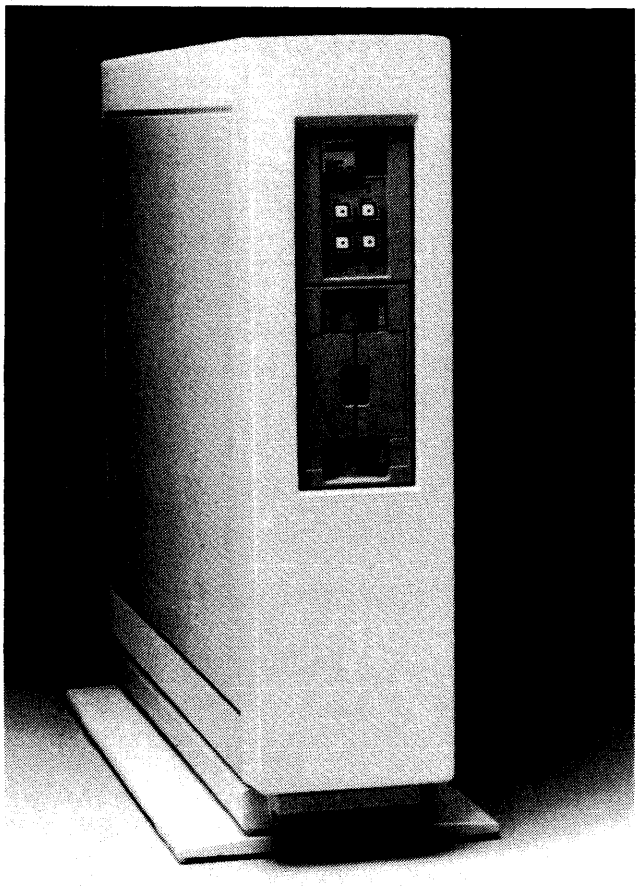
DEC PDP-11 Family

MANAGEMENT SUMMARY

UPDATE: *Since our last update, DEC has introduced the MicroPDP-11/73, a multiuser microcomputer which approaches the performance of the top-of-the-line PDP-11/44. The company has also added new peripherals, along with new and enhanced operating systems and new communications software.*

The MicroPDP-11/73 is a high-end addition to the Micro/PDP-11 grouping within the PDP-11 family; it joins the MicroPDP-11/23 (formerly known as the Micro/PDP-11).

According to DEC, the MicroPDP-11/73 provides raw CPU power three to five times greater than that of the MicroPDP-11/23 and equivalent to that of the high-end PDP-11/44. A fully configured MicroPDP-11/73 system reportedly delivers 75 percent of the performance provided by a fully configured PDP-11/44.



The MicroPDP-11/73 incorporates DEC's new 15MHz J-11 chip set, and, when fully configured, delivers about 75 percent of the performance of the top-of-the-line PDP-11/44 minicomputer. The MicroPDP-11/73 can support up to 4MB of memory and can accommodate up to 14 workstations, with 4 to 12 concurrently active.

DEC continues to enhance its PDP-11 family, recently adding minicomputer power in a supermicro package to the lower end with the addition of the MicroPDP-11/73. New disks, printers, and system and communications software offerings have added additional dimensions to this longtime competitor in the commercial computing market, both strengthening the family itself and increasing compatibility with DEC's more powerful VAX systems.

MODELS: MicroPDP-11/23; MicroPDP-11/73; PDP-11/23-Plus; PDP-11/24; and PDP-11/44.
MEMORY: 256KB-4MB.
DISK CAPACITY: 10.4MB-3.6GB.
WORKSTATIONS: Up to 4 on MicroPDP-11/23; up to 12 on MicroPDP-11/73; up to 10 on PDP-11/23-Plus and PDP-11/24; and up to 48 on PDP-11/44. (Concurrent users; number can vary according to application.)
PRICE: $5,995-$60,300 (base system prices).

CHARACTERISTICS

MANUFACTURER: Digital Equipment Corporation (DEC), 146 Main Street, Maynard, Massachusetts 01754. 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 FORMATS

BASIC UNIT: 16-bit word plus two parity bits. The processor can also handle 8-bit bytes, and is capable of bit manipulation.

FIXED POINT OPERANDS: 6-bit words or 8-bit bytes are used as operands in both single- and double-operand instructions. Bit manipulation is provided through Boolean AND/OR instructions.

FLOATING-POINT OPERANDS: 64-bit double-precision operands with an 8-bit exponent and signed 56-bit fraction. Single- and double-precision hardware via a floating-point processor is optionally available. This hardware includes a dedicated set of six 64-bit accumulators. ROM implementation of the extended instruction set (EIS) is also available. Floating-point software subroutines are available for all PDP-11s.

INSTRUCTIONS: PDP-11 instructions are 16 bits long. If program counter addressing is employed, then an additional 16 bits are added to the instruction length. Instruction formats are numerous, varying from one PDP-11 model to another. Common formats throughout the PDP-11 line occur in instructions of the single operand group, the double operand group, branch group, subroutine return, and condi-

DEC PDP-11 Family

CHART A. SYSTEM COMPARISON

MODEL	MicroPDP-11/23	MicroPDP-11/73	PDP-11/23-Plus	PDP-11/24	PDP-11/44
SYSTEM CHARACTERISTICS					
Date of introduction	6/82	7/84	12/81	2/81	11/79
Date of first delivery	5/83	9/84	1/82	3/81	6/80
Operating system	RT-11; RSX-11S; RSX-11M; Micro/RSX; RSX-11M-Plus; RSTS/E; Micro/RSTS; Ultrix-11; DSM-11; CTS-300	RT-11; RSX-11S; RSX-11M; Micro/RSX; RSX-11M-Plus; RSTS/E; Micro/RSTS Ultrix-11; DSM-11; CTS-300	RT-11; RSX-11S; RSX-11M; RSX-11M-Plus; RSTS/E; Ultrix-11; DSM-11; CTS-300	RT-11; RSX-11S; RSX-11M; RSX-11M-Plus; RSTS/E; Ultrix-11; DSM-11; CTS-300	RT-11; RSX-11S; RSX-11M; RSX-11M-Plus; RSTS/E; Ultrix-11; DSM-11; CTS-300
Upgradable from	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
Upgradable to	Not applicable	Not applicable	Not applicable	Not applicable	Not applicable
MIPS	—	—	—	—	—
Relative performance (based on a rating of the 11/44 at 1.0)	0.4	0.75-1.0	0.4	0.4	1.0
MEMORY					
Minimum capacity, bytes	256K	512K	256K	1M	1M
Maximum capacity, bytes	4M	4M	4M	4M	4M
Type	MOS	MOS	MOS	MOS	MOS
Cache memory	None	8KB	None	None	8KB
Cycle time, nanoseconds	560	560	560	510	490
Bytes fetched per cycle	2	2	2	2	2
INPUT/OUTPUT CONTROL					
Number of channels	—	—	—	—	—
High-speed buses	None	None	None	None	None
Low-speed buses	1	1	1	1	1
MINIMUM DISK STORAGE	11MB	11MB	20.8MB	20.8MB	20.8MB
MAXIMUM DISK STORAGE	208MB	208MB	41.6MB	3.6GB	3.6GB
NUMBER OF WORKSTATIONS	4 active	12 active	10 active	10 active	48 active
COMMUNICATIONS PROTOCOLS	2780/3780, 3270, Hasp, SNA, DNA, DDCMP, X.25, 200 UT, Univac 1004	2780/3780, 3270, Hasp, SNA, DNA, DDCMP, X.25, 200 UT, Univac 1004	2780/3780, 3270, Hasp, SNA, DNA, DDCMP, X.25, 200 UT, Univac 1004	2780/3780, 3270, Hasp, SNA, DNA, DDCMP, X.25, 200 UT, Univac 1004	2780/3780, 3270, Hasp, SNA, DNA, DDCMP, X.25, 200 UT, Univac 1004

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

The Micro/PDP-11/73 CPU incorporates DEC's new 15MHz CMOS VLSI J-11 microprocessor chip set, which provides a full PDP-11 instruction set, including Extended Instruction Set (EIS), floating point instructions, 8KB of direct-mapped write-through cache memory, a Memory Management Unit (MMU), and console terminal microcode. The CPU module also includes a 32KB bootstrap/diagnostic ROM, a 2KB EEROM, a console serial line unit, and a program-controlled line clock. The system supports from 512KB to 4MB of main memory (based on 64K-bit MOS chips); memory provides 18- or 22-bit addressing.

The MicroPDP-11/73 can run 10 DEC operating systems: Micro/RSX; RSX-11S, -11M, and -11M-Plus; MicroRSTS and RSTS/E; RT-11; CTS-300; DSM-11; and Ultrix-11 (formerly called V7M11), DEC's 16-bit implementation of AT&T's Unix operating system. According to DEC, the MicroPDP-11/73 is software-compatible with the rest of the PDP-11 family; depending on configuration requirements and media, most PDP-11 application software available for those operating systems will run on the MicroPDP-11/73 without being rewritten.

The MicroPDP-11/73 supports Q-Bus peripheral products, including disks, tapes, and data communcations interfaces. Among newly introduced peripherals, the MicroPDP-11/73 supports the 31MB RD52 Winchester disk subsystem; the TK25, a 55-ips, 60MB, 8-inch cartridge streaming tape subsystem; and the RC25, a 52MB fixed/removable disk subsystem combining a 26MB Winchester fixed disk and a 26MB sealed removable cartridge. The

tion code operators group. Operation codes vary from 4 bits to 16 bits in length. A Commercial Instruction Set (CIS) is available on the PDP-11. The CIS is a CPU microcode extension that implements a set of commercial instructions on a variety of data types, including character-string, packed decimal, and numeric formats. The firmware implementation yields much faster program execution times than a similar software implementation.

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

MAIN STORAGE

STORAGE TYPE: Storage types include Parity MOS (MicroPDP-11 systems and PDP-11/23-Plus) and ECC MOS (PDP-11/24 and PDP-11/44).

CYCLE TIME: See Chart A for information on each model.

CAPACITY: Ranges from 256KB to 4MB. See Chart A for memory capacities of specific models.

CHECKING: Parity on the basis of one bit per byte is available with dynamic MOS memory for the MicroPDP-11/23, MicroPDP-11/73, and PDP-11/23-Plus. Error correcting and checking (ECC) is a feature of dynamic MOS memory for the PDP-11/24 and PDP-11/44. ECC corrects all single-bit errors and detects all double-bit errors and most multiple-bit errors.

STORAGE PROTECTION: Via the memory management function on all PDP-11s. Mapping automatically provides hardware storage protection.

RESERVED STORAGE: The uppermost 8192 bytes on the Unibus-based PDP-11/24 and PDP-11/44 are reserved for I/O registers.

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RC25, while not strictly new, is now available for PDP-11 systems in a Q-Bus version; it was previously available only in a Unibus version with the VAX-11/725.

The Micro/PDP-11/73 can support up to two complete RC25 subsystems for 208MB of online disk storage. Up to 14 terminals can be attached, with 4 to 12 stations concurrently active.

The Micro/PDP-11/73 is available in rackmount, floorstand, and desktop enclosures; according to DEC, the system can fit on top of or under a desk, and can operate in a normal business environment without special power or air conditioning requirements.

DEC is targeting the MicroPDP-11/73 toward both technical and commercial applications, including engineering, manufacturing, office automation, communications, medical, education, small business, and laboratory.

DEC has also introduced several printers which are both PDP-11- and VAX-compatible: the LN01S and LN03 laser printers, the LCP01 color inkjet printer, the LA210 dot-matrix printer, and the LQP03 letter-quality printer.

The LN01S is a 12-ppm laser printer. It features 12 resident text fonts and has full bit-map capability through an external controller with a 1.4MB page buffer; the controller incorporates a 512KB memory that can store up to 96 fonts. The LN03 is a tabletop laser printer that prints up to 8 pages per minute. It features three resident Courier fonts and provides print resolution of 300 by 300 dots per square inch. The LN03 can print in both landscape and portrait modes.

The LCP01 is a desktop ink-jet color printer that produces presentation-quality graphics on paper and transparencies. It incorporates a graphics processor, and can store up to five fonts in local memory. The LCP01 can print up to 216 shades, and has a maximum resolution of 1536 by 1152 dots. It is compatible with DEC's VT100 terminals, as well as with the newer VT240/241 graphics terminals. The LA210 is a dot-matrix printer that achieves speeds of 40 cps in letter-quality mode, 80 cps in correspondence mode, and 240 cps in draft mode. The LA210 also has a graphics capability. The LQP03 is a 130-petal daisywheel printer; depending on the text font, it can print 25 cps or 34 cps.

DEC has also upgraded the existing features of its VT200 family of terminals, enhancing the text and graphics functions of the VT240 and VT241 and the text functions of the low-end VT220. The National Replacement Character set (NRC) has been added to all three terminals, providing complete backward compatibility with the older VT100 family. This feature allows terminals to generate international characters either through the NRC mode or through the Multinational Character Set (MCS), which is already available. Also, additions have been made to the terminal identification capabilities of the VT220 and VT240 terminals when they are in VT100 emulation mode; again, these additions were made to enhance backward compatibility

All PDP-11s reserve at most 511 locations at the low end of memory for interrupt vectors, trap vectors, and floating. Floating vectors are assigned for communications and other devices that interface with the PDP-11.

CACHE MEMORY: The MicroPDP-11/73 and the PDP-11/44 have integral cache memories of 8KB.

CENTRAL PROCESSORS

GENERAL: The MicroPDP-11/23, the MicroPDP-11/73, and the PDP-11/23-Plus are all based on Digital's Q-Bus.

The MicroPDP-11/23 CPU includes a 16-bit, microprogrammed PDP-11/23-Plus processor using DEC's F-11 chip set. It employs a standard instruction set of 91 instructions. The processor module includes two asynchronous serial line units, a bootstrap/diagnostic ROM, and a line frequency clock. A microcoded floating-point chip (KEF11-AA) can be added to provide 46 instructions for single-precision (64-bit) floating-point data; execution of those instructions can be enhanced by addition of the FPF11 floating-point processor. A Commercial Instruction Set (CIS) microcoded chip (KEF11-BB) can be added for commercial applications requiring fast Cobol program execution.

The CPU used in the MicroPDP-11/73 is a multifunction module. It includes the 15MHz CMOS VLSI J-11 microprocessor chip set (instruction set processor and memory management unit), an asynchronous serial line, line frequency clock, a 32KB bootstrap/diagnostic ROM, a 2KB electrically erasable ROM, and a serial line unit for the console terminal. An 8KB direct-mapped, write-through cache is also included. The integral memory unit of the MicroPDP-11/73 is compatible with that of the PDP-11/44.

The instruction set processor of the MicroPDP-11/73 offers a standard 91-instruction set and a floating-point instruction set. The MicroPDP-11/73 memory management unit executes instructions in kernel, supervisor, and user modes, and includes separate addressing space for instructions and data.

The PDP-11/23-Plus is a 16-bit, microprogrammed processor with extended addressing capability. Integral to the CPU is the microprocessor chip set also used on the PDP-11/24. The CPU module itself contains the CPU, a memory management unit, a line frequency clock, a bootstrap/diagnostic ROM, and two serial line units. The PDP-11/23-Plus CPU, in conjunction with its memory management unit, executes instructions in either kernel or user mode.

The PDP-11/23-Plus processor offers a standard instruction set of 91 instructions. This instruction set includes both single and double operand instructions that operate with bit, byte, 16-bit word, and multiple-word data types. A variety of addressing modes extends the standard instruction set to over 400 instructions common to all PDP-11 processors. In addition to the standard instruction set, an optional microcoded floating-point chip (KEF11-A) provides 46 instructions for single-precision (32-bit) and double-precision (64-bit) floating-point data; as with the MicroPDP-11/23, an optional floating-point processor can be added for even faster execution of Fortran programs. A Commercial Instruction Set (CIS) microcoded chip is also available for business applications requiring fast Cobol program execution.

The MicroPDP-11/23, MicroPDP-11/73, and PDP-11/23-Plus microcomputers feature high-density, parity MOS memory based on 64K RAM chip technology. A single quad-height memory module contains 512KB of mem-

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CHART B. MASS STORAGE

MODEL	RL02	RD51	RD52	RC25
Type	Cartridge	Winchester	Winchester	Fixed/removable
Controller model	RLV12 (Q-Bus) or integrated (Unibus)	RQDX1	RQDX1	Integrated (Q-Bus or Unibus)
Drives per subsystem/controller	4	2	2	2
Formatted capacity per drive, megabytes	10.4	11	31	26/26
Number of usable surfaces	2	4	—	4
Number of sectors or tracks per surface	512 tracks	1,200 tracks	3,485 tracks	831 tracks
Bytes per sector or track	256/sector	512/sector	512/sector	512/sector
Average seek time	55 ms	85 ms	49 ms	35 ms
Average rotational/relay time	12.5 ms	8.3 ms	8.5 ms	10.5 ms
Average access time	67.5 ms	93.3 ms	57.5 ms	45.5 ms
Data transfer rate	512KB/sec.	625KB/sec.	625KB/sec.	1.25MB/sec.
Supported by system models	All	Micro PDP-11/23 and -11/73; PDP-11/23-Plus	Micro PDP-11/23 and -11/73; PDP-11/23-Plus	All but PDP-11/23-Plus
Comments				Combines 26MB Winchester and 26MB sealed removable cartridge

CHART B. MASS STORAGE (Continued)

MODEL	RA80	RA60	RA81
Type	Winchester	Removable	Winchester
Controller model	UDA50	UDA50	UDA50
Drives per subsystem/controller	4	4	4
Formatted capacity per drive, megabytes	121	205	456
Number of usable surfaces	7	6	7
Number of sectors or tracks per surface	1,092 tracks	1,600 tracks	2,496 tracks
Bytes per sector or track	512/sector	512/sector	512/sector
Average seek time	25 ms	41.3 ms	28 ms
Average rotational/relay time	8.3 ms	8.7 ms	8.3 ms
Average access time	33.3 ms	50 ms	36.3 ms
Data transfer rate	1.2 MB/sec.	1.98MB/sec.	2.2MB/sec.
Supported by system models	PDP-11/24, -11/44	PDP-11/24, -11/44	PDP-11/24, -11/44
Comments			

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

with the older terminals, in this case at the application level.

Additional capabilities for the VT240 and VT241 include facilities for color graphics print output, a polygon fill capability, and enhanced support for Tektronix 4010/4014 graphics protocols. The Tektronix enhancements include a text registration mode to ensure adequate positioning of text when the terminal is in 4010/4014 mode, full top-line availability when in 4010/4014 mode, and a rotated print capability, which enables the user to rotate and expand a graphic screen display so that it can be printed in landscape (horizontal) mode on an 8½-by-12 inch page. According to Digital, existing VT200 terminals can be upgraded upon request.

On the software side, DEC has added the Micro/RSTS operating system for the MicroPDP-11 grouping, enhanced and renamed its Unix-based V7M-11 Unix operating system, and introduced DECnet/SNA Gateway routines for RSX systems.

ory, while a 256KB memory management facility allows the processor to extend memory addresses to 4MB (22 bits), in conjunction with the extended Q-Bus and address relocation mapping.

The PDP-11/24 and the PDP-11/44 are based on the DEC Unibus. The CPU of the PDP-11/24 is a microprogrammed processor that executes arithmetic and control logic operations to produce fixed-point arithmetic, hardware multiply and divide, and extensive test and branch instructions. Additional microcode, available as an option, allows the execution of single- and double-precision (32- and 64-bit) floating-point instructions. The floating-point unit provides 46 additional instructions for high-speed floating-point computation. The PDP-11/24 also contains standard PDP-11 instructions, plus the extended instruction set, memory management, power/fail automatic restart, six general purpose registers, two stack pointers, and one program counter. An additional register, the CPU error register, permits system software error logging.

The integral memory management unit of the PDP-11/24 provides additional capabilities and protection in a multiprogramming environment. It assigns memory pages to user programs and prevents users from unauthorized access to

DEC PDP-11 Family

Micro/RSTS, designed for the MicroPDP-11 computers, is a prebuilt subset of RSTS/E (Resource Sharing Timesharing System/Extended), which runs on all PDP-11 systems. Micro/RSTS supports system calls and programming facilities supported by RSTS/E. Micro/RSTS, which allows a maximum of 14 terminals and 10 jobs, uses the DCL command language, a facility specifically designed for users with limited computer knowledge.

DEC's V7M11 Unix is now called Ultrix-11. Version 2.0 of that operating system provides hardware support for the Micro/PDP-11/73, as well as for other PDP-11 Family computer systems.

The DECnet/SNA Gateway routines allow RSX-11M- and RSX-11M-Plus-based systems in DECnet networks to share information with IBM systems running under SNA. The Remote Job Entry (RJE) routine allows the user on a DECnet node to perform as a remote SNA workstation or group of workstations and transmit batch jobs to an IBM host and receive job output; the node appears to the user as a turnkey package operating with JES2 or JES3 software on an IBM mainframe. The 3270 Terminal Emulator (3270 TE) routine allows the user of a VT 100 or VT 100-compatible device to interact with an IBM system running programs written for 3270 users. The Application Program Interface enables a user-written application in a DECnet node to exchange messages with a cooperating application in an IBM host. The Gateway Network Management routine controls the DECnet-to-SNA interface. It includes normal Decnet network management activities, troubleshooting, and monitoring of SNA/SDLC lines.

While adding new products, DEC continues to support the rest of the PDP-11 family, which consists of four models: MicroPDP-11/23 (formerly known as the MicroPDP-11), PDP-11/23-Plus, PDP-11/24, and PDP-11/44. Two other systems, the PDP-11/23-S and the high-end PDP-11/84, are targeted toward OEMs; because they address only a limited target market, these systems are not covered in this report.

The family is divided into two groups along architectural lines. The MicroPDP-11/23 and -11/73 systems and the PDP-11/23-PLUS are based on DEC's Q-Bus, while the PDP-11/24 and PDP-11/44 are based on the Unibus. The two buses are similar in I/O speed and memory addressability, but differ as to the range of communications interfaces and the size and variety of peripherals they can support. The Q-Bus, for example, can only support disk drives with individual capacities up to 52MB; the Unibus, which supports DEC's microprocessor-based Digital Storage Architecture (DSA), can handle drives with capacities up to 456MB.

The MicroPDP-11/23 employs a CPU based on the F-11 chip set—the same chip set used in the PDP-11/23-Plus. Like the MicroPDP-11/73, the MicroPDP-11/23 is available in floorstanding, tabletop, and rackmount enclosures. Minimum memory is 256KB or 512KB, expandable to 4MB. Systems can be configured with one or two 11MB pages outside their own area. Memory management also permits kernel and user modes to relocate individually anywhere in physical memory, allowing context switching to occur. Additionally, pages of memory may be constrained for either read-only access or nonaccess operations. Also, 16-bit, 18-bit, or optional 22-bit translation is offered to ensure compatibility with other members of the PDP-11 family.

The PDP-11/44 CPU also contains fixed-point arithmetic with hardware multiply and divide, extensive test and branch operations, and other control operations, as well as room for the addition of the floating-point processor, Commercial Instruction Set, and Unibus options. The PDP-11/44 processor acts as the arbitration unit for Unibus control by regulating bus requests and transferring control of the bus to the requesting device with the highest priority.

The PDP-11/44 cache memory is integrated into the processor. It is an 8KB high-speed RAM memory, organized as a direct mapped cache with write-through features.

CONTROL STORAGE: Information unavailable from vendor.

REGISTERS: The MicroPDP-11/23, the PDP-11/23-Plus, and the PDP-11/24 have nine general-purpose registers. The PDP-11/44 has 10 general registers which can be used as accumulators, index registers, or stack pointers. One of the general registers is used as 11/44's program counter, and three others are used as the processor stack pointers, one for each operational mode.

The MicroPDP-11/73 has two sets of general-purpose registers, with six registers to a set, along with three stack pointers and a program counter.

ADDRESSING: Eight address modes are provided, with each operand address consisting of three bits to specify address mode and three bits that specify the register used to calculate the address. The modes are: Register (operand in register); Register Indirect (operand address in register); Auto Increment/Decrement (self-incrementing/decrementing operand address in register); Auto Increment/Decrement Indirect (self-incrementing/decrementing register which points to an address in memory); Indexed; and Indexed Indirect. The eight modes can allow a specific operation code (for example, MOV, for move) to accomplish register/register, register/memory, memory/memory, memory/stack, and register/stack manipulation.

INTERRUPTS: All PDP-11 models have four automatic hardware priority level interrupts.

OPERATING ENVIRONMENT: The MicroPDP-11/23 and MicroPDP-11/73 come in rackmount, floorstand, or tabletop enclosures. The rackmount enclosure is 5.2 inches high, 19 inches wide, and 25.5 inches deep; the floorstand model is 24.5 inches high, 10 inches wide, and 28.5 inches deep; the tabletop model is 6 inches high, 21.5 inches wide, and 27 inches deep. The tabletop and floorstand models each weigh 70 pounds; the rackmount model weighs 55 pounds. Power requirements are 120 VAC, 60 Hz, 90 to 128 VRMS or 240 VAC, 50 Hz, 180 to 256 VRMS. For systems with RX50 diskettes, permissible operating temperature range is 59 degrees Fahrenheit to 90 degrees Fahrenheit at 20 percent to 80 percent humidity; operating temperatures for systems with RD51/RD52 disks range from 50 degrees Fahrenheit to 104 degrees Fahrenheit.

The PDP-11/23-Plus is available in cabinet-mounted or rackmount versions. The cabinet-mounted version is 41.8 inches high, 21.3 inches wide, and 30 inches deep; it weighs 375 pounds. Power requirements are 120 VAC, 60 Hz, 90 to 132 VRMS or 240 VAC, 50 Hz, 180 to 264 VRMS. Operating temperature is 50 degrees Fahrenheit to 104 degrees

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CHART C. WORKSTATIONS

MODEL	VT220	VT240/VT241	VT100/VT101	VT102/VT131	VS11
DISPLAY PARAMETERS					
Max. chars./screen	3168	3168	1920	3168	512 x 512 resolution
Buffer capacity	—	—	—	—	—
Screen size (lines x chars.)	24 x 80 or 132	24 x 80 or 132	24 x 80 or 14 x 132	24 x 80 or 132	—
Tilt/swivel screen	Tilt standard	Standard	Not applicable	Not applicable	Not applicable
Symbol formation	7 x 10 dot-matrix	8 x 10 dot-matrix	7 x 9 dot-matrix	7 x 9 dot-matrix	Not applicable
Character phosphor	White, green, or amber	White, green, or amber	Black on white or white on black	Black on white or white on black	—
Total colors/no. simult. displayed	Not applicable	—	Not applicable	Not applicable	16 colors maximum
KEYBOARD PARAMETERS					
Style	Typewriter	Typewriter	Typewriter	Typewriter	Typewriter
Character/code set	ASCII and line-drawing graphics	ASCII and line-drawing graphics	ASCII and line-drawing graphics	ASCII and line-drawing graphics	—
Detachable	Yes	Yes	Yes	Yes	Yes
Program function keys	15	15	—	—	—
TERMINAL INTERFACE	RS-232-C, RS-423, 20 ma std.	RS-232-C, RS-423, 20 ma std.	RS-232-C or 20 ma	RS-232-C or 20 ma	—
COMMENTS		800 x 240 pixel graphics array; VT241 includes color monitor.		VT131 has memory space for 2 user-defined character sets.	Includes 40-routine Fortran Draw software package.

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

RD51 or 31MB RD52 5¼-inch Winchester disks, or with single or multiple RC25 52MB fixed/removable disks; up to two complete RC25 subsystems can be configured, for a total disk capacity of 208MB. Backup devices also include the 800KB RX50 dual diskette, the TK25 60MB cartridge tape drive, and the 10.4MB RL02 cartridge disk drive. The Micro/PDP-11 can support up to 14 workstations, with as many as four concurrently active.

The PDP-11/23-Plus is targeted toward multiuser commercial applications requiring 20MB to 40MB of disk storage. The PDP-11/23-Plus is available with either 256KB or 512KB of main memory, expandable to 4MB. It comes in rackmount or cabinet-based units. The basic PDP-11/23-Plus is configured with either a 1MB dual-drive diskette subsystem or a 20.8MB dual-drive cartridge disk subsystem; two more 10.4MB cartridge drives can be added, for a maximum of 41.6MB of disk storage. The PDP-11/23-Plus supports 10 concurrently active workstations.

The PDP-11/24 includes a single-board CPU with options for a Commercial Instruction Set and either a floating-point processor chip or a hardware floating-point unit. The PDP-11/24 features 1MB of memory, expandable to 4MB. It supports Unibus mass storage devices and has a maximum mass storage capacity of 3.6GB. Like the PDP-11/23-Plus, the PDP-11/24 supports up to 10 concurrently active terminals.

The top-of-the-line PDP-11/44 reportedly offers twice the performance of the PDP-11/24. The PDP-11/44 CPU features 1MB of main memory and an 8KB cache memory; main memory is expandable to 4MB. A Commercial Instruction Set and floating point processor are optional. The PDP-11/44 supports up to 48 workstations in concurrent operation. Mass storage capacity ranges from 20.8MB to 3.6GB.

The PDP-11/24 and PDP-11/44 systems are available in four levels of integration: rackmount computers, kernel

Fahrenheit at 10 percent to 90 percent humidity. The rackmount CPU box is 5.2 inches high, 19 inches wide, and 26.8 inches deep; it weighs 46.5 pounds. Electrical requirements are 120 VAC, 60 Hz, 90 to 132 VRMS or 240 VAC, 50 Hz, 180 to 264 VRMS. Operating temperature range is 41 degrees Fahrenheit to 122 degrees Fahrenheit at 10 percent to 95 percent humidity.

The PDP-11/24 comes in two types of cabinets: 5.2 inches high, 19 inches wide, and 25 inches deep or 10.4 inches high, 16.6 inches wide, and 26 inches deep. The PDP-11/24 CPU box weighs either 45 or 70 pounds. Power requirements are 120 VAC, 104 to 127 or 90 to 128 VRMS or 240 VAC, 208 to 258 or 180 to 256 VRMS. Operating temperature range is 41 degrees Fahrenheit to 122 degrees Fahrenheit at 10 percent to 95 percent humidity.

The PDP-11/44 processor cabinet is 10.4 inches high, 16.2 inches wide, and 26 inches deep; the CPU box weighs 90 pounds. Power requirements are 120 VAC, 90 to 128 VRMS or 240 VAC, 180 to 256 VRMS. Operating temperature is 41 degrees Fahrenheit to 122 degrees Fahrenheit at 10 percent to 95 percent humidity.

INPUT/OUTPUT CONTROL: I/O control on the PDP-11/24 and PDP-11/44 is handled through the Unibus, a bidirectional, asynchronous interconnect providing a single common data path that treats all components or modules of a PDP-11 family system as equal-level devices for data access and transfers; those components include the processor, memory modules, and peripheral controllers. The priority of any device connected to the Unibus is determined by its physical position; hence, the processor is normally attached to give it the highest priority. I/O control on the MicroPDP-11 computers and the PDP-11/23-Plus is handled by the Q-Bus. Both buses are similar, but Unibus allows greater flexibility and variety in the type and number of peripherals that can be attached.

CONFIGURATION RULES

GENERAL: The extent to which a PDP-11 system can be configured varies from model to model, depending upon the amount of expansion space available in CPUs and expansion cabinets, as well as the operating system employed.

MicroPDP-11 systems are configured with either 256KB (MicroPDP-11/23) or 512KB (MicroPDP-11/23 and -11/73) of memory, expandable to 4MB in 256KB or 512KB increments. System packaging accommodates, internally,

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CHART D. PRINTERS

MODEL	LXY	LP25	LP26	LP27
Type	Dot-matrix	Band	Band	Band
Speed	170-600 lpm	300/215 lpm	600/445 lpm	1200/800 lpm
Bidirectional printing	No	No	No	No
Paper size	—	Up to 15 inches	Up to 15 inches	Up to 18.75 inches
Character formation	Variable	Variable	—	—
Horizontal character spacing (char./inch	Variable	Variable	—	10
Vertical line spacing (lines/inch)	—	6 or 8	6 or 8	6 or 8
Character set	96 ASCII	64/96	64/96	64/96
Controller/Interface	LP11/RS-232-C	LP11	LP11	Integrated
No. of printers per controller/interface	—	—	—	—
Printer dimensions, in. (h x w x d)	46.5 x 30 x 24.3	43.8 x 30.3 x 33.6	43.8 x 30.3 x 33.6	43.8 x 35 x 38
Graphics capability	Yes	No	No	No

CHART D. PRINTERS (Continued)

MODEL	LN01	LN01S	LN03
Type	Laser	Laser	Laser
Speed	12 ppm	12 ppm	8 ppm
Bidirectional printing	No	Not applicable	Not applicable
Paper size	8½ x 11 or 8½ x 14 inches	8.5 x 11 or 8.5 x 14 inches	8.5 x 11 inches
Character formation	300 x 300 dots/ sq. in.	300 x 300 dots/ sq. in.	300 x 300 dots/ sq. in.
Horizontal character spacing (char./inch)	—	Variable	Variable
Vertical line spacing (lines/inch)	8.57	Variable	Variable
Character set	188	12 Courier-like fonts standard	3 Courier fonts
Controller/Interface	LP11/Parallel	LP11/Parallel	Integrated controller; RS-232-C interface
No. of printers per controller/interface	—	—	1
Printer dimensions, in. (h x w x d)	36 x 25.8 x 26	36 x 25.8 x 26	—
Graphics capability	No	Yes	Yes

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

computers, System Building Blocks, and packaged systems. Rackmount computers allow space for extensive system and memory expansion. Kernel computers are cabinet-mounted systems that permit expansion within the cabinet; they allow users to build systems tailored to specific applications. System Building Blocks (SBBs) are cabinet-based systems that can be expanded through the addition of specific tape and disk devices from vendor-determined option lists. SBBs also include the PDP-11 Operating System General License, a package of license and warranty options for various PDP-11 operating systems. Packaged systems are fully configured systems that, as purchased, include the hardware and software components required for a full PDP-11 system.

In addition to the new Micro/RSTS, nine principal operating sytems are available for PDP-11 systems; eight run on all models. *RT-11* is a single-user, realtime operating system for interactive program development and dedicated online applications. *RSX-11M* is a compact, realtime system for multiprogramming applications and program development. *RSX-11M-Plus* is an optimized version of RSX-11M for larger multipurpose realtime applications and program development. *RSX-11S* is an execute-only realtime system for multiprogramming applications; it requires an RSX-11M, RSX-11M-Plus, or VAX/VMS system for generation and program development. *Micro/RSX*

one 11MB RD51 Winchester disk, one 31MB RD52 Winchester disk, or one 800KB RX50 dual-drive diskette. An additional Winchester or diskette drive can be added externally. In addition to the aforementioned Winchesters, the MicroPDP-11 systems externally support the 52MB RC25 drive, which combines a 26MB Winchester disk with a 26MB sealed removable cartridge; up to two complete RC25 subsystems can be configured, for a total online disk storage capacity of 208MB.

The MicroPDP-11/23 supports up to six serial line units, and the MicroPDP-11/73 supports up to nine.

The MicroPDP-11/SV (Special Value), a specially configured version of the MicroPDP-11/23 for small businesses, is also available. Two RS-232/-432 asynchronous serial lines are standard, and can be expanded to accommodate 6 users. (DEC states that 4 users are a typical maximum in commercial environments.) Up to 4MB of memory can be addressed. One quad slot is available on the system for addition of an expansion serial device, an external disk drive, or more memory. The MicroPDP-11/SV is available with either an 11MB RD51 or a 31MB RD52 Winchester disk; another disk can be configured if it is the only additional device.

PDP-11/23-Plus systems include 256KB or 512KB of memory and either one RLV22 disk subsystem (one controller and two 10.4MB RL02 cartridge disk drives) or one RXV21 diskette subsystem (one controller and two 0.5MB RX02 drives). Memory can be expanded to 4MB in 256KB or 512KB increments; two more RL02 cartridge drives can be added to those systems that initially support two RL02s, for

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CHART E. MAGNETIC TAPE EQUIPMENT

MODEL	TK25	TS05	TU77	TU80
TYPE	Cartridge	Reel-to-reel	Reel-to-reel	Streaming
FORMAT				
Number of tracks	10	9	9	9
Recording density, bits per inch	8000	1600	1600/800	1600
Recording mode	Serial	PE	PE/NRZI	PE
CHARACTERISTICS				
Controller model	Q22 bus, TS11 software compatible	Integrated	Integrated	Integrated
Drives per controller	1	1	4	1
Storage capacity, bytes	60M	40M	40M (1600 bpi) 20M (800 bpi)	40M
Tape speed, inches per second	55	100	125	100
Data transfer rate, units per second	55KB	40KB/160KB	200KB	160KB
Streaming technology	Yes	Yes	No	Yes
Start/stop mode; speed	—	Yes; 25 ips	—	Yes; 25 ips
Switch selectable	—	—	Yes	No

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

is an extended version of RSX-11M-Plus for the MicroPDP-11 systems only; it is intended for small commercial and realtime applications, as well as for small multiuser program development in both high-level languages and Macro assembly.

RSTS/E is a general timesharing, resource-sharing system that permits simultaneous occurrence of different types of activities, including batch processing, interactive data processing, and detached job processing. *DSM-11* is a multiuser data management system with timesharing facilities for interactive users, detached jobs, and other simultaneous activities. The aforementioned *Ultrix-11* is an interactive, timesharing, native Unix operating system based on the AT&T Version 7 Unix; it also features Berkeley and AT&T Unix System V enhancements. Ultrix-11 is compatible with Ultrix-32 and Ultrix-32m, the Berkeley-Unix-based systems for the VAX family. *CTS-300* is a disk-based, single-user or multiuser operating system for commercial applications on smaller PDP-11 systems.

Local area and wide area communications among Digital systems are handled through DECnet software, which permits networks of over 1,000 nodes and can provide both Ethernet and X.25 communications facilities. Communications with IBM and other industry-standard systems and networks are handled through Internet software products.

Digital also offers office automation, data management, and program development applications for the PDP-11 family. In addition to DEC-proprietary business applications, over 2,000 third-party software packages are available for the PDP-11 family.

COMPETITIVE POSITION

Given the market's current drift away from conventional minicomputers, DEC has wisely begun to concentrate its efforts within the PDP-11 family on the lower end. The MicroPDP-11/73 is a significant addition to the PDP-11 family, for it provides the power of a midrange minicomputer in a supermicrocomputer package, delivering heightened low-end power while retaining software compatibility

a system total of four; an additional cabinet is required for that expansion.

The Unibus-based PDP-11/24 and PDP-11/44 are available in four levels of integration: rack-mount models providing space for further expansion; cabinet-mounted kernel computers that provide a base for OEM system integration; System Building Blocks (SBBs) that include the PDP-11 General Operating System License and allow the user to expand the system by choosing from a variety of disk and tape devices; and packaged systems that include all necessary hardware and software components, except the console terminal.

Both the PDP-11/24 and the PDP-11/44 are configured with 1MB of memory, expandable to 4MB in 1MB increments. For mass storage, they support 121MB RA80 and 456MB RA81 fixed disk drives, 205MB RA60 removable disk drives, and 10.4MB RL02 cartridge drives, along with RX02 dual 0.5MB floppy drives.

WORKSTATIONS: Generally, up to 14 stations can be configured on PDP-11 systems running Micro/RSX and Micro/RSTS; up to 16 workstations can be configured on systems running under RT-11, RSX-11S, RSX-11M, and RSX-11M-Plus operating systems. Up to 127 terminals can be configured on RSTS/E-based systems. The number of concurrently operating terminals supported can vary, depending upon the application. The MicroPDP-11/23 and MicroPDP-11/73 accommodate up to 14 workstations, up to 4 concurrently active on the MicroPDP-11/23, and up to 12 concurrently active on the MicroPDP-11/73. The PDP-11/23-Plus and PDP-11/24 support 10 simultaneously active stations, while the PDP-11/44 supports up to 48 concurrently active users.

DISK STORAGE: Up to eight disk drives can be attached to RT-11-, RSX-11S-, RSX-11M-, and RSX-11M-Plus-based systems; up to sixteen can be attached to RSTS/E-based systems. The MicroPDP-11 systems can support up to 208GB of disk storage; the PDP-11/23-Plus supports up to 41.6MB, while the PDP-11/24 and PDP-11/44 support up to 3.6GB each.

MAGNETIC TAPE: The MicroPDP-11/23 and the PDP-11/23-Plus support Q-Bus versions of the TS05, a 1600 bpi, PE tape subsystem, and the TK25, a 60MB cartridge tape drive; the MicroPDP-11/73 supports only the TK25. The PDP-11/24 and PDP-11/44 also support TU80 1600 bpi PE tape drives and TU77 and TE16 800/1600 bpi NRZI/PE tape drives, as well as a Unibus version of the TK25 cartridge tape drive. The maximum number of mag-

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all the way up the product line. In addition, the system's added power comes at a lower price; according to DEC, the MicroPDP-11/73 provides lower per-terminal cost than other PDP-11 systems. The manufacturer has stated that a 12-user system employing DEC's VT220 terminals has a per-terminal cost under $2,400.

Because of its intrinsic power and breadth of applications, the Micro/PDP-11/73 can compete against a range of general-purpose commercial computing systems, from supermicros to low-end minis. For example, the MicroPDP-11/73 stacks up favorably against NCR's Motorola MC68000-based I-Tower. The I-Tower provides slightly more disk storage (260MB) than the DEC system; however, the MicroPDP-11/73 holds the edge in memory (4MB versus the I-Tower's 2MB). The two are nearly equal in workstation capacity; the I-Tower supports up to 16 workstations, while the MicroPDP-11/73 allows configuration of up to 14 stations, with 12 concurrently active.

The MicroPDP-11/73 is also equipped to take on low-end minicomputers. It can give the 5362 model of IBM's System/36 a run for its money, easily surpassing that system's memory and auxiliary storage capacities (512KB and 120MB, respectively), and ceding an edge only in workstation support; the 5362 handles up to 22 local and 64 remote workstations. The MicroPDP-11/73 can also take on Hewlett-Packard's HP 260, which offers 870KB of main memory, 190MB of disk, and support for 11 concurrently active workstations (although up to 18 stations can be configured).

Digital's focus on the low end of the PDP-11 family also positions the company to take advantage of a growing industry trend toward supermicros and micros in specialized applications, like computer integrated manufacturing (CIM). For instance, DEC is already marketing a MicroPDP-11-based turnkey system, called DECtap, for shop floor accounting functions, thus expanding the presence of the PDP-11 family in factory automation (a market in which the PDP-11 family has participated for quite awhile, both for accounting functions and for process control).

Despite its recent focus on the MicroPDP-11 grouping, DEC has not abandoned the upper end of the line. According to a recent estimate by International Data Corporation (IDC), a consulting and market research firm based in Framingham, Massachusetts, over 100,000 PDP-11s are currently installed worldwide, providing a sizable base of user support.

Also, despite repeated predictions of the death of the 16-bit mini, there is still an active market for conventional minicomputers like the traditional PDP-11s, and those systems can continue to compete effectively against a range of antagonists, including systems from IBM, Sperry, and Honeywell.

The PDP-11/44, for instance, compares favorably with IBM's System/38 Model 6XX. The 11/44 matches the 6XX in main memory capacity (4MB), and slightly betters it in disk storage (3.6GB versus the 6XX's 3.3GB). While the

netic tape subsystems that can be attached to any single PDP-11 system is eight.

PRINTERS: Up to eight printers can be attached to RSTS/E-based systems. Only one printer can be attached to RT-11-, RSX-11S-, RSX-11M-, and RSX-11M-Plus-based systems. Micro/RSX supports LA50 and LA100 printing terminals as output-only hardcopy devices; it permits configuration of one LP25 or LP26 line printer with LPV11 interface.

OTHER PERIPHERALS: PDP-11 systems support an ink-jet color printer, dot-matrix and letter-quality printers, and a voice synthesis module.

The LCP01 is a desktop ink-jet color printer that produces presentation-quality graphics on paper and transparencies. It incorporates a graphics processor, and can store up to five fonts in local memory. The LCP01 can print up to 216 shades, and has a maximum resolution of 1536 by 1152 dots. It is compatible with DEC's VT100 terminals, as well as with the newer VT240/241 graphics terminals.

The LA50 Personal Printer is a tabletop dot-matrix printer for use with video terminals and small systems. It prints at speeds up to 100 cps in text mode and 50 cps in memo mode; it also has a graphics capability. The LA12 DECwriter Correspondent is an interactive printing terminal that prints at up to 80 cps in memo mode and 150 cps in draft mode. The LA100 is a microprocessor-controlled hardcopy terminal and printer; it can print up to 240 cps in draft mode, 30 cps in letter-quality mode, and 80 cps in memo mode. The LA100 is available in two versions: the receive-only Letterprinter 100 and the keyboard send/receive Letterwriter 100. The LA120 is a 180-cps printing terminal. Like the LA100, the LA120 is available in two versions: the receive-only DECprinter III and the keyboard send/receive DECwriter III.

The LA210 is a dot-matrix printer that achieves speeds of 40 cps in letter-quality mode, 80 cps in correspondence mode, and 240 cps in draft mode. It has a graphics capability. The LQP02 is a 32-cps letter-quality daisywheel printer. The LQP03 is a 130-petal daisywheel printer; it can print 25 cps in 10-inch Shannon text and 34 cps in 12-pitch triple-A text.

DECtalk is a voice synthesis module that converts standard ASCII text into speech output. DECtalk uses RS-232-C interconnection, standard operating system support, and standard terminal control sequences. It also features modular telephone connections which allow users to access a computer data base with a standard Touch-Tone telephone. The host computer for DECtalk must support the ASCII character set, EIA RS-232-C serial interconnects, ANSI control codes, and X-on/X-off.

MASS STORAGE

See Chart B.

INPUT/OUTPUT UNITS

See Chart C for terminals, Chart D for printers, and Chart E for magnetic tape equipment.

COMMUNICATIONS CONTROL

A number of asynchronous, synchronous, and Ethernet communications devices are available for both Q-Bus and Unibus PDP-11 systems.

The *DHV11* is an 8-line asynchronous, direct memory access (DMA) multiplexer that provides local or remote interconnection between Q-Bus PDP-11 systems and EIA RS-232-C/CCITT V.28 terminals or other systems. It oper-

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6XX supports 128 workstations, the PDP-11/44 allows configuration of 127, although only 48 can be concurrently active. The PDP-11/44 also holds its own against Sperry's System 80 Models 4 and 6, which provide up to 4MB of main memory but fall short of the PDP-11/44 in disk capacity (1.3GB) and workstation support (40). Finally, the PDP-11/44 can compete against Honeywell's DPS 6/75, which offers 2MB of memory, 2GB of disk, and support for 96 workstations.

ADVANTAGES AND RESTRICTIONS

The PDP-11 has several significant advantages. The variety of available configurations allows users to acquire and build systems that can address small-scale, large-scale, or midrange application requirements. The range of operating systems gives users a choice among realtime, timesharing, and batch operations, as their requirements dictate. Moreover, because most of those operating systems are compatible across the system line, software can be directly transported from one model to another; programs developed on a MicroPDP-11 system can be transported without alteration to a PDP-11/24 or PDP-11/44 running in the same operating environment.

Also, the compatibility between the PDP-11 and VAX families is a plus for PDP-11 users who want to move upward. In designing the MicroPDP-11 computers, DEC has consciously implemented the same form factors used for the MicroVAX I in order to retain size and Q-Bus peripheral compatibility. Moreover, peripherals from Q-Bus- and Unibus-based PDP-11 systems can be transferred to similar VAX systems, so users can reduce migration costs if they move up to a VAX. In addition, many applications developed on PDP-11 systems can be run in compatibility mode on VAX computers, so many users need not recode their programs if they go to a larger system.

On the negative side, there is no direct upgrade path within the PDP-11 family; no system can be field upgraded to the next highest. Thus, in-family migration to a more powerful computer requires a processor swap.

It is possible that prospective users of the PDP-11/24 and PDP-11/44 could be nervous at the prospect of buying systems that are members of a dying breed—the 16-bit mini—and might fear a scarcity of support, software, or peripherals. As the installed base figures quoted above indicate, however, the PDP-11 series remains highly popular, with thousands of third-party software packages and hundreds of third-party peripheral devices available. Moreover, DEC continues to come up with new products that permit the versatile PDP-11 systems to be used in various ways—even aside from conventional computing. For example, the company markets a special-purpose software package, called LAT-11 (LAT stands for Local Area Transport), which allows a properly configured Unibus PDP-11 to be used as a server for up to 64 terminals. Due to continued vendor support and its entrenched user and vendor bases, the upper end of the PDP-11 line still has a solid future.

ates at program- or jumper-selectable speeds up to 38.4K bps full duplex with full modem control on each line. The DHV11 is compatible with Digital's family of modems and with Bell 100 and 200 series modems and their equivalents.

The *DZQ11* is a 4-line asynchronous multiplexer that provides local or remote interconnection between Q-Bus PDP-11 systems and EIA RS-232-C/CCITT V.28 and EIA RS-423-A/CCITT V.10 terminals or other systems. The DZQ11 operates at program-selectable speeds up to 9600 bps full duplex with limited modem control on each line; it is compatible with Digital modems and with Bell 100 and 200 series modems and their equivalents.

The *DLVE1* is a single-line asynchronous interface that provides local or remote interconnection between Q-Bus systems and EIA RS-232-C/CCITT V.28 terminals. It operates at program- or jumper-selectable speeds from 50 to 19.2K bps full duplex. Limited modem control is included. It is compatible with Digital modems and with Bell 100 and 200 series modems and their equivalents.

The *DLVJ1* is a 4-line asynchronous interface that provides local or remote interconnection between Q-Bus systems and EIA RS-232-C/CCITT V.28, EIA RS-422/CCITT V.11, and EIA RS-423/CCITT V.10 terminals. The DLVJ1 acts as four separate devices. It operates at program- or jumper-selectable speeds from 150 to 38.4K bps full duplex. Limited modem control is included. DLVJ1 is compatible with Digital modems and with Bell 100 and 200 series modems and their equivalents.

The *DZV11* is a 4-line asynchronous multiplexer that provides local or remote interconnection between Q-Bus systems and EIA RS-232-C/CCITT V.28 terminals or other systems. It operates at program-selectable speeds up to 9600 bps full duplex with limited modem control on each line; it is compatible with Digital modems, and with Bell 100 and 200 series modems and their equivalents.

The *DEQNA* is an Ethernet to Q-Bus synchronous communications controller which connects Q-Bus systems to Ethernet local area 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.

The *DPV11* is a single-line synchronous interface that provides local or remote interconnection between Q-bus systems and other systems with EIA RS-232-C/CCITT V.28 or V.11 interfaces. The DPV11 operates at speeds up to 56K bps half or full duplex with full modem control. It is programmable for either byte-oriented protocols (DDCMP or Bisync) or bit-oriented protocols (SDLC or HDLC). It is compatible with Digital modems and with Bell 200 series modems and their equivalents.

The *DMV11* is a microprocessor-controlled, single-line synchronous interface that provides local or remote interconnection between Q-Bus systems and systems with EIA RS-232-C/CCITT V.28 or V.35 interfaces, or with EIA RS-423/-449 interfaces. The DMV11 implements the DDCMP protocol in hardware and supports DMA data transfers, DECnet point-to-point or multipoint configurations, and full modem control. It operates at speeds from 19.2K bps to 56K bps at half or full duplex. It is compatible with Digital modems and with Bell 200 series modems and their equivalents.

The *KMV11-A* is a DMA single-line programmable communications controller that provides interconnection between Q-Bus systems with EIA RS-232-C/CCITT V.28, EIA RS-422/CCITT V.11, and EIA RS-423/CCITT V.10 interfaces. It can operate at speeds up to 64K bps. The

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USER REACTION

Datapro's 1984 Computer Users Survey brought responses from 137 PDP-11 users, whose systems had average installed lives of 53.1 months. (It should be noted that among the respondents' systems were PDP-11/34s and -11/70s, which the company no longer actively markets.) Of the respondents, 107 (79.9 percent) had purchased their systems, 6 rented or leased from the manufacturer, and 21 leased from a third party.

Ninety users (65.7 percent) ran accounting/billing applications, while 58 ran payroll/personnel programs and 54 ran order processing/inventory applications. Forty-one users used their systems for educational scheduling/administration applications, and 33 ran purchasing applications; 25 ran sales/distribution programs, while 19 ran manufacturing applications. On the technical side, 25 users employed scientific/engineering programs, while 22 used mathematics/statistics packages. Other applications cited included process control, health care/medical, and banking/check processing.

Basic, cited by 68 users (49.6 percent), was by far the most popular programming language. Fifteen users mentioned Fortran, and seven said that they used Cobol. Four users said that they employed Pascal, three used RPG, and one used PL/1. One-hundred and ten users (80.3 percent) used in-house personnel to develop programs, while 52 relied on packaged programs from DEC. Thirty-five users resorted to contract programming, while three used programs especially tailored by DEC personnel. Sixty-eight users (49.6 percent) relied on software from third-party suppliers.

Main memory capacities on the installed systems ranged from 512KB to more than 16MB. Most users reported between 512KB and 4MB. Fifty-eight had between 512KB and 1MB, 57 had between 1MB and 2MB, and 19 had from 2MB to 4MB. Three users reported memory over 4MB.

Disk storage on the respondents' systems ranged from less than 10MB to more than 4.8GB. Ninety-four users reported between 100MB and 1.2GB; of those, 72 (53.3 percent of all respondents) had between 100MB and 600MB, while 22 had between 600MB and 1.2GB. Only one user had less than 10MB; 12 had between 10MB and 50MB, and 18 had between 50MB and 100MB. Nine users reported between 1.2GB and 4.8GB; only one had over 4.8GB of disk.

Thirteen users reported between 1 and 5 local workstations, while 50 had between 6 and 15. Thirty-six users reported between 16 and 30 local stations, while 26 had between 31 and 60 stations. Twelve users had over 60 local workstations. Thirty-one users had no remote workstations. Fifty-eight users (42.7 percent) had between 1 and 5 remote stations, while 25 reported between 6 and 15. Twelve users had between 16 and 30 remote stations, while 10 users reported between 31 and 60.

Forty-nine users employed a data base management system; eight users said that they planned to install one. Forty-

KMV11-A can be programmed in synchronous or asynchronous mode, and provides full support for Digital modems and for Bell 200 series and equivalent modems.

The *DL11* is a single-line asynchronous interface that provides local and remote interconnection between Unibus systems and EIA RS-232-C/CCITT V.28 or 20 ma devices. It operates at switch-selectable speeds from 50 to 9600 bps half or full duplex; full modem control is available on some versions. The DL11 is compatible with Digital modems and with Bell 100 and 200 series modems and their equivalents.

The *DH11* is a 16-line asynchronous DMA multiplexer that provides local and remote interconnection between Unibus systems and EIA RS-232-C/CCITT V.28 terminals. DH11 operates at program-selectable speeds up to 9600 bps, half or full duplex. Full modem control is available on some versions. It is compatible with Digital modems and with Bell 100 and 200 series modems and their equivalents.

The *DHU11* is a 16-line asynchronous DMA multiplexer that provides local and remote interconnection between Unibus systems and EIA RS-232-C/CCITT V.28 or EIA RS-423-A/CCITT V.10 terminals. It operates at speeds up to 9600 bps, half or full duplex. Full modem control is available on all lines.

The *DZ11* is an 8-line asynchronous multiplexer that provides local and remote interconnection between Unibus systems and up to eight EIA RS-232-C/CCITT V.28 or 20 ma terminals. It operates at program-selectable speeds up to 9600 bps full duplex. Limited modem control is provided. The DZ11 is compatible with Digital modems, as well as with Bell 100 and 200 series modems and their equivalents.

The *DMR11* is a microprocessor-controlled, single-line synchronous interface that provides local or remote interconnection between Unibus systems and computer systems with EIA RS-232-C/CCITT V.28, CCITT V.35, EIA RS-423/RS-449, or EIA RS-422/RS-449 interfaces. The DMR11 implements DDCMP in hardware and supports DMA data transfers, DECnet point-to-point configurations, and full modem control. It operates at speeds up to 1M bps, half or full duplex. It can communicate with another DMR11, a DMV11, a DMP11, or any other synchronous interface that implements DDCMP version 3.1 or 4.0. Depending upon the version selected, the DMR11 is compatible with Digital modems and with Bell 200 series and 500a11/5 modems and their equivalents.

The *DUP11* is a single-line synchronous interface that provides local or remote interconnection between Unibus systems and other computer systems with RS-232-C/CCITT V.28 interfaces. The DUP11 operates at speeds up to 9600 bps half or full duplex with full modem control. The DUP11 is programmable for either byte-oriented protocols (DDCMP or Bisync) or bit-oriented protocols (SDLC or HDLC). The DUP11 is compatible with Digital modems and with Bell 200 series modems and their equivalents.

The *KMS11-BD/BE* is an 8-line programmable, synchronous, intelligent front end that provides interconnection between Unibus systems and other devices with EIA RS-232-C/CCITT V.28, MIL-188-144 unbalanced, or CCITT V.35 (with optional hardware module) interfaces. It operates at speeds up to 56K bps half or full duplex with full modem control, and supports DMA data transfers.

The *KMS11-P* is a one-line programmable, synchronous, intelligent communications controller that provides interconnection between Unibus systems with EIA RS-232-C/CCITT V.28, EIA RS-423-A/CCITT V.10, CCITT V.35, or RS-422-A/CCITT V.11 interfaces. This microprocessor-based device operates at speeds up to 64K bps half or full

seven users (35.3 percent) had integrated office automation functions on their PDP-11s. Sixty-nine users (51.1 percent) had a disaster recovery plan, while 48 had none; 18 users said that they planned to implement one.

The following table shows the ratings that the survey respondents gave to their PDP-11 systems:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	68	59	8	0	3.4
Reliability of system	83	44	7	1	3.6
Reliability of peripherals	66	58	8	1	3.4
Maintenance service:					
Responsiveness	69	49	7	3	3.4
Effectiveness	63	50	14	1	3.4
Technical support:					
Troubleshooting	33	70	23	3	3.0
Education	19	68	35	6	2.8
Documentation	26	76	22	8	2.9
Manufacturers software:					
Operating system	66	60	5	0	3.5
Compilers & assemblers	42	74	7	1	3.3
Applications programs	20	70	9	1	3.1
Ease of programming	40	75	12	1	3.2
Ease of conversion	25	63	26	3	2.9
Overall satisfaction	47	79	6	0	3.3

*Weighted Average on a scale of 4.0 for Excellent.

Citing advantages, 95 users gave their PDP-11s high marks for ease of conversion and reconfiguration, and 92 gave high ratings to the PDP-11's ability to accommodate terminals and peripherals transported from other systems. The vendor's ability to deliver promised software and support was rated highly by 92 respondents. Rating the vendor's timeliness in delivering equipment, 92 users said that delivery had been on schedule, and 11 said that it had been ahead of schedule. Similarly, 101 users (76.5 percent) said that DEC had delivered their software on time, and three stated that delivery had been ahead of schedule. In addition, 99 users said that they found it quite easy to keep up with and implement the changes DEC made to hardware and software.

Although most users responded favorably, some negative notes crept into their evaluations. Compatibility of programs and data carried over from other systems was rated only "fair" or "poor" by 38 and 11 users, respectively. Moreover, 40 users (34.2 percent) rated the cost-cutting qualities of PDP-11 productivity aids only "fair"; another six users gave them "poor" ratings. On the environmental side, 36 users rated their PDP-11s "noisy," while six classified their systems as "excessively noisy."

Despite any negative comments, however, the PDP-11 users were highly pleased with their systems. Of the respondents, 123 (90.4 percent) said that they felt the system had done what they expected it to do. One-hundred and fourteen users (83.8 percent) said that they would recommend the PDP-11 to a prospective user.

To supplement the written responses, we contacted four respondents by telephone in March 1985; each was engaged in a different type of enterprise.

duplex with full modem control. The KMS11-P supports DMA data transfers and the X.25 protocol.

The *DEUNA* is an Ethernet-to-Unibus synchronous communications controller that connects Unibus systems to Ethernet LANs. It operates at 10M bps. DEUNA is supported under DECnet Phase IV software, and allows a Unibus system to communicate with up to 1,023 addressable devices on an Ethernet.

The *DMP11* is a microprocessor-controlled, single-line synchronous interface that provides local or remote interconnection between Unibus systems and other computer systems with EIA RS-423/CCITT V.10, EIA RS-422/CCITT V.11, EIA RS-232-C/CCITT V.28, or CCITT V.35 interfaces. The DMP11 implements DDCMP in hardware and supports DMA data transfers, DECnet point-to-point or multipoint configurations, and full modem control. It operates half duplex at 1M bps, and half and full duplex for other rates. Depending upon the operating system and layered software, the DMP11 can support up to 32 tributaries. In multipoint configurations, these tributaries can be other DMP11s or DMV11s. In point-to-point configurations, the DMP11 can communicate with any other synchronous interface that implements DDCMP version 3.1 or 4.0. The DMP11 is compatible with Digital modems and with Bell 200 series and 500al1/5 modems and their equivalents.

The *DFM Series* of statistical multiplexers are intelligent, standalone communications processors that support direct memory acess, synchronous and asynchronous operation, optional integral modems (4800 and 9600 bps), and expansion from 4 to 16 lines. They also feature: EIA RS-232-C/CCITT V.28 dial-up support; synchronous channel input on up to 50 percent of the channels of 1200 to 9600 bps; asynchronous input speeds of 50 to 9600 bps with autobaud above 150 bps; and concentrated link speeds of 1200 to 19.2K bps.

The *H4000 Digital Ethernet Transceiver* is a device that provides the functional interface between the Ethernet coaxial cable and an Ethernet station. The H4000 station transmits signals onto and receives signals from the cable, and detects any message collisions that may occur.

The *DELNI Local Network Interconnect* is a concentrator that allows up to eight Ethernet-compatible devices (not terminals) to be grouped together. The performance of a device remains constant whether the device is connected to the Ethernet through a DELNI or to an H4000 transceiver.

The *DEREP Ethernet Repeater* is a tabletop, standalone device with its own power supply, and allows for connection of multiple segments of Ethernet coaxial cable for expansion of the network. Each repeater adds a segment of coaxial cable up to 1,640 feet (500 meters) on which 99 additional H400 transceivers can be installed. The local repeater connects two coaxial cable segments no more than 328 feet (100 meters) apart, while the remote repeater (fiber optic) connects two coaxial cable segments up to 3,280 feet (1,000 meters) apart. The repeater times, amplifies, and repeats all signals it receives from one coaxial cable segment and passes the signal to the next segment.

The *DECOM Broadband Ethernet Transceiver* and an associated device, the *DEFTR Broadband Ethernet Frequency Translator,* allow PDP-11 systems to be configured in broadband Ethernet networks. The devices run under DECnet Phase IV networking software and are functionally equivalent to Digital's baseband Ethernet products.

DECOM provides full Ethernet functions on broadband, with a data rate up to 10M bps. It supports up to 1,024 nodes and is available for both dual- and single-cable broadband installations. When used with the DELNI clustering device,

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The first respondent, affiliated with a research contractor in the South, was a PDP-11/44 user who had converted from a PDP-11/34 and now had two PDP-11/44s. He said that the conversion had been extremely easy; he simply plugged in the 11/44 and began to use it, without having to make any operating system or application changes. He also said that the 11/44 was a much faster system than his old computer had been. The user remarked that he hoped to upgrade eventually to the PDP-11/84, and said he felt that the 11/44 offered possibilities for expanding upward without rewriting applications or retraining personnel. He also noted that the PDP-11/44's Unibus architecture offered the possibility of eventual migration to the middle and upper reaches of the VAX family; he said that he might migrate to a Unibus VAX in the future if PDP-11/VAX software compatibility becomes better.

The first user said that he hoped to add DECnet capabilities—both hardware and software—to his systems in 1985. When asked what advice he would give a prospective PDP-11/44 user, he responded that the system delivers very good performance for the price and is highly reliable, with very little downtime.

The second user represented a public utility company in the Midwest, and used both the PDP-11/24 and PDP-11/34A; his remarks focused on the 11/24. This user said that, prior to selecting the PDP-11/24, he had considered a VAX-11/730 but would have needed two operating systems for process control; with the PDP-11/24, he only needed to extend the RSX-11 operating system license for multiple CPUs—in his estimation, an easier and cheaper solution. He said that he was pleased with the consistency in software between the older and newer systems. Moreover, he remarked that the newer system allowed him to use more memory than the older system had (4MB, versus 256KB), so more tasks could be performed simultaneously; he now could use both Datatrieve and an editing facility, which require more memory than had previously been available.

The second user was also pleased with the versatility of the PDP-11/24. While he normally uses it for office functions, he had once used it for process control when the 11/34A, normally used for that function, went down. That remark brought up DEC's service, which he said was exemplary. The DEC service people had cabled the 11/24 over in the aforementioned instance when parts for the 11/34A were unavailable. He stated, also, that he had had no more than five hours of downtime in six years; because of that system and service reliability, he needed only three people to handle a processing plant that services three cities; in fact, operating costs were so low, he said, that he had been able to give customers a 10 percent rebate.

When queried as to his advice for prospective users, the second respondent said, "Take hardware and software support—it's worth it." He said that they cost $10,000 (including disk pack insurance) and $5,000 per year, respectively. He remarked that DEC personnel had "held his hand" during system programming, and had even tailored the PDP-11 system to accommodate non-DEC peripherals.

DECOM provides connection to as many as eight DECnet/Ethernet devices. DEFTR, used with DECOM in single-cable installations, enables a DECOM to transmit at one set of frequencies and receive at another. The DEFTR is not necessary in dual-cable installations, because the DECOM can transmit and receive at the same frequency using separate connection points for each cable.

Both broadband products attach to conventional cable television (CATV) cabling and components. Broadband and baseband Digital LANs can be interconnected through DECnet routers. Broadband and baseband DECnet/Ethernet LANs can be connected to other network environments through Digital's X.25 and SNA gateways.

The *DECnet Router Server* performs DECnet routing functions to connect DECnet Phase III or Phase IV local or remote hosts to the Ethernet, or to connect two independent Ethernets. DECnet Routers implement Phase IV DECnet protocols to allow network configurations of up to 1,023 nodes.

SOFTWARE

OPERATING SYSTEMS: The major operating systems for the PDP-11 include the single-user RT-11 disk-based system; the RSTS/E resource-sharing time-sharing system; Micro/RSTS; and the RSX-11 realtime multiprogramming systems: RSX-11M, RSX-11M-Plus, RSX-11S, Micro/RSX, and DSM-11. Several other operating systems are available, including: Ultrix-11; CTS-300; and Micro-Power/Pascal-RT.

***RT-11* is a compact, single-user, realtime operating system designed for interactive program development and online applications. Standard with all RT-11 systems are the Macro-11 assembly language, the KED keypad editor, and the EDIT text editor. Software supported by RT-11 includes Fortran 77, Basic-11, and DECnet-RT.**

RT-11 supports both single-job and foreground/background processing modes. In foreground/background mode, memory for user programs is divided into two separate regions. Two independent programs, therefore, can reside in memory and effectively share the resources of the system. The foreground program is given priority and executes until it relinquishes control to the background program, and vice versa. RT-11 also supports indirect command files, which permits execution of streams of commands contained in individual files. RT-11 also includes a batch facility.

RT-11 offers program development tools including a choice of three text editors, file and device maintenance utilities, an online debugger, and patch utilities. With DECnet-RT, RT-11 systems can be linked with other Digital operating systems for network operation. Using Internet protocol emulators, RT-11 can communicate with IBM mainframe systems or other systems that support Binary Synchronous Communication (BSC) protocols.

***RSTS/E (Resource Sharing Timesharing System/Extended)* is an interactive, multiuser, timesharing, resource-sharing, general-purpose operating system. Standard with all RSTS/E systems are Basic-Plus and Basic-Plus editor, Macro-11 assembly language, RMS-11 (Record Management Services) data management subsystem, and the Sort-11 utility; it supports a variety of software, including FMS11/RSTS/E, Datatrieve-11 data inquiry and report writing package, and DECnet/E, as well as high-performance protocol emulators for IBM interconnects. RSTS/E systems support concurrent interactive timesharing, transaction processing, batch processing, and program development.**

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The third user was a PDP-11/44 user affiliated with a midwestern manufacturing concern; he uses his system for general business functions, including accounts payable, payroll, general ledger, and order entry. He said that, before settling on the PDP-11/44, he had considered an IBM System/34 and a comparable (but unspecified) Burroughs system, but had gone with DEC because the company's representatives had better addressed his company's computing requirements. He opined that the machine is a good piece of hardware, and that the RSTS/E operating system is quite reliable. Like the first respondent cited above, he liked the fact that the 11/44 provides a base for possible migration to a Unibus VAX.

The third user was not as pleased as the second with DEC's support. He observed that the system was relatively problem-free, and required few service calls; when service is necessary, he said, he receives a fast response from the local branch. However, he said he feels Digital's service personnel are not always as knowledgeable as they should be, and don't always seem to explore all possibilities when a problem arises. He remarked that in several instances, problems they diagnosed as transient had recurred.

The fourth respondent was with an educational organization in the Pacific Northwest and employed a PDP-11/44. His purchase of the system had been necessitated by the software he required, which ran only on the PDP-11. He chose the 11/44 because it had the power and the storage and communications facilities to address his computing needs. He said that his system used 256KB of memory (soon to be expanded to 1MB), two 28MB disks and one recently added 256MB disk, and 20 stations (19 local and one remote). He remarked that DEC had originally proposed a PDP-11/34, but he was glad he had gone with the 11/44; the 11/34 would have been too small.

This fourth user said that his system runs under RSTS/E, which he considers a good operating system. However, he said he finds that system performance degrades quickly; when two large jobs (a sort and a print, for instance) are run simultaneously, the system bogs down. He said that the degradation was a function of memory, and is the reason he is expanding main storage on the system. He stated that he envisions keeping the 11/44 for about three years, and then moving up to the PDP-11/84 or to a VAX system. □

RSTS/E dynamically allocates system resources such as processor time, memory space, file space, and peripherals on a best fit/best throughput basis. Performance and throughput management features include shared common code, shareable data, intertask communication, disk data cache, overlapped seeks, and file placement control.

RSTS/E application development tools include high-level languages, data management and file processing facilities, program development aids, and communications capabilities. RMS and Sort-11 provide extensive file processing and data management services, that is, sequential, relative, and multikey ISAM support, file sharing, and protection mechanisms. Using facilities that support multiple job terminals, some RSTS/E systems can support up to 127 concurrent terminal users, even though the maximum number of simultaneous jobs per RSTS/E system is limited to 63.

***Micro/RSTS* is a prebuilt subset of RSTS/E. It supports system calls and programming facilities supported by RSTS/E. Micro/RSTS allows a maximum of 14 terminals and 10 jobs. Micro/RSTS uses the DCL command language, which is specifically designed for users with limited computer knowledge. The system does not support communications using DECnet or batch processing, due to storage limitations.**

Micro/RSTS is available in two parts. The Base Kit, intended for use as an applications engine and for Basic-Plus development, includes the operating system configured for a MicroPDP-11, documentation, RSTS/E operating system utilities, Basic-Plus, RMS-11, EDT, Sort/Merge, RSX emulation, and RT emulation. The Application Development Kit, for which the Base Kit is required, provides support for developing applications using Macro-11 (included) and high-level compilers. The Application Development Kit includes documentation, Macro-11, RSX utilities, RT-11 utilities, Task Builder (TKB), Librarian for RSX, Link (RT-11), Librarian for RT-11, and RMS-11 utilities. The minimum memory required for the kits is 256KB. The Base Kit takes up approximately 3MB of disk, while the Application Development Kit uses up about 2MB.

***RSX-11M* is a multiuser, multiprogramming, realtime operating system. Standard on all RSX-11M systems are the Macro-11 assembly language, the Files-11 data management services file system that provides volume structuring and protection, FCS (File Control Services), a basic file handling system, RMS-11, a superset of FCS, and the EDI and EDT editors. Optional software includes DECnet-11M, the Sort-11 utility, and additional data management facilities, including Datatrieve-11 and DBMS-11. RSX-11M systems support up to 32 simultaneous users.**

RMS (Record Management Services) is a superset of FCS (File Control Services), the basic file handling system for RSX-11M/RSX-11M-Plus systems, and is compatible with FCS written files. RMS permits relative, sequential, and multikey indexed file organizations (ISAM), and random, sequential, and record address access modes.

Because of its multiprogramming capabilities, RSX-11M permits realtime activities to execute concurrently with less time-critical activities such as program development, text editing, and data management. RSX-11M provides the environment for development and execution of multiple realtime tasks with a priority structured event-driven scheduling mechanism. Program development and realtime tasks can execute concurrently in systems with at least 48KB of memory.

The *RSX-11M-Plus* operating system is a superset of the RSX-11M operating system. It takes advantage of the expanded addressing capability of the PDP-11/24 and PDP-11/44 while maintaining the architecture of the RSX-11M operating system. RSX-11M-Plus supports up to 50 simultaneous users and provides facilities for batch job execution, interactive program development and execution, and timesharing. The system supports separate instruction and data spaces, allowing a user task to address up to 64KB of each simultaneously.

Standard on all RSX-11M-Plus systems are the Macro-11 assembly language and the Files-11 data management services file system that provides volume structuring and protection, FCS, RMS-1K, and the EDI and EDT editors. Optional software includes DECnet-11M-Plus, the Sort-11 utility, and Datatrieve-11 and DBMS-11 data management services. Also available is a Message Router, which provides store and forward message transport within a DECnet Phase III or Phase IV network.

In addition, RSX-11M-Plus supports DCL (Digital's standard command language), multistream batch processing,

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accounting, dynamic dual-ported disks, additional memory management capability, and more simultaneous tasks and terminals than RSX-11M.

RSX-11S is a memory-based subset of the RSX-11M operating systems. RSX-11S provides a runtime environment for execution of tasks on a memory-based processor. Memory resident application programs require the support of a disk-based host system like RSX-11M or RSX-11M-Plus for program development. RSX-11S has most of the RSX-11M features and generation capability, and supports all of the peripheral devices that are supported under RSX-11M. Other features included on RSX-11S are a monitor console routine, on-line task loader, system image preservation program, and file control services for record devices.

Micro/RSX is an extended subset of the RSX-11M-Plus operating system for the Micro/PDP-11. It can support up to 10 users and 14 terminals in both realtime and timesharing environments. Micro/RSX is packaged on an RX50 floppy disk and is customer-installable. Micro/RSX comprises two separate packages: the Base Kit and the Advanced Programmer's Kit. The Base Kit provides the RSX-11M-Plus Executive, utilities and device drivers, support for user mode program development in high-level languages, and a user documentation kit. The Base Kit occupies about 2.5MB of an RD51 disk. The Advanced Programmer's Kit, an optional add-on to the required Base Kit, contains software and documentation for Macro privileged mode program development; it includes a Macro assembler, a librarian, and system libraries for privileged mode programming.

The *DSM-11* operating system is a multiuser data management system that consists of an interactive high-level programming language, Digital Standard Mumps (Massachusetts General Hospital Multiprogramming System), a data management facility, and a timesharing executive. Digital Standard Mumps, an extension of the American National Standard Specification, is a high-level language oriented towards solving database problems, and is intended for use by programmers with little programming experience. The language includes text-handling capabilities, including inspection of any data item for content or format, concatenation of text strings, and segmentation of text. Other features of the DSM-11 operating system are: high-performance database handler; distributed database management; online, high-speed, database backup; automatic powerfail restart capability; and hardware device error reporting, system patching utility, and executive debugger for system maintenance.

Ultrix-11 is an interactive, timesharing, native Unix operating system based on the AT&T Version 7 Unix Timesharing System. It features: a hierarchical file system with demountable volumes; compatible file, device, and interprocess I/O; asynchronous processes; a system command language selectable on a per-user basis; a C compiler; and Fortran 77. Ultrix-11 also incorporates the Berkeley Unix full screen editor, a version of the Berkeley User Overlay Scheme for large programs, the Unix System III Source Code Control System (SCCS) plus the Berkeley SCCS interface program, and certain Unix System V commands. Ultrix-11 is compatible with Ultrix-32 and Ultrix-32m, the Berkeley-Unix-based systems for the VAX family.

Other features of Ultrix-11 include: disk bad block replacement; fully automatic system generation; system management commands; overlay kernel for CPUs without separate I and D space; and a crash dump analyzer.

CTS-300 is a disk-based, single-user or multiuser operating system for commercial applications on smaller PDP-11 systems. CTS-300 applications are written in Dibol, DEC's business-oriented language. The system comprises the following elements: the RT-11 operating system; a choice of three runtime systems: Single-User Dibol (SUD), Time-Shared Dibol (TSD), and Extended Memory TSD; and utilities.

Single-user Dibol allows one Dibol user or job to be run on a system; it requires only an entry-level system running on 32KB of memory. Time-Shared Dibol allows one or two users or two to four jobs to run simultaneously; it requires a medium system with at least 56KB of memory. Extended memory TSD allows up to 12 Dibol users or up to 16 Dibol jobs to run simultaneously; up to 12 can be attached to terminals, with the rest running in a detached environment.

CTS-300 also features: DKED, an editor that lets users create and modify Dibol programs online; an interactive command language; and Data Management Services (DMS), which handles sequential, random, or indexed sequential access method (ISAM) structured files.

MicroPower/Pascal-RT is a modular operating system and software development package; it is used to create microcomputer applications on PDP-11 systems. It includes a subset of the RT-11 operating system, an optimizing Pascal compiler, and programming, testing, and debugging tools. MicroPower/Pascal uses a two-processor development environment comprising a host PDP-11 running the RT-11 Extended Memory (XM), on which the Pascal compiler and development utilities reside and execute, and a target Q-Bus PDP-11, on which the application program resides and executes. The Pascal code for MicroPower/Pascal is structured in independent processes, which appear to execute simultaneously; each process cooperates with other processes in manipulating memory and shared peripheral devices.

DATABASE MANAGEMENT SYSTEMS: PDP-11 systems do not employ separate database management systems.

LANGUAGES: DEC offers several major programming languages for the PDP-11 family of computers.

Fortran IV is an extended superset of the ANSI X3.9-1966 standard. It features a high-speed, one-pass optimizing compiler and can produce absolute binary code suitable for standalone PDP-11 systems or for loading into ROM or PROM memory. Other features of Fortran IV include: the ability to use general expressions in all meaningful contexts; mixed-mode arithmetic; the BYTE data type for character manipulation; commenting at the end of each source line; and list-directed input/output.

Dibol-83, DEC's Business-Oriented Language, is a high-level language for commercial applications programming. It is similar to Cobol in that it has a DATA DIVISION and a PROCEDURE DIVISION, and uses English-like procedural statements. Unlike Cobol, Dibol-83 is designed specifically for creating interactive applications programs. Dibol-83 is available as part of CTS-300, and is an option on RSTS/E, RSX-11M-Plus, and Micro/RSX. Dibol-83 performs data manipulation, arithmetic expression evaluation, table subscripting, record redefinition, external calls to other programs, and both sequential and random access to files.

DECform, a data entry and file inquiry package, is included with Dibol-83 on CTS-300 and with RSTS/E Dibol. It is used for designing data entry screen formats. Both Dibol-83 and DECform have interactive debugging utilities.

Micro/RSX Dibol is compatible with Dibol-83 implementations on other operating systems, including RSTS/E, CTS-300, and RSX-11M-Plus while providing Micro/RSX-specific extensions. The product includes a compiler, a runtime library, external subrouting libraries, Dibol Debugging Technique, and interprogram communications capabilities.

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Basic-11/RT-11 is a conversational programming language utilizing English-like statements and familiar mathematical notations to perform operations. It is an incremental, interactive, interpretive compiler. Basic-11/RT-11 features: support for real, integer, double precision, and string data types; immediate mode statements for debugging and desk calculator usage; sequential data storage using the RT-11 file system; string capability, including string arrays and functions; disk virtual arrays for string, integer, and real data types; chaining with COMMON to accommodate large programs; CALL facility for invoking assembly language subroutines using a PDP-11 Fortran-compatible call interface; and formatted output using the PRINT USING statement.

Micro/RSX Basic-Plus-2 is the same extended Basic compiler as that which runs under the RSX-11M and RSX-11M-Plus operating systems. Micro/RSX Basic-Plus-2 takes advantage of the PDP-11 floating-point and integer instructions.

Micro/RSTS Basic-Plus-2 is an extended Basic compiler that runs under the Micro/RSTS operating system. It generates threaded code instructions, and uses the full printable ASCII character set and 8-bit character codes within constants and I/O operations.

Basic-Plus-2 is a software implementation language derived from the Dartmouth Basic language, and is a close subset of VAX Basic. The language processor is composed of a compiler and an Object-Time System/Library that contains the following run-time routines: library and arithmetic functions; dynamic allocation of string storage and I/O buffers; I/O operations handling; and processing errors in arithmetic, I/O, and system operations. Basic-Plus-2 runs on RSX-11M, RSX-11M-Plus, RSTS/E, Micro/RSX, and Micro/RSTS.

Coral 66 is a high-level block-structured programming language for realtime and process control applications. Features of Coral 66 include: BYTE, LONG (32-bit integer), and DOUBLE (64-bit floating-point) numeric types; reentrant code at the procedure level; executable generated code; switchable options to select target PDP-11 computer instruction sets, optimize generated code, check the bounds of array-type variables, control listing output, or read card format; and conditional compilation of defined parts of source code.

Cobol-81 is a Cobol compiler for interactive PDP-11 business systems, and is upward-compatible with VAX-11 Cobol. Cobol-81's sequential I/O and multikey indexed I/O modules meet the full ANSI-74 Level 1 standards. The system takes advantage of the PDP-11's optional Commercial Instruction Set, and provides library facilities and a symbolic debugger. Cobol-81 runs on any PDP-11 system with an extended instruction set.

Micro/RSX Cobol-81 and *Micro/RSTS Cobol-81* are implementations of Cobol-81 for the Micro/RSX and Micro/RSTS operating systems, respectively. Each is based on the ANSI Cobol Standard X3.23-1974 and includes some features planned for the next Cobol standard. Each consists of a compiler and an Object Time System/ Library, and shares some common syntax with VAX Cobol. Micro/RSX Cobol-81 also includes an interactive symbolic debugger.

Fortran-77 is an optimizing, high-performance compiler for the RSX-11M, RSX-11M-Plus, Micro/RSX, RSTS/E, Micro/RSTS, and RT-11 operating systems. It is an extended implementation of the subset Fortran language defined by the ANSI standard (X3.1978). The extensions are: TYPE and ACCEPT input/output statements; BYTE data type; hexadecimal and octal constants; virtual memory arrays on systems with memory management; and language elements to perform RMS multikey ISAM. (The last capability is not available under RT-11.) PDP-11 Fortran 77 is compatible with VAX Fortran. Available as a separate product on RSTS/E, Micro/RSTS, RSX-11M, RSX-11M-Plus, and Micro/RSX is Fortran-77 Debug, a symbolic tool for detecting runtime errors in programs.

Micro/RSX Fortran-77 and *Micro/RSTS Fortran-77* are extended implementations of the ANSI subset Fortran-77 standard (X3.9-1978), and run under the Micro/RSX and Micro/RSTS operating systems, respectively. Both contain all features of the subset, many full-set language features, and extensions not included in the ANSI Fortran-77 standard. Switch-selectable support is provided for user programs based on the previous ANSI Fortran standard (X3.9-1966). Each can be executed under control of an appropriate Fortran-77 Debug facility.

PDP-11 Pascal is a high-level language that includes the features of the Level 0 ISO Specification for Computer Programming Language Pascal (ISO 7185), along with extensions. It features sequential or direct record access, plus fixed- or variable-length records. Pascal/RSX runs on all RSX-11M- and RSX-11M-Plus-based systems with Extended Instruction Set (EIS), as well as on Micro/RSX systems configured with either the KEF11-AA floating-point chip option or the FPF11 dot floating-point processor card. *Micro/RSX PDP-11 Pascal* is an implementation of this language for the Micro/RSX operating system.

COMMUNICATIONS: DEC offers a number of software products both for communication among DEC machines and for access to networks that include other vendors' systems.

Communication with other DEC computer systems and networks is handled through *DECnet*, a family of Phase IV network products that allows a suitably configured PDP-11 computer system to participate as a routing or nonrouting (end) mode in a network with other Digital systems. DECnet offers task-to-task communications, utilities for network file transfer, homogeneous network command terminal support, and network resource capabilities, using the DEC Network Architecture (DNA) protocols. DNA supports Digital Data Communications Message Protocol (DDCMP) for point-to-point and multipoint communications, Ethernet protocols for local area networks, and X.25 for communications over public packet-switching networks. Phase IV networks of over 1,000 nodes are possible.

Among DECnet's principal features are:

- Task-to-task communication—enables two programs to exchange information. These two programs can be running under different operating systems, and can be written in different languages.
- File transfer—exchange of sequential ASCII or binary files; DECnet handles compatibility issues among operating systems. The transfer of file types other than sequential ASCII and binary may also be supported between particular operating systems.
- Remote command file submission and execution—one system can direct another to execute a specified program, either resident on the remote system or sent to the remote system as part of the request.
- Down-line loading—programs or whole software systems can be developed on a node with appropriate peripherals and shipped to another (to be executed, for example).
- Network command terminal—a terminal user at one system may be logically connected to another on the network running the same operating system and act as if directly connected to that system.

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- Adaptive routing—DECnet products communicate through a user-defined "least cost" path and have the ability to detect and automatically route around line or system failures.

- Network management—DECnet products include the tools for monitoring and controlling network operation. These include facilities for tuning network parameters, for logging events, and for testing nodes, lines, modems, and communication interfaces. For monitoring network operation or for testing a new network application, DECnet provides statistical traffic and error information. Access to such network performance information allows potential problems to be solved before they degrade network performance.

A DECnet network may be configured so that each network member is fully connected with every other member, or may communicate with other network nodes through an intermediate or routing network via a user-defined "least cost" path but have the ability to detect and route around line or system failures.

DECnet nodes may communicate with adjacent nodes over synchronous and asynchronous communications lines and parallel interfaces. DECnet nodes may share a communications link in a multipoint configuration. DECnet-11M and DECnet-11M-Plus nodes may communicate with each other (and with VAX and DECnet-20 nodes) with full DECnet functionality across a public packet switching network when used with Packetnet System Interface (PSI) products.

Interconnection of Digital systems with computers built by other manufacturers is supported by a family of products called *Internets*. DEC's protocol emulator (PE) products provide a way for DEC computers and terminals to communicate with computers and terminals built by IBM, CDC, and Sperry (Univac) by imitating those manufacturers' terminal and line products. Internet products are discussed in the following paragraphs.

The *2780/3780 Protocol Emulators (PEs)* are Bisync RJE emulators that allow files or jobs to be transferred between PDP-11 systems and IBM hosts supporting either the IBM 2780 or 3780 protocol. Multiple lines and multiple users are supported concurrently through operator and program control. The *RSTS/E 2780 Emulator* emulates the communications protocol of an IBM 2780 device while running as a user job under a suitably configured Unibus-based RSTS/E system. Files can be transmitted from any input medium, can be received from any medium supported by RSTS/E, and can be printed on any line printer supported by a RSTS/E operating system.

The *RSX-11 and RSTS/E 3271 Protocol Emulators (PE)* provide facilities for both program-to-program interactive communication and data pass-through 3270 terminal emulation. Terminal users and application programs can exchange data with a program running under IMS or CICS on an IBM 370 or 303X host. The PDP-11 system appears to the host as an IBM 3277 Model terminal and 3271 Model 2 control unit connected to a multidrop synchronous line. The PE module supports up to 6 synchronous lines. (Co-residency of RSX-11 3271 and either RSX-11 DECnet or RSX-11M/SNA PE is not supported.)

RSX-11M/IAS RJE/Hasp performs the standard functions of an IBM Hasp Remote Job Entry Workstation. RJE/Hasp mimics the CRT and keyboard of the Hasp workstation by offering remote console support. The Hasp PE user can communicate directly with the IBM mainframe from a local terminal to control and check the status of jobs on the IBM host.

RJE Hasp provides multileaved (pseudosimultaneous, bidirectional) communication of up to 7 input and 7 output data streams. Standard Hasp protocol features include data compression of repeated sequential characters, including blanks, full EBCDIC transparency, and multileaving. Communication line control is performed directly by one of the RJE/Hasp tasks. Concurrent use of the communications device by other RSX-11M or RSX-11M-Plus tasks is precluded. Any mass storage or unit record device supported by RSX-11M or RSX-11M-Plus can be used as a source or destination of data for a Hasp data stream.

The *RSX-11M/SNA Protocol Emulator* provides an RSX-11M system with the ability to participate in an IBM Systems Network Architecture (SNA) network. RSX-11M/SNA enables the RSX-11M user application programs to communicate with IBM application programs or system services on a task-to-task basis. RSX-11M/SNA supports up to 4 half-duplex or full-duplex synchronous lines at speeds up to 9600 bps; the emulator allows a maximum of 32 user sessions. The supported communications devices are DUP11s. Coresidency with DECnet-11M or with RSX-11/3271 is not supported.

DECnet/SNA Gateway routines allow Digital systems to share information with IBM systems running under SNA. The Remote Job Entry (RJE) routine allows the user on a DECnet node to perform as a remote SNA workstation or group of workstations and transmit batch jobs to an IBM host and receive job output; the node appears to the user as a turnkey package operating with JES2 or JES3 software on an IBM mainframe. The 3270 Terminal Emulator (3270 TE) routine allows the user of a VT 100 or VT 100-compatible device to interact with an IBM system running programs written for 3270 users. The Application Program Interface enables a user-written application in a DECnet node to exchange messages with a cooperating application in an IBM host. The Gateway Network Management routine controls the DECnet-to-SNA interface. It includes normal Decnet network management activities, troubleshooting, and monitoring of SNA/SDLC lines.

Mux200/RSX-IAS provides communications with a CDC 6000 Cyber series or other system using the 200 UT Mode 4A communications protocol. The PDP-11 user can communicate at command level with a host system, submitting jobs for batch processing and receiving results from the host. The software package can be configured to support either ASCII or external BCD versions of the communications protocol. Mux200/RSX-IAS enables several users to communicate simultaneously with a host system over a single line. The PDP-11 system, while using a single physical drop, appears to the host as a number of multidrops and terminals on the circuit.

UN1004/RSX provides communication between a Unibus-based RSX-11M system and a Univac 1100 series or another type of system using the Univac 1004 RMS-1 communications protocol. The software provides remote job entry (RJE) terminal emulation through which the user can send data in 80-column card format and receive data in line or card format. UN1004/RSX supports one synchronous communications circuit to a host computer, a single switched or dedicated lease line, 2-wire or 4-wire common carrier facility at transmission rates up to 4800 bpi, and ASCII line communications code. Only full-duplex console terminals may act as emulator terminals.

DEC also provides *Packetnet System Interfaces (PSIs)* for PDP-11 systems; these products include an X.25 Protocol Interface, and Interactive Terminal Interface, and RSX-11 PSI (discussed in the following paragraphs).

RSX-11 PSI has two subsets, RSX-11 PSI/M and RSX-11 PSI/M-Plus, that allow suitably configured RSX-11M and

DEC PDP-11 Family

RSX-11M-Plus operating systems to connect to public packet-switching networks (PPSNs) conforming to the CCITT recommendation of June 1980. These PSI products support task-to-task communication via the network and remote terminal communication through a packet assembler/disassembler (PAD) facility provided by the network. Terminals connected to a host RSX-11M or RSX-11M-Plus system cannot act as network terminals to other systems connected to the network. Access to RSX-11 PSI/M or RSX-11 PSI/M-Plus is supported for RSX-11M user programs written in Macro-11, Fortran-IV, and Fortran-77. The communications discipline used is the CCITT V.24 (EIA-RS-232) at the hardware level, and symmetric LAPB variant of the X.25 frame level protocol and the X.25 packet level protocol.

RSX-11 PSI/M and RSX-11 PSI/M-Plus can coexist with, or operate as a layered product under DECnet-11M or DECnet-11M-Plus, allowing the use of DECnet facilities over PPSNs as well as private leased lines or switched telephone networks. The Packetnet System Interface supports a subset of Digital Network Architecture's management features including loading and unloading software, defining lines, and providing access to error counters and other maintenance functions. RSX-11 PSI/M and RSX-11 PSI/M-Plus have been certified and are warranted on the following networks: Transpac (France), Datex-P (Germany), PSS (United Kingdom), and Telenet (USA).

UTILITIES: *Sort-11* is an optional data sorting utility that can accept as input any RMS-11 format file and output a reordered RMS-11 format file. Input files can contain data stored in binary, EBCDIC, or ASCII format, and the file organization can be sequential, relative, or indexed sequential. Records can be sequenced by key fields in ascending and descending order. Sort-11 cannot be used to merge two separate files. Sort-11 provides four different user-selectable sorting processes: Record Sort (manipulates records in their entirety); Tag Sort (produces a reordered file by manipulating only the key position of each record); Address Routing Sort (produces a file for the data and multiple address files that are used to access the data in the desired sequences); and Index Sort (produces a separate index file that contains the record SORT key field and a pointer to the record's location in the data file).

OFFICE AUTOMATION: PDP-11 systems are targeted toward general commercial applications, rather than toward Office Automation. However, the PDP-11 does have word processing packages for use in office environments.

DECword/DP is a software package that puts fully featured word processing in the RSTS/E and Micro/RSTS timesharing environments. It can be run from any terminal on a system under one of those environments, and gives end users the type of text-manipulation features usually associated with standalone word processor equipment. DECword/DP provides features such as menu-driven function selection, cut and paste, forward and reverse scrolling, global search and replace, and automatic word wrap. It also offers footnoting, spelling error detection, list processing, and computer-aided instruction in use of the system.

DECtype is a full-featured word processing package for the CTS-300, RSX-11M-Plus, and Micro/RSX operating systems. It permits concurrent word and data processing in a multiuser environment; features include menu-driven operation, cut and paste capability, forward and reverse scrolling, search and replace, automatic word wrap, subscripts, superscripts, and headers and footers. The package also provides a four-function editor math utility and full printer control facilities.

DECmail-11 is a command-driven electronic mail system available for RSTS/E, Micro/RSTS, RSX-11M-Plus, and Micro/RSX. Users can create, edit, store, and forward messages; search by date and subject key string; retrieve messages held in user folders; define commands; and use online help facilities. This system can also be used under DECnet for multinode access.

APPLICATIONS: DEC offers numerous data management, program development, and graphics applications for PDP-11 systems. In addition, over 2,000 third-party applications are available for the systems.

FMS-11 (Forms Management System) is used by applications programmers to build interactive screen-oriented data entry capabilities into application programs. FMS-11 can be used in conjunction with a standard programming language such as Fortran, Cobol-81, or Basic-Plus-2. Components of the FMS-11 package are: the Form Editor for layout and modification of video forms; the Video Keypad Editor for general-purpose text editing of standard ASCII files; the Form Utility for manipulation of FMS forms descriptions during debugging; the Form Driver for performing screen processing at application run-time; and RT-11, the Application Run-Time Supervisor for running application programs independently of programs running on other system terminals.

Datatrieve-11 is an interactive query, report, and data maintenance system that allows data retrieval, sorting, and updating; report generation and creation; and maintenance and accessing of data dictionary entries. Datatrieve-11 includes online prompting, help, and tutorial features. The system uses the RMS-11 record management system to access data records in sequential, relative, or indexed files. Frequently used sequences of commands can be stored in a data dictionary, and an Application Design Tool (ADT) interactively steps novices through the process of creating domain and record definitions. *Micro/RSX Datatrieve-11,* for the Micro/RSX environment, is also available.

PLXY-11 is a software package that provides RT-11, RSX-11M, RSX-11M-Plus, and RSTS/E applications programmers with access to the plotting capabilities of Digital's LXY12/LXY22 lineprinter/plotters. Using the PLXY-11 graphics subroutines, programmers can create software that prints out representations of data in graphs and charts with clear alphanumeric labeling.

ADE (Applications Development Environment) is a programming tool specifically designed for nonprogrammers to use in developing and running small, simple applications for use in small businesses. It allows users with little or no computer experience to perform record keeping and bookkeeping tasks such as maintaining and printing mailing lists, inventory lists, time sheets, and budgets. ADE runs in the RSTS/E timesharing environment. *PDP-11 ADE/RSX,* a version for the RSX-11M and -11M-Plus environments, is also available.

Menu-11 is a software package that allows application programmers to design a customized interface between an RSTS/E system and its users. It allows for RSTS/E's DCL command language environment to be sealed off from novice or infrequent users and replaced with a set of interactive menus backed by help texts, giving users access to just those procedures and utilities needed in their work. Menu-11 consists of a set of programs that interact with RSTS/E and control the display of menus to users according to command files prepared by programmers.

MicroPower/Pascal-RSX is a modular software development package for microcomputer applications. It includes an optimizing Pascal compiler and tools to create, build test, and debug concurrent realtime application programs running under the RSX-11M or RSX-11M-Plus operating system. The target system for the application can be any Digital Q-Bus or extended Q-Bus processor.

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A-to-Z software is a group of general-purpose application and office packages for MicroPDP-11 systems. The A-to-Z Integrated System, layered on Micro/RSX, provides menu and system management functions, and allows users to install and modify Micro/RSX applications. Word Processing, Electronic Mail, and Business Graphics modules are also available, as are a Data Inquiry module, for hardcopy reports and terminal-based inquiries, and an Integration Kit, for creation and migration of software packages targeted for the A-to-Z Integrated System.

PRICING

POLICY: DEC provides PDP-11 systems on a purchase basis, with separately priced maintenance agreements. Discounts for volume purchases are available. Leasing arrangements are available through DEC's U.S. Customer Finance Group, which provides leasing alternatives through various programs for commercial organizations, state and municipal entities, and federal government agencies and prime contractors. DEC software is licensed rather than sold. Users purchase licenses and distribution rights separately.

SUPPORT: Hardware products are warranted against defects in material and workmanship for 90 days, either from date of installation completion, or, if Digital does not do the installation, from date of delivery. Digital warrants software products classified as "Digital-Supported" for 90 days; the warranty is generally received by the customer after the product is installed or 30 days after delivery, depending upon which date comes first.

Field service is offered on several levels to meet varying customer needs. For customers with in-house troubleshooting and self-maintenance capabilities, DEC offers the off-site facilities of 150 Digital Servicenters throughout the U.S. for terminals and small systems. The Servicenters provide two-day turnaround for carry-in repairs.

On-site field service is offered worldwide through a network of offices with assigned service representatives. These offices provide both field service and spare parts inventory.

The Basic Service agreement includes remedial maintenance, preventive maintenance, installation of latest engineering changes, and automatic escalation of complex problems. Service calls receive priority status, second only to calls under the DECservice agreement.

The DECservice agreement adds the following features to the basic field service agreement: response time of four hours if the system is located within 100 miles of a Digital service location, and extended coverage up to 24 hours a day, 7 days a week.

Per Call Service is offered both on-site and off-site on a noncontractual basis. Service is available Monday through Friday, 8 a.m. to 5 p.m. Each on-site call is charged on a time and materials basis; off-site per call service is available through mail-in board replacement and carry-in system repairs.

An optional adjunct to DEC's on-site field service, Recover-all, provides full product repair or replacement for equipment damage caused by accidents or incidents normally not covered under service agreements, such as fire or water damage, power failures, and natural disasters. The cost of Recover-all ranges from 7 to 10 percent of the total monthly service charge of each covered contract line item. Actual charges depend on system configuration and type of service coverage.

In addition, Media Maintenance is available for Digital disk cartridges.

Software maintenance is offered through several levels of optional service. DEC's Software Product Services (SPS) organization provides the following programs:

- Self-Maintenance Service, for customers who wish to maintain their own software; this program includes media and documentation updates, formal software problem reporting mechanisms, and newsletters and dispatches containing information on software developments and enhancements

- Basic Service, for users who do not require on-site support; this program includes all elements of the Self-Maintenance Service, plus telephone support and on-line support through Digital's Software Information Network (DSIN), an online software information system

- DECsupport Service, which includes all elements of Basic Service, plus on-site assistance and software support.

System Startup Service Packages provide customers with the system-level support and training required to start up and manage their systems. These packages provide training, documentation, and software service. The user selects from among three levels of support, based on a number of factors, including computer experience and system use. All three levels include dial-in telephone support, and both the operating system and associated software products purchased with the system are supported. Prices are based on the size and complexity of the system and the level of support required.

DEC also sponsors the Digital Equipment Computer Users Society (DECUS), a voluntary, nonprofit users' group. DECUS provides an extensive program library, users' groups, special interest groups, and workshops/symposia. The society is responsible for maintaining the DECUS program library and publishing a library catalog, the proceedings of symposia, and a periodic newsletter.

TRAINING: Training in programming, system operations, and applications is offered in over 20 DEC facilities in the United States and worldwide. Digital also offers on-site instruction. DEC's Educational Services division publishes a digest listing available courses four times a year.

TYPICAL CONFIGURATIONS: The following tables show typical PDP-11 configurations.

The following is a typical MicroPDP-11/73 configuration:

SX-EA52E-EK floor/table packaged system; includes CPU, 512KB parity MOS memory, RX50 800KB dual diskette drive, RD52 31MB Winchester disk, DHV11 8-line asynchronous multiplexer, and PDP-11 Operating System General License	$15,140
Eight VT220-A2 monochrome terminals and keyboards/country kits	11,160
LA100-BA 40-/80-/240-cps dot matrix printer	2,195
Total Price	$28,495

The following is a typical PDP-11/24 configuration:

SX-FX200-EK(EN) PDP-11/24 System Building Block; includes CPU and power supply, 1MB ECC MOS memory, KT24 Physical Address Extension (PAX) module, CPU cabinet with power controller, EIA cable for console	$ 17,000

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terminal, and PDP-11 operating system general license	
MS11-PB 1MB add-on memory module	4,900
KEF11-AA floating-point option	225
KEF11-BB Commercial instruction set	495
H775-A Battery backup unit	700
RUA81-AA RA81 456MB rack-mount fixed disk drive and UDA50 controller	24,500
DD11-CK expansion backplane	470
TU80-AA TU80 25/100 ips magnetic tape subsystem	11,000
LP11-AA LP25 300-lpm band printer	8,350
Eight VT240-A2 monochrome graphics terminals and U.S. country kits	17,560
DZ11-DP Eight-line multiplexer with I/O panel controller for EIA/CCITT terminals	2,175
Two LA50-RA 50-/100-cps dot matrix printers	1,390
Total Price	$ 88,765

The following is a typical PDP-11/44 configuration:

SX-40200-EK(EN) PDP-11/44 System Building Block; includes CPU and power supply, 1MB ECC MOS memory, cabinet with power controller, I/O connection panel, EIA cable for console terminal, and PDP-11 operating system general license	$ 34,800
Three MS11-PB 1MB add-on memory units	14,700
KT24 Physcial Address Extension (PAX) module	800
FP11-F floating-point processor	3,100
KE44-A Commercial instruction set	7,900
H7750-BA(BB) Battery backup unit	1,600
RUA81-AA RA81 456MB rack-mount fixed disk drive and UDA50 controller	24,500
RA81-EA Three 456MB RA81 fixed disk drives in cabinet	50,000
TU80-AA TU80 25-/100-ips magnetic tape subsystem	11,000
DD11-CK Expansion backplane	470
DD11-DK Expansion backplane	940
LN01-CA 12-ppm laser printer	19,995
LXY22-CA LXY22 600-lpm graphics printer	15,800
Four LA50-RA 50-/100-cps dot matrix printers	2,780
Two DHU11-AP 16-line multiplexers	6,990
24 VT240-A monochrome graphics terminals and U.S. country kits	52,680
Eight VT241-AA color graphics terminals and U.S. country kits	25,560
Total Price	$273,615

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint. ($)
MicroPDP-11/23 BASE AND BOX SYSTEMS			
11A23-F	MicroPDP-11/23 floor/table system base; includes CPU; 256KB parity MOS memory, and RX50 800KB dual diskette	7,300	62
11A23-R	Same as 11A23-F, but rackmount model	7,300	62
11C23-F	MicroPDP-11/23 floor/table system base; includes CPU, 256KB parity MOS memory, RX50 800KB dual diskette, and 11MB RD51 Winchester disk	9,100	78
11C23-R	Same as 11C23-F, but rackmount model	9,100	78
11C23-FA	11C23-F plus BQ01-AA country kit for U.S. and English-speaking Canada	9,200	78
11C23-RA	11C23-R plus BQ01-AA country kit for U.S. and English-speaking Canada	9,200	78
11C23-FE	MicroPDP-11/23 floor/table system base; includes CPU, 512KB parity MOS memory, RX50 800KB dual diskette, and 11MB RD51 Winchester disk	9,850	84
11C23-FH	Same as 11C23-FE, but backplane has only 4 slots; used for MicroPDP-11/SV	5,995	84
11C23-RE	Same as 11C23-FE, but rackmount model	9,850	84
11E23-FD	MicroPDP-11/23 floor/table system base; includes CPU, 256KB parity MOS memory, RX50 800KB dual diskette, and 31MB RD52 Winchester disk	10,225	87
11E23-RD	Same as 11E23-FD, but rackmount model	10,075	87
11E23-FE	MicroPDP-11/23 floor/table system base; includes CPU, 512KB parity MOS memory, RX50 800KB dual diskette, and 31MB RD52 Winchester disk	10,975	94
11E23-FH	Same as 11E23-FE, but backplane has only 4 slots; used for MicroPDP-11/SV	7,495	94
11E23-RE	Same as 11E23-FE, but rackmount model	10,825	94
11H23-AA	MicroPDP-11/23 rackmount system; includes 512KB parity MOS memory and 52MB RC25 fixed/removable disk in H9642 cabinet	16,995	96
MicroPDP-11 SYSTEMS			
SX-RA500-EX	MicroPDP-11/23 floor/table packaged system; includes CPU, 256KB parity MOS memory, RX50 800KB dual diskette, RD51 11MB Winchester disk, DZV11 multiplexer for six terminal ports, and operating system general license	10,125	89
SX-RA500-FA	SX-RA500-EX plus a BQ01-AA country kit for USA and English-speaking Canada	10,225	90
SX-RA50E-EX	MicroPDP-11/23 floor/table packaged system; includes CPU, 512KB of parity MOS memory, RX50 800KB dual diskette, 31MB RD52 Winchester disk, DZV11 multiplexer for 6 terminal ports, and operating system general license	10,875	95
SX-RA520-EK(EN)	Same as SX-RA50E-EX, but without DZV11 multiplexer	12,675	105
MicroPDP-11/73 BASE AND BOXED SYSTEMS			
11/73-BC(BD)	MicroPDP-11/73 rackmount model; includes CPU and 512KB parity MOS memory	7,800	70
11H73-AA(AB)	MicroPDP-11/73 system; includes 512KB parity MOS memory and 52MB RC25 fixed/removable disk in H9642 cabinet	19,500	109

NA—Not applicable.
NC—No charge.

DEC PDP-11 Family

		Purchase Price ($)	Monthly Maint. ($)
MicroPDP-11/73 BASE AND BOXED SYSTEMS (Continued)			
SX-EA52E-EK(EN)	MicroPDP-11/73 floor/table packaged system; includes CPU, 512KB parity MOS memory, DHV11 8-line asynchronous multiplexer, RX50 800KB dual diskette, 31MB RD52 Winchester disk, and operating system general license	15,140	120
SX-EA54E-EK(EN)	MicroPDP-11/73 floor/table packaged system; includes CPU, 512KB parity MOS memory, DHV11 8-line asynchronous multiplexer, 31MB RD52 Winchester disk, 60MB cartridge tape drive, and operating system general license	19,040	160
MicroPDP-11/73 SYSTEM BUILDING BLOCKS			
	Each MicroPDP-11/73 System Building Block (SBB) includes a CPU, 512KB parity MOS memory, bootstrap/diagnostic ROM, one asynchronous serial line, BA23-A system enclosure, and appropriate mounting kit. In addition, a selection must be made from the mass storage (system device and load device) menu. (System devices are the 11MB RD51 Winchester and the 31MB RD52 Winchester; load device options are the RX50 diskette and the TK25 cartridge tape.) Selections from the communications device, console terminal, and software license menus are optional.		
173QY-B2	MicroPDP-11/73 SBB with BA23A-AF floorstand/tabletop kit	7,950	70
173QZ-B2	MicroPDP-11/73 SBB with BA23A-AR rackmount kit	7,800	70
PDP-11/23-Plus SYSTEMS			
11T23-BK(BL)	PDP-11/23-Plus system base; includes 512KB parity MOS memory, two RL02 disks, and controller	19,950	249
11V23-BE(BJ)	PDP-11/23-Plus system base; includes 256KB parity MOS memory and one RX02 dual diskette subsystem (1MB)	13,000	132
SX-RXMMA-EK(EN)	PDP-11/23-Plus packaged system; same as 11T23-BK(BL), but includes operating system general license	20,750	249
11/23-BC(BD)	Rackmount PDP-11/23-Plus; includes CPU, 256KB Parity MOS memory, two serial line units, line frequency clock, boot and diagnostic ROMs, and 9-slot backplane (7 unused slots)	5,690	82
11/23-BE(BF)	Same as 11/23-BC(BD), but with 512KB memory	6,690	109
PDP-11/24 SYSTEMS			
11/24-CC(CD)	PDP-11/24; includes CPU and power supply, 1MB ECC MOS memory, and KT24 Physical Address Extension (PAX) module in 5.25-in. (13.3-cm.) rackmountable box	11,000	95
11/24-DC(DD)	PDP-11/24; includes CPU and power supply, 1MB ECC MOS memory, and KT24 PAX module in rackmountable 10.5-inch (26.6-cm.) box	12,500	105
11X24-FA(FB)	PDP-11/24 Kernel Computer; includes CPU and power supply, 1MB ECC MOS memory, KT24 PAX module, I/O connection panel, and H9642 CPU cabinet with power controller; contains mounting space for RA80, RA81, RL02, RX02, or TU58 mass storage device	14,000	118
PDP-11/24 SYSTEM BUILDING BLOCKS			
SX-FX100-EK(EN)	PDP-11/24 System Building Block. Includes CPU and power supply; 1MB ECC MOS memory; KT24 PAX module; I/O connection panel; EIA cable for console terminal; H9642-EA(EB) CPU cabinet with power controller, providing space for one TU58-DA, RUA80-AA, RUA81-AA, RL211-AK, or RX211-BK mass storage device; and operating system general license	16,000	115
SX-FX200-EK(EN)	Same as SX-FX100-EK(EN), but with wide H9645-EA(EB) cabinet, providing space for any combination of two TU58, RL02, RX02, RA80, and RA81 mass storage devices; two RA80/RA81 devices cannot be configured together	17,000	105
PDP-11/24 PACKAGED SYSTEMS			
SX-FXGMB-EK(EN)	PDP-11/24 packaged system; includes CPU, 1MB ECC MOS memory, 121MB RA80 disk drive and UDA50 controller, one 10.4MB RL02 cartridge disk drive and controller, H9645-EA(EB) cabinet with power controller, EIA cable for console terminal, I/O connection panel, KT24 PAX module, and operating system general license	42,000	304
SX-FXMMB-EK(EN)	PDP-11/24 packaged system; includes CPU and power supply, 1MB ECC MOS memory, KT24 PAX module, H9645-EA(EB) cabinet with power controller, two RL02 10.4MB cartridge disk drives and controller, EIA cable for console terminal, I/O connection panel, and operating system general license	26,900	$248
PDP-11/44 SYSTEMS			
11/44-DA(DB)	PDP-11/44; includes CPU and power supply and 1MB ECC MOS memory in 10.5-in. (26.6-cm.) rackmountable box	29,300	175
11X44-FA(FB)	PDP-11/44 kernel computer; includes CPU and power supply, 1MB ECC MOS memory, I/O connection panel, and H9642-EA(EB) cabinet with power controller; has 10.5 in. (26.6 cm.) of mounting space at top for RA80, RA81, RL02, RX02, or TU58 mass storage device	29,950	165

NA—Not applicable.
NC—No charge.

DEC PDP-11 Family

		Purchase Price ($)	Monthly Maint. ($)
PDP-11/44 SYSTEM BUILDING BLOCKS			
SX-40100-EK(EN)	PDP-11/44 System Building Block; includes CPU and power supply; 1MB ECC MOS memory; I/O connection panel; EIA cable for console terminal; H9642-EA(EB) cabinet with power controller, providing space for one TU58-DA, RUA80-AA, RUA81-AA, RL211-AK, or RX211-BK mass storage device; and operating system general license	33,000	165
SX-40200-EK(EN)	Same as SX-40100-EK(EN), but with wide H9645-EA(EB) cabinet, providing space for any combination of two TU58, RL02, and RX02 mass storage devices; two RA80/RA81 devices cannot be configured together	34,800	175
PDP-11/44 PACKAGED SYSTEMS			
SX-40GMB-EK(EN)	PDP-11/44 packaged system; includes CPU and power supply, 1MB ECC MOS memory, nine-slot expansion backplane, 121MB RA80 disk drive and UDA50 controller, RL02 10.4MB cartridge disk drive and controller, EIA cable for console terminal, H9545-EA(EB) cabinet with power controller, I/O connection panel, and operating system general license	60,300	357
SX-40MMB-EK(EN)	PDP-11/44 packaged system; includes CPU and power supply, 1MB ECC MOS memory, two RL02 10.4MB cartridge disk drives and controller, EIA cable for console terminal, I/O connection panel, H9645-EA(EB) cabinet with power controller, and operating system general license	44,700	309
PROCESSOR OPTIONS AND MEMORIES			
Q-Bus Systems Options (MicroPDP-11/23 and -11/73 and PDP-11/23-Plus)			
FPF11	Single- and double-precision floating point; operates on 32-bit and 64-bit floating point numbers; microcode resides on one quad module mounted adjacent to CPU	2,000	25
KEF11-AA	Single- and double-precision floating point; performs hardware operations on 32-bit and 64-bit floating point numbers; mounts on CPU board	225	NC
KEF11-BB	Commercial Instruction Set (CIS); implements a set of 27 commercial instructions on data types including character strings, packed decimal, and numeric formats; mounts on CPU board	495	NC
MCV11-DC	32KB CMOS static Random Access Memory with on-board battery backup	990	20
MSV11-LF	128KB MOS memory	1,000	15
MSV11-LK	256KB MOS memory	1,250	28
MSV11-PK	256KB parity MOS memory	1,250	28
MSV11-PL	512KB parity MOS memory	2,000	55
PDP-11/24 Options			
FPF11	Single- and double-precision floating point; operates on 32-bit and 64-bit floating point numbers; microcode resides on one quad module mounted adjacent to CPU	2,000	25
KEF11-AA	Single- and double-precision floating point; performs hardware operations on 32-bit and 64-bit floating point numbers; mounts on CPU board	225	NC
KEF11-BB	Commercial Instruction Set (CIS); implements a set of 27 commercial instructions on data types including character strings, packed decimal, and numeric formats; mounts on CPU board	495	NC
KT24	Physical Address Extension (PAX) module allows memory expansion up to 1MB with a 5.25-inch CPU box and up to 4MB with a 10.5-inch CPU box; must mount in second hex slot in CPU backplane next to the processor	800	16
H775-A	Battery backup for 5.25-inch PDP-11/24 CPU	700	8
H7750-BA(BD)	Battery backup for 10.5-inch PDP-11/24 CPU	1,600	16
MS11-LD	256KB ECC MOS memory	1,700	91
MS11-PB	1MB ECC MOS memory	4,900	46
PDP-11/44 Options			
FP11-F	Floating Point Processor for PDP-11/44; 46 floating-point instruction set; performs hardware operations on 32-bit and 64-bit floating point numbers; mounts in dedicated slot in PDP-11/44 backplane	3,100	20
KE44-A	Commercial Instruction Set (CIS) processor for the PDP-11/44; implements a set of 27 commercial instructions on data types including character strings and packed decimal and numeric formats; mounts in adjacent slots in PDP-11/44 backplane	7,900	18
H7750-BA(BD)	Battery backup for PDP-11/44 CPU	1,600	16
MS11-PB	1MB ECC MOS memory	4,900	46
MASS STORAGE			
RUA80-AA(AD)	RA80 121MB rackmount fixed disk drive and UDA50 controller	19,500	111
RUA80-CA(CD)	RA80 fixed disk subsystem with 121MB storage; contains RA80 H9642 cabinet-mounted disk drive and UDA50 controller	22,000	111
RUA80-JA(JD)	RA80 fixed disk subsystem; includes H9642 cabinet-mounted 121MB drive and two UDA50 controllers	27,500	141

NA—Not applicable.
NC—No charge.

DEC PDP-11 Family

		Purchase Price ($)	Monthly Maint. ($)
MASS STORAGE (Continued)			
RUA80-UA(UD)	Additional UDA50 controller with cable; for dual-porting RA80, RA81, and RA60 disks; for RA81 drives, requires RUA81-CA(CD), -AA(AD), or -EA(ED)	5,500	30
RA80-AA(AD)	RA80 rackmount 121MB disk drive (no cabinet); requires UDA50 controller and cabinet for mounting	14,000	81
RA80-CA(CD)	RA80 cabinet-mounted 121MB fixed disk drive; requires UDA50 controller	16,500	81
RUA81-AA(AD)	RA81 rackmount 456MB drive with UDA50 controller	24,500	120
RUA81-CA(CD)	RA81 fixed disk subsystem; includes 456MB cabinet-mounted drive and UDA50 controller	27,000	120
RUA81-EA(ED)	RA81 fixed disk subsystem; includes three 456MB cabinet-mounted drives and UDA50 controller	56,000	300
RUA81-JA(JD)	RA81 fixed disk subsystem; includes one 456MB cabinet-mounted drive and two UDA50 controllers	32,500	150
RA81-AA(AD)	RA81 rackmount disk drive (no cabinet); requires UDA50 controller and H9642-AP(AR) cabinet	19,000	90
RA81-CA(CD)	RA81 cabinet-mounted disk drive; requires UDA50 controller	21,500	90
RA81-EA(ED)	Three cabinet-mounted RA81 drives; requires UDA50 controller	50,000	270
RUA60-AA	RA60 205MB removable disk drive (no cabinet) and UDA50 controller	21,500	110
RUA60-CA(CD)	RA60 removable disk subsystem; includes 205MB cabinet-mounted drive and UDA50 controller	24,000	110
RUA60-JA(JD)	Same as RUA60-CA(CD), except with two UDA50 controllers	29,500	140
RA60-AA	RA60 rackmount disk drive (no cabinet); requires H9642-AP(AR) cabinet and UDA50 controller	16,000	80
RA60-CA(CD)	RA60 cabinet-mounted disk drive; requires UDA50 controller	18,500	80
RL211-AK	RL02 rackmount, top-loading 10.4MB cartridge disk drive and controller to interface to the PDP-11 Unibus	6,900	71
RLV22-AP	RL02 cartridge disk subsystem; same as RL211-AK, except controller interfaces to the Q-Bus on MicroPDP-11 and PDP-11/23-Plus systems	6,900	73
RL02-AK	Add-on cartridge disk drive	3,600	63
RLV12-AP	RLV12 controller; interfaces 1-4 RL01 or RL02 drives to the Q-Bus. System option includes module, internal cables, and I/O connector panel insert. Must be ordered with the system in which it will be installed.	3,900	14
RLV22-AK	Base option for the Q-Bus; requires cabinet kit	6,800	74
RD51-A	RD51 5¼-inch, 11MB Winchester disk drive; intended for addition to MicroPDP-11 system enclosure	1,295	7
RD51-D	RD51 11MB Winchester drive in desktop enclosure; includes I/O cable	1,895	18
RD51-R	RD51 rackmount 11MB Winchester drive; requires enclosure	1,895	18
RD52-A	RD52 31MB Winchester disk drive; for addition to MicroPDP-11 system enclosure	3,000	19
RD52-DA(DB)	RD52 31MB Winchester drive in desktop enclosure with I/O cable	3,600	19
RD52-RA(RB)	RD52 rackmount 31MB Winchester disk drive; requires enclosure	3,600	19
RX211-BK(BM,BN)	RX02 dual floppy disk subsystem; includes two 0.5MB RX02 drives and controller to interface to PDP-11 Unibus; rackmount	4,150	50
RXV21-EP(ES,ET)	RX02 tabletop dual floppy disk subsystem; includes two 0.5MB RX02 drives and controller to interface to the Q-Bus on MicroPDP-11 and PDP-11/23-Plus systems	4,500	50
RXV21-EA(ED,EC)	Tabletop upgrade option for the Q-Bus; requires a cabinet kit	4,430	50
RX50-AA	RX500 0.8MB diskette drive; for addition to MicroPDP-11 system enclosure	700	8
RX50-D	RX50 0.8MB diskette drive in desktop enclosure; includes I/O cable	1,300	20
RX50-R	RX50 0.8MB rackmount diskette drive; requires enclosure	1,300	20
RQDX1	Q-Bus controller for RX50, RD51, and RD52 drives	1,290	12
RQDX1-E	Double-height disk drive bus extender module for use with the RQDX1 disk controller	150	NA
RQDX1-P	Q-Bus controller for RX50, RD51, and RD52 drives and for MicroPDP-11/73 System Building Blocks; includes cabinet kit	1,340	12
RUX50-YA	Intelligent quad-size, single board Unibus controller; interfaces up to two RX50 0.8MB dual diskette drives; includes 9-ft. (2.7-m) I/O cable; requires an RX50-D when a desktop unit is added to a PDP-11 Unibus system, and an RX50-R and rackmount chassis when a rackmount unit is added to a PDP-11 Unibus system	1,300	12
RUC25-AA(AB)	Tabletop RC25 52MB (26/26) fixed/removable disk drive	12,500	39
RUC25-BA(BB)	Rackmount RC25 52MB fixed/removable disk drive with Unibus controller; mounts in H9642-F and H9642-M Unibus expansion cabinets	12,500	39
RUC25-CA(CB)	Rackmount dual RC25 fixed/removable disk drives with Unibus controller; mounts in H9642-F and H9642-M Unibus expansion cabinets	21,000	72
RQC25-AA(AB)	Tabletop RC25 52MB fixed/removable disk drive with Q-Bus controller; may require bootstrap option for add-on to PDP-11/23-Plus	12,500	39
RQC25-BA(BB)	Rackmount RC25 52MB fixed/removable disk drive with Q-Bus controller; may require bootstrap option for add-on to PDP-11/23-Plus	12,500	39
RQC25-CA(CB)	Rackmount dual RC25 52MB fixed/removable disk drives with Q-Bus controller; may require bootstrap option for add-on to PDP-11/23-Plus	21,000	72
RC25-DA(DB)	Tabletop add-on RC25 52MB fixed/removable disk drive; may require bootstrap option for add-on to PDP-11/23-Plus	8,500	33
RC25-EA(EB)	Rackmount add-on RC25 52MB fixed/removable disk drive; mounts in H9642-F and H9642-M Unibus expansion cabinets; may require bootstrap option for add-on to PDP-11/23-Plus	8,500	33
MAGNETIC TAPE			
TQK25-EA	Standalone TK25 60MB cartridge tape drive; includes Q-Bus interface card, packaging, external cable, universal power supply, and cabinet kit with 16-in. (0.41-m) CPU cable; for MicroPDP-11 systems	3,200	48

NA—Not applicable.
NC—No charge.

DEC PDP-11 Family

		Purchase Price ($)	Monthly Maint. ($)
MAGNETIC TAPE (Continued)			
TQK25-EC	Same as TQK25-EA, but with 32-in. (0.81-m) cable in cabinet kit; for PDP-11/23-Plus (may require KDF11-B2 bootstrap option for add-on)	3,200	48
TSV05-AA(AB, AC, AD)	Q-Bus TS05 1600-bpi, 25-/100-ips magnetic tape system with hardware for rackmounting, control module, and cables; for MicroPDP-11 and PDP-11/23-Plus systems (may require KDF11-B2 bootstrap option for add-on to PDP-11/23-Plus)	8,900	85
TSV05-BA(BB, BC, BD)	Q-Bus TS05 magnetic tape system mounted in a 41.7-in. (106-cm) H9642 cabinet with power controller and 21 in. (53.3 cm) of expansion space; for MicroPDP-11 and PDP-11/23-Plus systems (may require KDF11-B2 bootstrap option for add-on to PDP-11/23-Plus)	9,995	85
TSU05-AA(AB, AC, AD)	Unibus TS05 1600-bpi, 25-/100-ips magnetic tape system with hardware for rackmounting, control module, and cables; for PDP-11/24 and PDP-11/44 systems	13,500	85
TSU05-BA(BB, BC, BD)	Unibus TS05 magnetic tape system in 41.7-in. (106-cm) H9642 cabinet with power controller and 21 in. (53.3 cm) of expansion space; for PDP-11/24 and PDP-11/44 systems	Contact DEC	85
TJU77-AB(AD)	TU77 magnetic tape transport and controller to interface to the PDP-11 Unibus: includes the controller, a tape formatter and one nine-track TU77 tape transport; 1600-bpi and 800-bpi record densities; 125-ips read/write speed	36,800	259
TU77-AF(AJ)	TU77 magnetic tape transport; requires TJU77	23,800	193
TU80-AA(AB)	TU80 magnetic tape subsystem; 1600-bpi, 25-/100-ips, half-inch magnetic tape subsystem; employs start/stop and streaming tape technology; interfaces to any Unibus system; includes tape drive cabinetry	11,000	85
TERMINALS			
VT220-A2(A3)	VT220 video terminal with white phosphor nonglare screen	1,180	6
VT220-B2(B3)	VT220 video terminal with green phosphor nonglare screen	1,180	6
VT220-C2(C3)	VT220 video terminal with amber phosphor nonglare screen	1,180	6
VT22K-AA	Data processing country kit (including keyboard) for VT220; for U.S. and English-speaking Canada	215	3
VT22K-BA	Word processing country kit (including keyboard) for VT220; for U.S. and English-speaking Canada	215	3
VT240-A2(A3)	Monochrome graphics terminal with white phosphor nonglare screen; includes monitor, keyboard, and system box	1,980	16
VT240-B2(B3)	Monochrome graphics terminal with green phosphor nonglare screen; includes monitor, keyboard, and system box	1,980	16
VT240-C2(C3)	Monochrome graphics terminal with amber phosphor nonglare screen; includes monitor, keyboard, and system box	1,980	16
VT241-AA	Color graphics terminal for U.S. and English-speaking Canada; includes monitor, keyboard, and system box	2,980	23
VT24K-AA	Data processing country kit (including keyboard) for VT240 and VT241; for U.S. and English-speaking Canada	215	3
VT24K-BA	Word processing country kit (including keyboard) for VT240 and VT241; for U.S. and English-speaking Canada	215	3
VT100-AA(AB)	VT100 tabletop video display terminal with U.S. power cord and plug	1,945	18
VT100-WA(WB)	VT100 terminal with advanced video, word processing keyboard, and U.S. power cord and plug	2,140	22
VT101-AA(AB)	VT101 video display terminal with local echo, advanced video printer port, and U.S. power cord and plug	1,350	15
VT102-AA(AB)	VT102 tabletop video terminal with local echo, advanced video printer port, and U.S. power cord and plug	1,595	22
VT102-WA(WB)	VT102-AA with word processing/DECWord keyboard, EIA interface, 120 VAC, and U.S. plug	1,595	22
VT102-WC	Same as VT102-WA(WB), but with 100 VAC	1,595	22
VT131-AA(AB)	VT131 video display terminal with conversational block mode transmission capability	1,695	25
VT131-AC	VT131-AA with 100 VAC power cord and U.S. plug	1,695	25
BCC02-06	6-ft. (2-m) cable for connecting VT240 monochrome monitor to system box	35	NC
BCC03-06	6-ft. (2-m) cable for connecting color monito to system box; for upgrading VT240 to VT241	35	NC
VT1XX-AA	20 ma adapter for the VT100; allows VT100 terminal to convert from an EIA interface to a 20 ma current loop interface	140	4
VT1XX-AB	Advanced video option for the VT100	180	4
VT1XX-AC	Printer port option; allows connection of a VT100 to a hardcopy printer	350	7
VT1XX-CA	20 ma interface adapter option for VT100/VT101/VT102/VT131; converts from an EIA RS-232-C interface to a 20 ma interface	140	4
VT1XX-CB	Graphics upgrade kit for VT100	1,800	11
VT1XX-CE	Word processing upgrade kit for VT100	395	NA
RT100-AA(AB)	RT100 ruggedized video terminal for industrial environments; includes sheet-steel case, filtration system, hinged keyboard, and EIA interface	4,300	35
RT100-BA(BB)	Same as RT100-AA(AB), but with 20 ma interface	4,300	40
RT102-AA(AB)	RT102 ruggedized video terminal for industrial environments; includes EIA interface	4,300	35
RT102-BA(BB)	Same as RT102-AA(AB), but with 20 ma interface	4,300	40
RT102-EA	Completely sealed, industrialized VT102 video terminal with tactile feedback keyboard and EIA interface	4,500	35
RT102-FA	Same as RT102-EA, but with 20 ma interface	4,500	40
RT137-AA	RT137 ruggedized bar code terminal; includes RT100 video terminal with bar code reader, bar code keyboard, VT100 keyboard, light pen, and EIA interface	5,625	52

NA—Not applicable.
NC—No charge.

DEC PDP-11 Family

		Purchase Price ($)	Monthly Maint. ($)
TERMINALS (Continued)			
RT137-AE	RT100 video terminal with bar code reader, bar code keyboard, light pen, and EIA interface	5,250	52
RT137-AK	RT100 video terminal with bar code reader, RT1XX-AC keyboard, light pen, and EIA interface	6,215	72
RT137-SR	Bar code badge slot reader	565	10
RT1XX-AC	VT100- and RT100-compatible Mylar industrial membrane keyboard	1,250	12
RT1XX-AE	Plastic membrane keyboard for VT100 series terminals	1,100	10
RT1XX-AF	VT100-compatible environmentally sealed keyboard with typewriter-like keys	1,250	12
RT7XX-AC	Bar code ruby wand	199	NA
RT037-AA	RT037 bar code reader and decoder	2,150	30
RT037-BA	RT037 bar code reader, decoder, and keypad	2,395	30
LA12-AB	LA12 DECwriter Correspondent hardcopy terminal with integral 1200-baud dial-through keyboard modem, 300-baud coupler, EIA interface, and carrying case	2,195	21
LA12-CB	LA12 hardcopy terminal with integral 300-baud coupler, EIA interface, and carrying case	1,595	21
LA12-DB	LA12 tabletop and console model with EIA interface only	1,495	21
LAX12-U2	Dial-through keyboard 1200-baud integral modem upgrade for LA12-CB, -DB	600	NC
LAX12-U4	300-baud acoustic coupler upgrade for LA12-DB	100	NC
LA100-BA	Letterwriter 100 keyboard send/receive hardcopy terminal with numeric keypad, tractors, cable, ribbon cartridge, package of paper, Courier 10/ Orator 10 fonts in U.S./U.K. character sets	2,195	27
LA100-BB	Letterwriter 100 keyboard send/receive hardcopy terminal with numeric key, tractors, cable, ribbon cartridge, one package of paper, Courier 10 font, international overlay, and VT100 line drawing set	2,195	27
LA100-CA	Letterwriter 100 keyboard send/receive hardcopy terminal with tractors, cable, ribbon cartridge, one package of paper, Courier 10/Orator 10 fonts in U.S./U.K. character sets, and multiple font option	2,295	27
LA100-CB	Letterwriter 100 keyboard send/receive hardcopy terminal with tractors, cable, ribbon cartridge, one package of paper, Courier 10 font, international overlay, VT100 line drawing set, and multiple font option	2,295	27
LA120-DA	LA120 DECwriter keyboard send/receive hardcopy terminal; accommodates 1- to 6-part forms	2,800	34
COLOR GRAPHICS SYSTEM			
VS11-FA	VS11 Unibus systems color raster graphics display station	5,435	73
VS11-FC(FD)	Same as VS11-FA, but includes second frame buffer	6,495	94
VOICE SYNTHESIS MODULE			
DTC01-AA	DECtalk voice synthesis module; English-speaking text to speech board, speech analog and telephone output	4,000	22
PRINTERS			
LA50-RA	LA50 tabletop printer (50-/100-cps) with push tractor feed, 110 VAC power supply	695	8
LA50-RB/RC	LA50 tabletop printer (50-/100-cps) with push tractor feed, 220/240 VAC power supply	715	8
LA50-RD	LA50 tabletop printer with push tractor feed, 100 VAC power supply	715	8
LA100-ZA	Letterprinter 100 receive-only printer (40-/80-/240-cps) with tractors, cable, ribbon cartridge, one package of paper, and Courier 10/Orator 10 fonts in U.S./U.K. character sets	1,595	28
LA100-ZB	Same as LA100-ZA, but with international overlay, VT100 line drawing set, and Courier 10 font only	1,595	28
LA120-RA	LA120 DECprinter III (180-cps) receive-only printer for use with 1- to 6-part forms	2,420	39
LA120-RB	Same as LA120-RA, but for use with 4- to 9-part forms	2,600	39
LA210-AA	40-/80-/240-cps letterprinter with power cord and documentation	1,595	28
LQP02-AA(AD)	LQP02 32-cps letter-quality printer with Courier 10 font	2,800	29
LQPX2-AA	Bidirectional forms tractor option for fanfold paper	250	NC
LQPX2-SF	Dual-tray cutsheet feeder with envelope tray	1,800	19
LQP03-A	LQP03 25-cps, 120 V/60 Hz letter-quality printer with 130-character print wheel and U.S. power cord	1,395	23
LQP03-B	LQP03 25-cps, 220-240 V/50 Hz letter-quality printer with 130-character print wheel	1,395	23
LQPX3-SF	Single-tray sheet feeder	1,800	19
LQPX3-FT	Bidirectional tractor	245	NC
LN01-CA(CB)	LN01 12-ppm laser printer with LP11 interface and 30-ft. (9.1-m.) cable; two 188-character fixed-space fonts	19,995	295
LN01S-CA	LN01S 12-ppm laser printer with 12 standard Courier-like fonts, LP11 interface, and 30-ft. (9.1-m) cable	29,995	336
LP11-AA	LP25 band printer; 300 lpm for 64 ASCII character set; for Unibus systems	8,350	100
LP11-BA	LP25 band printer; 300 lpm for 64 ASCII set or 215 lpm for 96 ASCII character set; for Unibus systems	8,950	100
LPV11-AP	LP25 Q-Bus systems band printer; 300 lpm for 64-character set	8,350	100
LPV11-BP	LP25 Q-Bus systems band printer; 300 lpm for 64-character set or 215 lpm for 96-character set	8,950	100
LPV11-A	LP25 Q-Bus upgrade option; 300 lpm for 64-character set; requires cabinet kit	8,300	100
LPV11-B	LP25 Q-Bus upgrade option; 300 lpm for 64-character set; requires cabinet kit	8,900	100
LP11-EA	LP26 Unibus systems band printer; 600 lpm for 64-character set	13,600	143

NA—Not applicable.
NC—No charge.

DEC PDP-11 Family

		Purchase Price ($)	Monthly Maint. ($)
PRINTERS (Continued)			
LP11-EB	LP26 Unibus systems band printer; 600 lpm for 64-character set and 445 lpm for 96-character set (includes both)	14,400	143
LPV11-EP	LP26 Q-Bus systems band printer; 600 lpm for 64-character set	13,600	150
LPV11-FP	LP26 Q-Bus systems band printer; 600 lpm for 64-character set or 445 lpm for 96-character set	14,400	150
LPV11-E	LP26 Q-Bus upgrade option; 600 lpm for 64-character set; requires cabinet kit	13,550	150
LPV11-F	LP26 Q-Bus upgrade option; 600 lpm for 64-character set and 445 lpm for 96-character set; requires cabinet kit	14,350	150
LP27-UA(UB)	LP27 Unibus systems band printer; 1200 lpm for 64-character set or 800 lpm for 96-character set; includes 30-ft. (9.5-m) data cable and controller	29,990	247
LP27-DA(DB)	LP27 band printer with 50-ft. (15.2-m) data cable and long-line controller; with optional cables, allows operation up to 1,000 ft. (304.7 m) from host processor	32,990	295
LXY12-CA(CB)	LXY12 Unibus systems 300-lpm dot-matrix graphics printer with 30-ft. (9.2-m) cable, pedestal with basket, paper guide, and LP11 controller	11,250	99
LXY12-DA(DB)	LXY12 300-lpm dot-matrix graphics printer with cable for interfacing to RS-232-C serial port, pedestal with basket, and paper guide	11,250	99
LXY22-CA(CB)	LXY22 Unibus systems 600-lpm dot-matrix graphics printer with 30-ft. (9.2-m) cable, pedestal with basket, paper guide, and LP11 controller	15,800	129
LXY22-DA(DB)	LXY22 600-lpm dot-matrix printer with cable for interfacing to RS-232-C serial port, pedestal with basket, and paper guide	15,800	129
LCP01-AA	LCP01 ink-jet color printer with graphics processor	14,595	Contact DEC
CABINETS AND EXPANSION HARDWARE			
H9642-AP(AR)	Top-loading cabinet for RA60 removable disk; holds one RA60 in top bay and three RA60s, RA80s, and RA81s in any combination in middle and bottom bays	2,500	NC
H9642-BD(BE)	Top-loading expansion cabinet for RL02 cartridge disk drive	1,570	NC
H9642-EA(EB)	CPU cabinet for PDP-11/24 and PDP-11/44; includes I/O connection panel and accommodates 10.5- or 5.25-inch CPU, battery backup unit, and one of the following storage devices: TU58-DA, RL211-AK, RUA80-AA(AD), RUA81-AA(AD), or RX211-BK(BN)	2,200	NC
H9642-FA(FB)	Partitioned expander cabinet; includes shielded cable duct and I/O connection panel; provides mounting space for a BA11-KU(KV) Unibus expander box and one of the storage devices applicable to H9642-EA(EB), above	2,200	NC
H9642-FC(FD)	Unpartitioned expander cabinet for a BA11-KU(KV) Unibus expander box and two I/O connection panels; no disk or tape options can be mounted	2,050	NC
H9645-EA(EB)	Wide CPU cabinet for PDP-11/24 and PDP-11/44; provides mounting space for a 10.5-inch CPU and two of the following storage devices: TU58, RL02, RX02, RA80, and RA80; the storage devices can be combined, although two RA80/RA81 devices cannot be configured together; includes I/O connection panel and side mounting for battery backup unit	2,500	NC
BA11-KU(KV)	Rackmount, 10.5-in. (26.6-cm) Unibus expansion box with slides for use in expander cabinets; includes cable for connection to CPU box and fans for front-to-back cooling; must be mounted in shielded enclosure	3,500	24
BA11-SE(SF)	Cabinet-mounted, 22-bit addressing expansion box with bezel for expansion of PDP-11/23-Plus system	2,000	15
DD11-CK	Four-slot expansion backplane mounting unit for use in BA11-KU(KV) expander boxes or in PDP-11/24 and PDP-11/44 CPU boxes; accommodates two hex and two quad slot modules	470	NC
DD11-DK	Nine-slot expansion backplane mounting unit for use in BA11-KU(KV) expansion boxes or in PDP-11/24 and PDP-11/44 CPU boxes; accommodates seven hex and two quad modules	940	NC

Q-Bus COMMUNICATIONS OPTIONS

Communications options are available either as factory-installed system options or as field-installable upgrade options. System options include the module, internal cables, and I/O connection panel inserts. For upgrade options, the customer must order the base option module and a cabinet kit containing the unique cable, filter assembly, and bracket hardware required to install the option in a specific cabinet. Several cabinet kits can be available for a given option, because different CPU cabinets require cables of different lengths and mounting brackets of different sizes.

Asynchronous Interfaces

DHV11	Eight-line asynchronous communications multiplexer; speeds to 38.4K bps		
DHV11-AP	DHV11 system option	1,350	14
DHV11-M	DHV11 upgrade option; includes base module only; requires an appropriate cabinet kit	1,200	14
DLVE1	Asynchronous, RS-232-C, one-line interface; dual-sized module; operating speeds from 50 to 19.2K bps		
DLVE1-DP	DLVE1 system option	550	8
DLVE1-M	DLVE1 upgrade option. Includes base module only; requires a cable kit	440	8

NA—Not applicable.
NC—No charge.

DEC PDP-11 Family

		Purchase Price ($)	Monthly Maint. ($)
Asynchronous Interfaces (Continued)			
DLVJ1	Four line EIA/CCITT asynchronous interface with limited modem control; line speeds from 150 to 38.4K bps		
DLVJ1-LP	DLVJ1 system option	650	12
DLVJ1-M	DLVJ1 upgrade option. Includes base module only; requires external cables and appropriate cable kit	580	11
DZQ11	Four-line asynchronous EIA/CCITT multiplexer; operating speeds to 9600 bps		
DZQ11-DP	DZQ11 system option	750	11
DZQ11-M	DZQ11 upgrade option. Includes base module only; requires external cables and appropriate cabinet kit	625	11
DZV11	Four-line asynchronous multiplexer with limited modem control on all lines; operating speeds to 9600 bps		
DZV11-DP	DZV11 system option	900	11
DZV11-M	DZV11 upgrade option. Includes base module only; requires selection of external cables and appropriate cabinet kit	720	11
Synchronous Interfaces			
DEQNA	DECnet option that connects Q-Bus systems to DECnet Ethernet local area network (LAN); requires transceiver cables and H4000 transceiver or DELNI to connect to Ethernet		
DEQNA-KP	DEQNA system option	1,150	14
DEQNA-M	DEQNA upgrade option. Includes base module only; requires external cables and appropriate cabinet kit	1,000	14
DPV11	Single-line, program-controlled EIA/CCITT communications device; operating speeds to 56K bps		
DPV11-AP	DPV11 system option	770	13
DPV11-M	DPV11 upgrade option; requires an appropriate cabinet kit	550	13
DMV11	Intelligent microprocessor-based single-line synchronous interface; operating speeds to 56K bps		
DMV11-AP	DMV11 system option; RS-232-C/CCITT V.28 interface; requires external cable	2,200	39
DMV11-BP	DMV11 system option; CCITT V.35/DDS interface; includes cable for connection to modem	2,300	39
DMV11-CP	DMV11 system option; integral modem; requires external cable	2,000	39
DMV11-FP	DMV11 system option; RS-423-A/CCITT V.24 interface; requires external cable	2,300	39
DMV11-M	DMV11 upgrade option; RS-232-C or RS-423/RS-449 interface; includes base module only; requires selection of external cables and an appropriate cabinet kits	1,930	39
DMV11-N	DMV11 upgrade option; V.35 and integral modem interfaces; requires selection of external cables and an appropriate cabinet kit	1,560	39
KMV11	Single-line synchronous/asynchronous programmable EIA/CCITT communications interface		
KMV11-AA	Supports RS-232-C or CCITT V.28 operation at 19.2K bps; for use on PDP-11/23-Plus systems; external cable not included	2,500	28
KMV11-AE	Supports RS-449/RS-422-A or CCITT V.11 operation to 64K bps; for use on PDP-11/23-Plus systems; external cable not available from Digital	2,700	28
KMV11-AF	Supports RS-449/RS-423-A or CCITT V.10 operation to 19.2K bps; for use on PDP-11/23-Plus systems; external cable not available from Digital	2,500	28

UNIBUS COMMUNICATIONS OPTIONS

Communications options are available either as factory-installed system options or as field-installable upgrade options. System options include the module, internal cables, and I/O connection panel inserts. For upgrade options, the customer must order the base option module and a cabinet kit containing the unique cable, filter assembly, and bracket hardware required to install the option in a specific cabinet. Several cabinet kits can be available for a given option, because different CPU cabinets require cables of different lengths and mounting brackets of different sizes.

Single-Line Asynchronous Interfaces

DL11	DL11 single-line asynchronous interfaces provide local and remote intercommunication for Unibus systems and EIA/CCITT or 20 ma devices; operating speeds from 50 to 9600 bps		
DL11-AP	DL11 system option; EIA/CCITT serial line interface with modem control, jumper selectable options; compatible with Bell 100 and 200 series modems or their equivalents; cable included	1,170	8
DL11-HP	DL11 system option; 20 ma serial line interface and line frequency realtime clock; switch-selectable options; cable for terminal connection is included	990	7
DL11-DP	DL11 system option; EIA/CCITT RS-232-C serial line interface and line frequency realtime clock without modem control; includes cable	950	7
DL11-M	DL11 upgrade option; RS-232-C interface and modem control. Includes base module only; requires external cables and an appropriate cabinet kit	770	8
DL11-N	DL11 upgrade option; RS-232-C and 20 ma interfaces without modem control; includes base module only; requires external cables and an appropriate cabinet kit	760	7

NA—Not applicable.
NC—No charge.

DEC PDP-11 Family

		Purchase Price ($)	Monthly Maint. ($)
Multiline Interfaces			
DH11	16-line asynchronous DMA multiplexers for local or remote connection of Unibus PDP-11s to EIA/CCITT terminals operating speeds up to 9600 bps		
DH11-AP	DH11 system option; includes modem control; cables not included	8,950	68
DH11-DP	DH11 system option; does not include modem control; cables not included	7,950	57
DH11-M	DH11 upgrade option; RS-232-C interface with full modem control. Includes base module only; requires external cables and appropriate cabinet kit	7,240	68
DH11-N	DH11 upgrade option; RS-232-C interface without modem control. Includes base module only; requires external cables and appropriate cabinet kit	6,175	57
DHU11	Sixteen-line asynchronous multiplexer with direct memory access; connects Unibus systems to EIA/CCITT terminals; operating speeds up to 9600 bps		
DHU11-AP	DHU11 system option. Includes modem control; external cables not included	3,495	45
DZ11	Eight-line asynchronous multiplexer; connects Unibus system to maximum of eight EIA/CCITT or 20 ma terminals; operating speeds up to 9600 bps		
DZ11-DP	DZ11 system option; eight-line multiplexer for EIA/CCITT terminals; includes modem control; cables not included	2,175	33
DZ11-HP	DZ11 system option; eight-line multiplexer for 20 ma current loop terminal; cables not included	2,500	33
DZ11-M	DZ11 upgrade option; RS-232-C interface. Includes base module only; requires external cables and an appropriate cabinet kit	1,560	33
DZ11-N	DZ11 upgrade option; 20 ma interface. Includes base module only; requires external cables and an appropriate cabinet kit	1,635	33
Point-to-Point Interfaces			
DUP11	Single-line programmable synchronous interface between Unibus systems and systems with EIA RS-232-C/CCITT V.28 interface; operating speeds to 9600 bps		
DUP11-AP	DUP11 system option; interfaces to Bell 200 series modems or equivalents; external cable not included	1,575	12
DUP11-M	DUP11 upgrade option. Includes base module only; requires an appropriate cabinet kit	1,230	12
DMR11	DDCMP-based, microprocessor-controlled synchronous interface to connect Unibus systems to other systems with EIA/CCITT interfaces; oprating speeds up to 1MB/second		
DMR11-AP	DMR11 system option; interfaces to EIA RS-232-C synchronous modems (Bell 200 series-compatible) at speeds up to 19.2K bps; includes data set control; cable not included	4,400	39
DMR11-BP	DMR11 system option; interfaces CCITT V3.5/DDS synchronous modems (Bell 500al1/5 or equivalent) at speeds up to 1M bps; includes data set control and cable for modem connection	4,400	39
DMR11-CP	DMR11 system option; includes integral modem for local interconnection; cables not included	4,400	39
DMR11-EP	DMR11 system option; interfaces to EIA RS-422/CCITT V.24 synchronous modems; supports speeds up to 1MB/sec.; includes data set control for switched network operation; cable not included (not available through Digital)	4,400	39
DMR11-FP	DMR11 system option; interfaces to RS-423/CCITT V.24 synchronous modems at speeds to 56K bps; includes data set control; cables not included	4,400	39
DMR11-M	DMR11 upgrade option. Includes base module only; requires an external cable and an appropriate cabinet kit	4,110	39
KMS11-BD/BE	Programmable, eight-line synchronous interface; connects Unibus systems to systems with EIA/CCITT or MIL interfaces; operating speeds up to 56K bps; includes DD11-DK double system unit	12,500	97
KMS11-BE	Same as KMS11-BD, but does not include DD11-DK double system unit	12,200	97
KMS11-P	One-line, programmable, intelligent synchronous communications controller; connects Unibus systems and systems with EIA/CCITT interfaces; operating speeds up to 64K bps		
KMS1P-M	KMS11-P; inlcudes microprocessor unit and line unit modules; requires a cable kit	5,710	76
Multipoint Synchronous Interfaces			
DMP11	Single-line, microprocessor-controlled synchronous interface; connects Unibus systems to systems with EIA/CCITT interfaces; implements DDCMP; operating speeds to 1M bps		
DMP11-AP	DMP11 system option; interfaces to EIA RS-232-C synchronous modems (Bell series 200 compatible) at speeds up to 19.2K bps; includes data set control; cable not included	6,900	74
DMP11-BP	DMP11 system option; interfaces to CCITT V.35/DDS synchronous modems (Bell 500al1/5 or equivalent) at speeds up to 56K bps, includes data set control and cable for modem connection	6,900	74
DMP11-CP	DMP11 system option; includes integral modem for local interconnection; cable not included	6,900	74
DMP11-EP	DMP11 system option; interfaces to EIA RS-422/CCITT V.24 synchronous modems, supports up to 1M bps (HDX) or 500K bps (FDX); includes data set control for switched network operation; cable not included (not available through Digital)	6,900	74
DMP11-FP	DMP11 system option; interfaces to RS-423/CCITT V.24 synchronous modems at speeds to 56K bps; includes data set control; external cable not included	6,900	74
DMP11-M	DMP11 upgrade option. Includes base module only; requires external cable and an appropriate cabinet kit	6,450	74
DEUNA-AA	Synchronous communications controller; connects Unibus systems to a DECnet Ethernet LAN; operating speeds up to 10M bps	3,500	44

NA—Not applicable.
NC—No charge.

DEC PDP-11 Family

		Purchase Price ($)	Monthly Maint. ($)
STATISTICAL MULTIPLEXERS			
DFM Series	Standalone, intelligent communications processors (ICPs) supporting direct memory access, synchronous/asynchronous operation, optional integral modems (4800 and 9600 bps), and expansion from 4 to 16 lines		
DFM04-SA	DFM four-channel system option. Includes standalone statistical multiplexer/ data switch and cables	2,950	25
DFM04-SB	DFM four-channel system option. Includes standalone statistical multiplexer/ data switch, cables, and 4800 bps V.27 modem card	4,800	35
DFM04-SC	DFM four-channel system option. Includes standalone statistical multiplexer/ data switch, cables, and 9600 bps V.29 modem card	5,800	35
DFM04-AA	DFM four-channel upgrade option. Includes standalone statistical multiplexer only	2,675	25
DFM04-AB	DFM four-channel upgrade option. Includes standalone statistical multiplexer and 4800 bps V.27 modem card	4,525	35
DFM04-AC	DFM four-channel upgrade option. Includes standalone statistical multiplexer and 9600 bps V.29 modem card	5,525	35
DFM08-SA	DFM eight-channel system option. Includes standalone statistical multiplexer/ data switch and cables	3,875	30
DFM08-SB	DFM eight-channel system option. Includes standalone statistical multiplexer/ data switch, cables, and 4800 bps V.27 modem card	5,725	40
DFM08-SC	DFM eight-channel system option. Includes standalone statistical multiplexer/ data switch, cables, and 9600 bps V.29 modem card	6,725	40
DFM08-AA	DFM eight-channel upgrade option. Includes standalone statistical multiplexer only	3,350	30
DFM08-AB	DFM eight-channel upgrade option. Includes standalone statistical multiplexer and 4800 bps V.27 modem card	5,200	40
DFM08-AC	DFM eight-channel upgrade option. Includes standalone statistical multiplexer and 9600 bps V.29 modem card	6,200	40
DFM12-SA	DFM 12-channel system option. Includes standalone statistical multiplexer/ data switch and cables	4,850	35
DFM12-SB	DFM 12-channel system option. Includes standalone statistical multiplexer/ data switch, cables, and 4800 bps V.27 modem card	6,700	45
DFM12-SC	DFM 12-channel system option. Includes standalone statistical multiplexer/ data switch, cables, and 9600 bps V.29 modem card	7,700	45
DFM12-AA	DFM 12-channel upgrade option. Includes standalone statistical multiplexer only	4,075	35
DFM12-AB	DFM 12-channel upgrade option. Includes standalone statistical multiplexer and 4800 bps V.27 modem card	5,925	45
DFM12-AC	DFM 12-channel upgrade option. Includes standalone statistical multiplexer and 9600 bps V.29 modem card	6,925	45
DFM16-SA	DFM 16-channel system option. Includes standalone statistical multiplexer/ data switch and cables	5,825	40
DFM16-SB	DFM 16-channel system option. Includes standalone statistical multiplexer/ data switch, cables, and 4800 bps V.27 modem card	7,675	50
DFM16-SC	DFM 16-channel system option. Includes standalone statistical multiplexer/ data switch, cables, and 9600 bps V.29 modem card	8,675	50
DFM16-AA	DFM 16-channel upgrade option. Includes standalone statistical multiplexer only	4,800	40
DFM16-AB	DFM 16-channel upgrade option. Includes standalone statistical multiplexer and 4800 bps V.27 modem card	6,650	50
DFM16-AC	DFM 16-channel upgrade option. Includes standalone statistical multiplexer and 9600 bps V.29 modem card	7,650	50
MULTIPOINT PARALLEL INTERFACE			
PCL11-B	Parallel communications link that connects up to 16 processors in a local distributed processing network; operating speeds up to 1MB/sec.	9,300	73
ETHERNET COMMUNICATIONS OPTIONS			
H4000	H4000 Ethernet transceiver; provides functional interface between Ethernet coaxial cable and Ethernet station	300	4
DELNI-AA	Local Area Network Interconnect (LNI)	995	10
DEREP-AA	Local Ethernet repeater; connects two coaxial cable segments no more than 328 feet (100 meters) apart	1,500	21
DEREP-RA	Remote Ethernet repeater (fiber optic); connects two coaxial cable segments up to 3,280 feet (1,000 meters) apart	4,400	42
DECSA-EA	One-line DECnet router server; includes one DCSAX-LA line card	13,500	145
DECSA-CA	DECnet router server unit and eight DCSAX-LC line cards	14,000	191
DECSA-DA	DECnet router server unit and 16 DCSAX-LC cards	20,000	337
DCSAX-UA	Upgrade kit	4,750	90
DCSAX-LA	One-line synchronous EIA RS-232-C/CCITT V.24 line card for speeds up to 19.2K bps full-duplex	415	10
DCSAX-LB	One-line synchronous CCITT V.35 line card for speeds up to 500K bps full duplex	650	10
DCSAX-LC	Two-line asynchronous EIA RS-232-C/CCITT line card for speeds up to 19.2K bps full-duplex	375	7
DECSK-AA	U.S. country kit for DECnet/SNA gateway (required); includes power cord, hardware documentation, and labels	25	NC

NA—Not applicable.
NC—No charge

DEC PDP-11 Family

		Purchase Price ($)	Monthly Maint. ($)
ETHERNET COMMUNICATIONS OPTIONS (Continued)			
DECOM-AA	Dual-cable U.S. broadband Ethernet transceiver	4,250	Contact DEC
DECOM-BA	Single-cable U.S. broadband Ethernet transceiver	4,250	Contact DEC
DEFTR-AA	U.S. broadband Ethernet frequency translator	4,500	Contact DEC
REALTIME I/O OPTIONS			

I/O options are available either as factory-installed system options or as field-installable upgrade options. System options include the module, internal cables, and I/O connection panel inserts. For upgrade options, the customer must order the base option module and a cabinet kit containing the unique cable, filter assembly, and bracket hardware required to install the option in a specific cabinet. Several cabinet kits can be available for a given option, because different CPU cabinets require cables of different lengths and mounting brackets of different sizes.

Q-Bus Digital I/O Options			
DRV11-LP	System option; general purpose program-controlled parallel line interface unit; permits program-controlled data transfers at rates up to 40K words per second; cables not inlcuded	370	6
DRV11	Upgrade option; includes only base option module; requires appropriate cabinet kit	300	6
DRV11-BP	System option; general purpose direct memory access (DMA) parallel line interface unit; permits data transfers at rates up to 250K words per second in single cycle mode and up to 500K words per second in burst mode; cables not included	740	9
DRV11-B	Upgrade option; includes only base option module; requires an appropriate cabinet kit	670	9
DRV11-JP	System option; general purpose program controlled parallel line interface; contains 64 bidirectional input/output lines configured as four 16-bit ports; bit interruptible up to 16 lines; interrupt vectors may have fixed or rotating priorities; cables not included	520	9
DRV11-J	Upgrade option; includes only base option module. Requires an appropriate cabinet kit	450	9
Unibus Digital I/O Options			
DR11-CP	General purpose digital interface; permits bidirectional 16-bit parallel transfers between the user's device and the Unibus; includes all necessary interrupt, address, and control signals and all required cable connectors; cable for connection to user's device is not included	640	8
DR11-C	Upgrade option; includes only DR11 base option module	340	8
DR11-WP	System option; general-purpose direct memory access (DMA) controller which interfaces user devices to the PDP-11 Unibus; transfers up to 64K 16-bit words at 500,000 words per second	1,650	13
DR11-W	Upgrade option; includes only the DR11 base option module	1,350	13
DR11-WC	Long-line version of DR11-W general purpose interface; provides for cable interconnection up to 1,000 feet; includes DR11-W plus differential adapter module, interconnect cables, test connectors for the adapter module, and an FCC-compliant I/O panel	3,295	40
DR11-WD	Long-line upgrade kit for DR11-W; includes all items in DR11-WC except DR11-W interface module	1,795	23
DRS11/DSS11	Digital I/O devices. DSS11 input module provides 48 optically isolated inputs with one interrupt input. DRS11 output module provides 48 buffered outputs with one interrupt. Unibus systems support up to 16 in any combination		
DRS11-A	Digital output device (TTL); includes one RC filtered interrupt input and two 19.6-ft. flat ribbon cables	2,145	22
DRS11-B	Digital output device with open collector drives; includes one RC filtered interrupt input and two 19.6-ft. flat ribbon cables	2,365	22
DRS11-MP	Optically isolated DC drivers with open collectors; DRS11-B required	1,000	17
DSS11-A	Digital input device (TTL); includes two 19.6-ft. ribbon cables	2,670	20
DSS11-B	Digital input device; includes two 19.6-ft. ribbon cables	2,890	20
DSS11-MP	Contact sense input; requires DSS11-A	1,400	14
General-Purpose Unibus Interface			
DRU11-C	Interfaces Unibus-based CPUs to instruments and other devices; transfer speeds up to 500 KW/sec. continuous		
DRU11-CC	Alternate buffer interface with TTL drives; allows interface up to 49.2 ft. (15 m) from processor	2,595	25
DRU11-CD	Alternate buffer interface with differential drivers; allows interface up to 984 ft. (300 m) from processor. Includes DRU11-CC with signal conditioning module	3,635	39
Realtime Clocks			
KW11-P	Unibus programmable realtime clock	880	10
KWV11-C	Q-Bus 16-bit programmable realtime clock	895	20

NA—Not applicable.
NC—No charge

DEC PDP-11 Family

SOFTWARE PRICES

		License Fee* ($)
OPERATING SYSTEMS		
QJ821-UZ	DSM-11	3,000
QJB51-UZ	Micro/RSX	**800
QR430-UZ	RSTS/E	3,000
QR500-UZ	RSX-11M-Plus	3,000
QJ642-UZ	RSX-11S	1,000
QJ085-UZ	Ultrix-11; for 16 users on MicroPDP-11 systems only	800
QJ087-UZ	Ultrix-11; maximum 16 users	1,500
QJ088-UZ	Ultrix-11; maximum 32 users	2,000
LANGUAGES		
QJ916-UZ	Basic-Plus-2 for RSTS/E	3,000
QY809-UZ	Basic-Plus-2 for Micro/RSTS	1,200
QJ918-UZ	Basic-Plus-2 for RSX-11M/-11M-Plus	3,000
QY805-UZ	Basic-Plus-2 for Micro/RSX	1,200
QJ913-UZ	Basic/RT-11	590
QJ993-UZ	Cobol-81 for RSTS/E	3,000
QJ994-UZ	Cobol-81 for RSX-11M/-11M-Plus	3,000
QY802-UZ	Cobol-81 for Micro/RSX	1,200
QP066-UZ	Cobol-66 for RSX-11M only	4,050
QP528-UZ	Dibol-83 for RSTS/E	3,000
QP540-UZ	Dibol-83 for RSX-11M/-11M/Plus	3,000
QY807-UZ	Dibol-83 for Micro/RSX	1,200
QJ813-UZ	Fortran-IV for RT-11	640
QR435-UZ	Fortran-IV for RSTS/E	700
QP230-UZ	Fortran-IV for RSX-11M/-11M-Plus	700
QR100-UZ	Fortran-77 for RSTS/E	3,000
QY810-UZ	Fortran-77 for Micro/RSTS	1,200
QJ668-UZ	Fortran-77 for RSX-11M/-11M-Plus	3,000
QY803-UZ	Fortran-77 for Micro/RSX	1,200
QY811-UZ	Fortran-77 Debug for Micro/RSTS	300
QJ128-UZ	Pascal/RSX for RSX-11M/-11M-Plus	3,000
QY806-UZ	Pascal/RSX for Micro/RSX	1,200
APPLICATIONS		
QP300-UZ	Datatrieve-11 for RSTS/E	3,000
QY300-UZ	Datatrieve-11 for Micro/RSTS	1,200
QP301-UZ	Datatrieve-11 for RSX-11M/-11M-Plus	3,000
QY301-UZ	Datatrieve-11 for RSX-11M/-11M-Plus	1,200
QR038-UZ	DECtype for RSX-11M-Plus	900
QJ038-UZ	DECtype for CTS-300	900
QY038-UZ	DECtype for Micro/RSX	595
QR480-UZ	DECword/DP for RSTS/E	4,500
QJ713-UZ	FMS-11 for RT-11	1,240
QJ716-UZ	FMS-11 for RSTS/E	1,240
QJ715-UZ	FMS-11 for RSX-11M/-11M-Plus	1,240
QP602-UZ	PDP-11 Sort/Merge for RSX-11M/-11M-Plus	410
QP029-UZ	Micro Power/Pascal-RSX for RSX-11M/-11M-Plus	1,500

**Single-use license and warranty.*
***PDP-11 Operating System General License; includes license, warranty, and one-time right to copy.* ■