk; TK50 95MB tape; DEQNA Ethernet controller; video graphics subsystem; keyboard; mouse; monochrome monitor; MicroVMS operating system and workstation software licenses; nonexpandable 5-slot backplane	16,995	198	236
VAXLAB				
LABVX-AB(AC)	VAXlab/STD; MicroVAX II-based configuration in BA123 enclosure	40,905	306	364
LABVX-DA(DB)	VAXlab/RM; MicroVAX II-based configuration in BA23 rackmount enclosure	34,940	280	333
I.ABVX-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	F/S	F/S
AAV11-DA	300KHz, DMA 2-channel, 12-bit resolution digital-to-analog converter	1,995	F/S	F/S
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	450	9	11
DRV11-WA	DMA 16-bit input/output parallel digital interface	850	9	11
MEMORY				
MS630-AA	1MB memory increment	4,000	18	21
MS630-BA	2MB memory increment	2,500	36	43
MS630-BB	4MB memory increment	3,500	72	86
MS630-CA	8MB parity memory increment	5,000	64	76
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	1,840	16	19
RQDX3-M	Q-bus controller without cables; for use when replacing existing RQDX2 controllers (cables can be reused)	1,790	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
RX50A-AA/BA	RX50 800KB dual diskette drive with cables for BA23(AA) or BA123(BA) enclosure	900	8	10
RX50-AA	RX50 800KB dual diskette drive	900	8	10
RX50-D	RX50 800KB dual diskette drive mounted in desktop enclosure with I/O cable	1,500	20	24
RX50-R	RX50 800KB dual diskette drive for mounting in 19-inch standard equipment rack	1,500	20	24
RD53-A	RD53 71MB, 5¼-in. Winchester disk drive	4,050	38	45
RD53A-AA/BA	RD53 71MB drive with cables for BA23(AA) or BA123(BA) enclosure	3,000	19	23
RD53-DA/DB	RD53 71MB drive mounted in desktop enclosure with I/O cables	4,650	38	45
RD53-RA/RB	RD53 71MB drive in 19-inch standard equipment rack; requires H9302 enclosure	4,650	38	45
—	RD54 159MB Winchester disk drive	7,900	—	—
KDA50-QA	Q-bus controller for RA series disk drives	5,500	50	60
RA60-AF	RA60 205MB, 14-in. removable disk; requires 6-ft. cable	17,140	105	125
RQA60-AA/AD	RA60 205MB removable disk drive with KDA50 controller	23,000	155	185
RA60-CA/CD	RA60 205MB removable disk drive in H9642 cabinet	20,000	105	125
RQA60-CA/CD	RA60-CA/CD with KDA50 controller	25,500	155	185
RA81-HA/HD	RA81 456MB, 14-in. rack-mountable Winchester disk drive; requires cable, controller, and cabinet	18,640	95	113
RA81-EA/ED	Three RA81 456MB disk drives mounted in H9642 cabinet; requires KDA50 controller	50,000	284	338
RQA81-AA/AD	RA81 456MB rack-mountable disk drive with KDA50 controller; requires cabinet	24,500	145	173 ▶

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DEC MicroVAX II

		Purchase Price (\$)	Basic Service (Monthly) (\$)	DECserv. (Monthly) (\$)
▶ OPTICAL DISK				
RRD50-QA	600MB Compact Disk Read Only Memory (CDROM) disk drive with Micro-VAX II and VAXstation controller	2,290	28	33
RRD50-QC	CDROM drive with Q-bus control kit	2,195	28	33
RRD50-A2/A3	600MB CDROM add-on disk drive; requires RRD50-QA or QC	1,350	24	29
RRD50-EA	600MB CDROM disk drive with controller for IBM PC-compatible products	2,290	28	33
RRD50-EB	600MB CDROM disk drive with controller for VAXmate	2,195	24	29
MAGNETIC TAPE				
TQK50-AA	TK50 controller with cables for BA23 enclosure	995	8	10
TQK50-AB	Q22 controller for TK50-D/R in BA23 enclosure	995	8	10
TQK50-BA	TK50 controller with cables for BA123 enclosure	995	8	10
TQK50-BB	Q22 controller for TK50-D/R in BA123 enclosure	995	8	10
TK50-AA	TK50 95MB cartridge streaming tape drive	2,495	22	26
TK50-DA/DB	TK50 desktop tape drive	3,095	22	26
TK50-RA/RB	TK50 rackmount tape drive	3,095	22	26
TSV05-ZA/ZB	Q-bus TS05 magnetic tape system with hardware for rackmounting, control module, cables, and top access cover	9,995	89	106
TU81E-DA(DD)	TU81-Plus 1600/6250 bpi GCR tape drive	25,500	140	167
PRINTERS				
LA50-RA	LA50 50-/100-cps dot-matrix tabletop printer with push tractor feed and 110 VAC power supply	695	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	2,800	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
LQP02-AA(AD)	LQP02 32-cps daisywheel printer with Courier-10 font	2,800	37	44
LQPX2-AA	Bidirectional forms tractor for LQP02	250	NC	NC
LQPX2-SF	Dual-tray cutsheet feeder with envelope tray for LQP02	1,800	19	23
LQP03-A	LQP03 25-/34-cps daisywheel printer with 130-character wheel and power cord	1,395	23	27
LQPX3-FT	Bidirectional forms tractor for LQP03	245	NC	NC
LQPX3-SF	Single-tray sheet feeder for LQP03	695	8	10
LG01-BA	Q-bus text printer; requires cabinet kit	11,950	127	151
LG02-BA	Q-bus text and graphics printer; requires cabinet kit	14,000	127	151
LG01-UG	Upgrade kit to convert LG01 text printer to LG02 text and graphics printer	3,500	NA	NA
LXY12-DA/DB	300-lpm dot-matrix printer/plotter; includes RS-232-C interface cable, pedestal with basket, and paper guide	11,250	104	124
LXY22-DA/DB	600-lpm dot-matrix printer/plotter; same components as LXY12-DA/DB	15,800	135	161
LCG01-AA	LCG01 ink-jet color printer with graphics processor	14,595	125	149
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	1,995	10	12
WORKSTATIONS/TERMINALS				
VT220-D2(D3)	VT220 terminal with white phosphor nonglare screen; with VT22K-AA data processing or VT22K-BA word processing keyboard	795	12	14
VT220-E2(E3)	Same as VT220-A2(A3), but with green screen	795	12	14
VT220-F2(F3)	Same as VT220-A2(A3), but with amber screen	795	12	14
VT22X-AA	Integral 300-/1200-baud modem for VT220	395	6	7
VT240-A2(A3)	VT240 terminal with white phosphor nonglare screen	1,980	19	23
VT240-B2(B3)	VT240 with green screen	1,980	19	23
VT240-C2(C3)	VT240 with amber screen	1,980	19	23
VT241-AA	VT241 color terminal	2,980	26	31
VT24K-AA	VT240/241 data processing country kit/keyboard	215	NC	NC
VT24K-BA	VT240/241 word processing country kit/keyboard	215	NC	NC
VT24X-AA	Integral modem for VT240/241	495	6	7

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DEC MicroVAX II

		Purchase Price (\$)	Basic Service (Monthly) (\$)	DECserv. (Monthly) (\$)
▶ WORKSTATIONS/TERMINALS (Continued)				
LA 100-BA	LA 100 30-/80-/240-cps keyboard send/receive printing terminal with keyboard, numeric keypad, tractors, cable, ribbon cartridge, package of paper, and Courier-10/Orator-10 fonts	2,195	27	32
LA 100-BB	Same as LA 100-BA, but with Courier-10 font, international overlay, and VT100 line drawing set	2,195	27	32
LA 100-CA	LA 100 with keyboard, tractors, cable, ribbon cartridge, package of paper, Courier-10/Orator-10 fonts, and multiple font option	2,295	27	32
LA 100-CB	Same as LA 100-CA, but with Courier-10 font, international overlay, and VT100 line drawing set	2,295	27	32
LA 120-DA	LA 120 180-cps keyboard send/receive terminal for use with 1- to 6-part forms	2,800	34	40

VOICE SYNTHESIS MODULE

DTC01-AA	Single-line DECTalk text-to-speech unit; includes cables	4,000	22	26
DTC03-AA	Multiline DECTalk 8-channel text-to-speech unit; cables not included	24,000	250	298
DTC03-SL	Dual-line DECTalk 2-channel text-to-speech unit; cables not included	8,000	100	119
DTC03-AM	Add-on single-channel board for dual-line DECTalk; requires power and mechanical mounting (user-supplied)	3,000	32	38

COMMUNICATIONS/NETWORKING

DHV 11-M	DHV 11 eight-line asynchronous DMA multiplexer; requires cable	1,520	15	18
DZQ 11-M	DZQ 11 four-line asynchronous multiplexer; requires cable	680	11	13
DPV 11-M	DPV 11 single-line synchronous interface; requires cable	575	14	17
DMV 11-M	DMV 11 single-line synchronous interface; requires cable	2,125	41	49
DMV 11-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	2,950	30	36
DSRVA-AA	8-line DECserver 100	2,950	30	36
DEQNA-M	DEQNA Ethernet-to-Q-bus high-performance synchronous communications controller; requires cable	1,350	15	18

SOFTWARE PRICES

		License Fee (\$)
OPERATING SYSTEM		
Each operating system license includes a 90-day limited warranty		
QZ001-CZ	MicroVMS 2-user license	2,000
QZ002-C3	MicroVMS 8-user license and key on RX50 media	4,000
QZ002-C5	MicroVMS 8-user license and key on TK50 media	4,000
QZ003-C3	MicroVMS 16-user license and key on RX50 media	6,000
QZ003-C5	MicroVMS 16-user license and key on TK50 media	6,000
QZ004-C3	MicroVMS unlimited-user license and key on RX50 media	8,000
QZ004-C5	MicroVMS unlimited-user license and key on TK50 media	8,000
QZ376-DZ	VAXELN runtime license only	400
QZ832-UZ	Ultrix-32m 2-user license	1,000
QZ833-UZ	Ultrix-32m 8-user license	2,000
QZ837-UZ	Ultrix-32m 16-user license	3,000
QZAAF-UZ	Ultrix-32m 32-user license	4,000
COMMUNICATIONS		
QZD04-UZ	DECnet end license for MicroVAX II	630
Q4D04-UZ	DECnet end license for VAXstations	500
QZD05-UZ	DECnet full license for MicroVAX II	1,950
Q4D05-UZ	DECnet full license for VAXstations	845
QZD09-UZ	DECnet end node to full license upgrade for MicroVAX II	1,320
Q4D09-UZ	DECnet end node to full license upgrade for VAXstations	510
QZ363-UZ	DECnet/SNA 3270 for MicroVAX II	1,500
Q4363-UZ	DECnet/SNA 3270 for VAXstations	500
QZ455-UZ	DECnet/SNA Application Programming Interface (API) for MicroVAX II	1,200
Q4455-UZ	DECnet/SNA Application Programming Interface (API) for VAXstations	400
QZ022-UZ	DECnet/SNA Advanced Program-to-Program Communications (APPC) for MicroVAX II	1,500
Q4022-UZ	DECnet/SNA Advanced Program-to-Program Communications (APPC) for VAXstations	500
QZ454-UZ	DECnet/SNA Terminal Emulator (TE) for MicroVAX II	600

DEC MicroVAX II

		License Fee (\$)
► COMMUNICATIONS (Continued)		
Q4454-UZ	DECnet/SNA Terminal Emulator (TE) for VAXstations	200
QZ453-UZ	DECnet/SNA RJE for MicroVAX II	600
Q4453-UZ	DECnet/SNA RJE for VAXstations	200
QZ452-UZ	DECnet/SNA Gateway Management for MicroVAX II	300
Q4452-UZ	DECnet/SNA Gateway Management for VAXstations	300
QZ042-UZ	DECnet/SNA DISOSS Document Exchange Facility (DDXF) for MicroVAX II	900
Q4042-UZ	DECnet/SNA DISOSS Document Exchange Facility (DDXF) for VAXstations	300
QZ044-UZ	DECnet/SNA Printer Emulator (PrE) for MicroVAX II	600
Q4044-UZ	DECnet/SNA Printer Emulator (PrE) for VAXstations	200
QZ111-UZ	DECnet/SNA 2780/3780 Protocol Emulator for MicroVAX II	2,900
Q4111-UZ	DECnet/SNA 2780/3780 Protocol Emulator for VAXstations	1,500
QZ112-UZ	DECnet/SNA 3271 Protocol Emulator for MicroVAX II	2,900
Q4112-UZ	DECnet/SNA 3271 Protocol Emulator for VAXstations	1,500
QZ362-UZ	VMS/SNA for MicroVAX II	2,500
QZB12-UZ	VAX VIDA for MicroVAX II	10,500
Q4B12-UZ	VAX VIDA for VAXstations	3,500
—	Local Area VAXcluster for MicroVAX II	1,900
—	Local Area VAXcluster for VAXstations	1,000
DATA BASE MANAGEMENT		
QZ898-UZ	Datatrieve for MicroVAX II	4,920
Q4898-UZ	Datatrieve for VAXstations	1,640
QZ897-UZ	Common Data Dictionary (CDD) for MicroVAX II	1,365
Q4897-UZ	Common Data Dictionary (CDD) for VAXstations	264
QZ800-UZ	Forms Management System (FMS) for MicroVAX II	2,480
Q4800-UZ	Forms Management System (FMS) for VAXstations	650
QZD07-UZ	Rdb/ELN Development License for MicroVAX II	4,500
Q4D07-UZ	Rdb/ELN Development License for VAXstations	1,500
QZD08-DZ	Rdb/ELN Run Time Option (RTO) for MicroVAX II	750
Q4D08-UZ	Rdb/ELN Run Time Option (RTO) for VAXstations	250
QZ354-UZ	Rdb/MicroVMS for MicroVAX II	7,080
Q4354-UZ	Rdb/MicroVMS for VAXstations	2,360
QZ357-UZ	Rdb/MicroVMS Remote for MicroVAX II	819
Q4357-UZ	Rdb/MicroVMS Remote for VAXstations	273
QZ358-UZ	Rdb/MicroVMS Run Time Option (RTO) for MicroVAX II	2,730
Q4358-UZ	Rdb/MicroVMS Run Time Option (RTO) for VAXstations	910
LANGUAGES		
QZ018-UZ	Dibol for MicroVAX II	2,490
Q4018-UZ X	Dibol for VAXstations	830
QZ130-UZ	DSM (Digital Standard Mumps) for MicroVAX II	5,400
Q4130-UZ	DSM (Digital Standard Mumps) for VAXstations	5,400
QZ100-UZ	Fortran for MicroVAX II	3,100
Q4100-UZ	Fortran for VAXstations	1,035
QZ917-UZ	Lisp for MicroVAX II	4,800
Q4917-UZ	Lisp for VAXstations	4,800
QZ126-UZ	Pascal for MicroVAX II	2,835
Q4126-UZ	Pascal for VAXstations	945
QZ114-UZ	PL/1 for MicroVAX II	4,780
Q4114-UZ	PL/1 for VAXstations	1,595
QZ631-UZ	RPG II for MicroVAX II	1,890
Q4631-UZ	RPG II for VAXstations	630
QZ056-UZ	Ada for MicroVAX II	14,940
Q4056-UZ	Ada for VAXstations	4,980
QZ020-UZ	APL for MicroVAX II	4,780
Q4020-UZ	APL for VAXstations	1,595
QZ095-UZ	Basic for MicroVAX II	3,180
Q4095-UZ	Basic for MicroVAX II	1,060
QZ106-UZ	Bliss-32 for MicroVAX II	3,465
Q4106-UZ	Bliss-32 for VAXstations	1,155
QZ015-UZ	C for MicroVAX II	2,835
Q4015-UZ	C for VAXstations	945
QZ099-UZ	Cobol for MicroVAX II	4,780
Q4099-UZ	Cobol for VAXstations	1,595
QZ913-UZ	OPS5 for MicroVAX II	3,000
Q4913-UZ	OPS5 for VAXstations	3,000
UTILITIES AND TOOLS		
QZ425-UZ	Application Development Environment (ADE) for MicroVAX II	1,620
Q4425-UZ	Application Development Environment (ADE) for VAXstations	540
QZ451-UZ	DECcor for MicroVAX II	3,600
Q4451-UZ	DECcor for VAXstations	1,200
QZ310-UZ	DECalc for MicroVAX II	1,400
Q4310-UZ	DECalc for VAXstations	680

DEC MicroVAX II

License
 Fee
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► UTILITIES AND TOOLS (Continued)

QZ360-UZ	DECgraph for MicroVAX II	1,500
QZ361-UZ	DECslide for MicroVAX II	1,500
QZ038-UZ	DECtype for MicroVAX II	1,200
Q4038-UZ	DECtype for VAXstations	400
QZ007-UZ	DEC/CMS (Code Management System) for MicroVAX II	5,205
Q4007-UZ	DEC/CMS (Code Management System) for VAXstations	1,735
QZ500-UZ	DEC/MMS (Module Management System) for MicroVAX II	1,260
Q4500-UZ	DEC/MMS (Module Management System) for VAXstations	420
QZ143-UZ	DECshell for MicroVAX II	2,850
Q4143-UZ	DECshell for VAXstations	950
QZ810-UZ	GKS/Ob for MicroVAX II	3,600
QZ706-UZ	TDMS for MicroVAX II	2,478
Q4706-UZ	TDMS for VAXstations	826
QZ375-UZ	VAXELN Toolkit for MicroVAX II	4,000
QZ382-UZ	VAX-11 RSX for MicroVAX II	2,400
Q4382-UZ	VAX-11 RSX for VAXstations	800 ■