

DEC Datasystem D500, SM, and SN Series

MANAGEMENT SUMMARY

The DEC Datasystem product line includes a wide range of components offering an equally broad range of capabilities. In order to simplify the task for a user or systems house, DEC has configured a number of systems comprising a processor, operating system, debug tools and utility software, with hardware options and peripherals. Each of these systems is available in several packages that differ in main memory and in type and capacity of disk storage. These basic systems can be expanded through the addition of main memory, additional disk storage units and a variety of peripheral and communications equipment.

The medium to large scale PDP-11 systems covered here include the PDP-11/34A, 11/44, and 11/70 processors in conjunction with the CTS-500, RSX-11M, and RSX-11M-PLUS operating systems. The smaller PDP-11 Datasystems running under CTS-300 are covered in Report M11-385-201.

The Datasystems are designed primarily for sale either to sophisticated end-users or to Digital's Commercial OEMs. A primary characteristic of both of these markets is the ability for the users to develop their own applications software, thus reducing the amount of hand-holding support needed directly from DEC.

The DEC Datasystems are not turnkey systems dedicated to specific problem solutions with pre-programmed applications. Rather, applications programs must either be

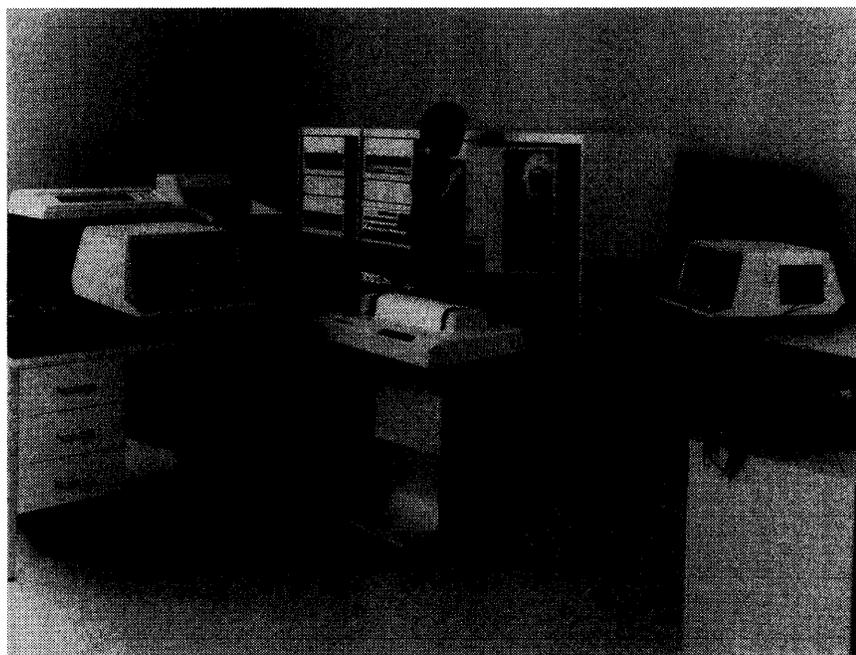
The combination of three DEC processors and three multi-user operating systems comprise the Datasystem product line for growth-oriented users. The PDP-11/34A, 11/44, and 11/70 processors team up with the CTS-500, RSX-11M, and RSX-11M-PLUS operating system to provide an impressive range of system capabilities.

MAIN MEMORY: 128K to 4096K bytes
DISK CAPACITY: 10 megabytes to 2048 megabytes
WORKSTATIONS: up to 127
PRINTERS: to 900 lpm
OTHER I/O: Magnetic tape

CHARACTERISTICS

MANUFACTURER: Digital Equipment Corporation, Commercial Products Group, Continental Boulevard, Merrimack, New Hampshire 03054. Telephone (603) 884-5111.

Digital Equipment Corporation (DEC) is the world's largest manufacturer of minicomputer systems. DEC's product lines include general-purpose computing systems, laboratory monitoring and control systems, process control systems, industrial control systems, editing and typesetting systems, and business computing systems. DEC maintains 200 sales and service offices in over 35 countries and has manufacturing facilities in Puerto Rico, Canada, Ireland, Scotland, Hong Kong, and Taiwan in addition to 17 facilities in the U.S. The company employs 55,000 persons worldwide and has installed more than 235,000 computer systems.



Utilizing the PDP-11/34, 11/44, or 11/70 processor, the DEC Datasystem family supports a maximum of 127 terminals, 4096K bytes of memory, and up to 2 billion bytes of disk storage. The configuration shown includes a 176-megabyte disk drive, a VT100 terminal, a 300-lpm printer, a 1600-bpi magnetic tape transport, and a DECwriter hard-copy terminal.

DEC Datasystem D500, SM, and SN Series

MODEL AVAILABILITY SUMMARY

Operating System	CTS-500*			RSX-11M			RSX-11M-PLUS	
Model Series	D530	D540	D570	SM30	SM40	SM70	SN40	SN70
Processor	PDP-11/34A	PDP-11/44	PDP-11/70	PDP-11/34A	PDP-11/44	PDP-11/70	PDP-11/44	PDP-11/70
Date Announced	11/76	11/79	2/75	—	11/79	—	11/79	5/79
Date of First Delivery	4/77	5/80	9/75	—	—	—	—	11/79

*CTS-500 is an adaption of DEC's RSTS/E time-sharing system.

➤ developed directly by the end user or prepared for him by a commercial OEM.

The basic marketing strategy for DEC's Datasystem line is to promote the systems as alternatives to centralized computer facilities in large or geographically dispersed companies that have remote sites with either localized time-sharing requirements, numerous small-to-medium-scale data bases, or medium-scale batch processing requirements. A medium to large scale PDP-11 Datasystem can be considered a centralized computing facility on its own merit for medium-sized companies or for divisions of large companies, while at the same time maintaining contact with other systems in a network.

The flexibility and capacities of the Datasystem configurations are quite impressive. The PDP 11/70 supports 127 terminals, 2048 megabytes of disk storage plus magnetic tape systems and line printers. A detailed description of the entire PDP-11 family, the backbone of the small and medium-sized Datasystems, is contained in Report M11-384-301.

To continue to increase the flexibility of the Datasystem product line, DEC has recently announced new products for the extreme ends of the mass storage spectrum. A new disk, the RMO5, has a 45 percent increase in capacity over the previous top of the line, the RPO6. The new 300 megabyte disk (256 megabytes formatted) is a free-standing unit to allow quick and easy integration. The integral controller will support up to eight drives for a total capacity of 2048 megabytes of storage. The RMO5 is also available as an add-on drive compatible with existing MASSBUS systems.

At the lower end of the storage scale, DEC has announced the TU58 DECTape II cartridge drive with a quarter-megabyte capacity per cartridge or a half-megabyte capacity per system. The TU58 can be used as an entry-level storage device or as an inexpensive backup unit. The cartridge disk system is available in a rack mount or a tabletop configuration and can be located up to 25 feet away from its associated computer.

Two new hardcopy terminals were also announced by DEC. The new DECprinter III is a receive-only version of the LA120 DECwriter III. It is bidirectional with logic to move the print head to the closest margin after a line is completed and to skip over "white space" (areas not requiring printing). The DECprinter III has a 7 x 7 dot matrix and will accept data at rates up to 9600 baud. ➤

➤ **VENDORS:** Manufacturer and OEM suppliers. Contact DEC's Commercial Products Group to find the OEM supplier in your locale.

MODELS: See Model Availability Summary.

DATE ANNOUNCED: See Model Availability Summary.

DATE ANNOUNCED: See Model Availability Summary.

DATE OF FIRST DELIVERY: See Model Availability Summary.

NUMBER INSTALLED TO DATE: Information not available.

DATA FORMATS

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

FIXED-POINT OPERANDS: 16-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: Optional floating-point processor provides either 32-bit single-precision operands with an 8-bit exponent and signed 24-bit fraction or 64-bit double-precision operands with an 8-bit exponent and signed 56-bit fraction. The hardware includes a dedicated set of six 64-bit accumulators. Floating point software sub-routines are available.

INSTRUCTIONS: PDP-11 instructions are 16 bits long. Program counter addressing adds 16 bits to the instruction length. Common formats occur in instructions of the single operand group, the double operand group, branch group, subroutine return, and condition code operators group. Operation codes vary from 4 bits to 16 bits in length.

INTERNAL CODE: ASCII.

MAIN STORAGE

STORAGE TYPE: Dynamic MOS and/or core for 11/34A-based system; ECC MOS for 11/44-based systems; ECC MOS and/or core for 11/70-based systems.

CYCLE TIME: 510 or 700 nanoseconds per 2-byte word for dynamic MOS versions of the PDP-11/34A, 1000 nanoseconds per word for core-based PDP-11/34A systems; 480 nanoseconds per word for 11/44 ECC MOS systems; and 700 nanoseconds for ECC MOS 11/70 systems, 1200 nanoseconds for core memory on the 11/70. All 11/70s with more than the minimum memory use interleaving to increase memory accessibility.

CAPACITY: 128K to 256K bytes for 11/34-based systems; 256K to 1024K bytes for 11/44-based systems; 256K to 4096K bytes for 11/70-based systems. The upper 8K bytes of ➤

DEC Datasystem D500, SM, and SN Series

PERIPHERALS/TERMINALS

Device	Description
Magnetic Tape	
TJE16/TWE16	Subsystem; 9-track; 45 ips; 800/1600 bpi
TS11	Subsystem; 9-track; 45 ips; 1600 bpi
TJU77/TWU77	Subsystem; 9-track; 125 ips; 800/1600 bpi
TU58	Cartridge Tape System; .5 megabytes total; 150-34,800 baud
Printers	
LA11-PA	Serial impact; 7 x 7 dot matrix; 132 positions, 96-character set; 180 cps
LP11-WA	Drum; 132 positions; 96-character set; 10 characters per inch; 240 lpm
LP11-VA	Same as LP-WA except 64-character set; 300 lpm
LP11-CA	Drum; 132 positions; 64-character set, 10 characters per inch; 900 lpm
LP-AA	Drum; 132 positions; 64-character set; 10 characters per inch; 285 lpm; 12-channel VFU
LP11-BA	Drum; 132 positions; 64- and 96-character set; 285 and 204 lpm
Terminals	
LA34-AA	DECwriter IV; 30 cps; 9 x 7 dot matrix; adjustable character width; 7 character sets, superscripts and subscripts
LA38-GA/HA	Tabletop or freestanding DECwriter IV printing terminal; 18 button numeric keypad; 30 cps; 300 cps; 4 character sizes
LA120-DA	EIA version, high-speed, interactive, hardcopy terminal, 7 x 7 dot matrix, 180 cps, 50 to 9600 bps
LA180	DECprinter I hardcopy, receive-only terminal; EIA/CCITT interface; 180 cps
VT55	Graphic display; alphanumeric CRT, printer/plotter; integral hardcopy device; 24 lines of 80 characters; full- or half-duplex; 75 to 9600 bps
VT100	Alphanumeric video display terminal; 24 lines of 80 characters or 14 lines of 132 characters; detached keyboard; scrolling; reverse video, or underlining.

▷ The LA 34-AA is a new member of the DECwriter IV family. It is a 30 character-per-second terminal the approximate size and shape of an office typewriter. It prints characters from a 9 x 7 dot matrix and has a 160-character buffer. It has adjustable character sizes from 5 to 16.5 characters per inch, prints seven national character-sets in addition to the standard United States set (Great Britain, Finland, Sweden, Norway/Denmark, Germany, France, and French Canadian), and, when operated in the roll and sheet-feed modes, prints superscripts and subscripts. The LA34-AA incorporates a keyboard selectable local echo, parity, and last-character-visible features, and form length can be selected from one line to 84-inch lengths.

A new printer port option for the VT100 series of video terminals enables hardcopy printers including the DECprinter III and DECwriter IV to be attached. With the new option, on command, either locally or from the host computer, the contents of the screen being displayed will be printed out. Also, the option will permit line-by-line printing (locally or from the host), automatically. Commands from the host also involve printing of individual lines or "printer controller mode," where data is printed out directly without appearing on the screen. Called the VTIXX-AC, the printer port option is field-installable, enabling users of VT100-series terminals to upgrade at the system site.

Users can intermix terminals on the Datasystems as each terminal transmits an identifying code that enables the software to adapt to its specified characteristics. Details of the available Datasystems peripherals and terminals can be found in the chart on page M11-385-403.

The hardware configurations are flexible enough to meet the needs of most users. The choice of operating systems ▷

► memory are reserved for I/O functions and registers on all models.

CHECKING: A parity bit is standard with each byte. Error checking and correction (ECC) corrects all 1-bit errors and detects all double-bit errors, and most multi-bit errors. The process or memory mapping automatically protects storage.

RESERVED STORAGE: The uppermost 8K bytes are reserved for I/O registers. All PDP-11 processors reserve at most 511 locations at the low end of memory for interrupt vectors, trap vectors, and floating vectors.

CACHE MEMORY: The optional cache memory on the 11/34A has a 150-nanosecond cycle time; on the 11/44, 215 nanoseconds; on the 11/70, 240 nanoseconds.

CENTRAL PROCESSORS

See text and processor characteristics charts in Report M11-384-301 for details on the PDP-11/34A, and 11/44 and 11/70 processors.

REGISTERS: PDP-11/34A systems have eight user-accessible 16-bit registers (six general-purpose, one stack pointer, and one program counter). The general-purpose registers can be used as index registers, hardware stack pointers, accumulators, or autoincrement/autodecrement registers. The 11/44 has 10 general purpose registers which can be used as accumulators, index registers, or as stack pointers. Three general registers are used as the processor stack pointers and one is used as the program counter. The 11/70 has 16 user-accessible 16-bit registers and a 16-bit processor status register. The 16 registers are arranged as two sets of six general-purpose registers, three stack pointers, and a program counter.

ADDRESSING: Eight address modes are provided: 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 operand ►

DEC Datasystem D500, SM, and SN Series

dictates the strengths, weakness, and flexibility of the system as a whole. The salient characteristics of each of the operating systems are summarized below:

The Commercial Transaction System (CTS-500): A general-purpose, timesharing, multi-language system whose features facilitate ease of use and do not require a high level of technical expertise for programming. CTS-500 also provides upward growth from CTS-300. It is designed for business applications requiring large numbers of terminals with concurrent program development, interactive and batch processing, and transaction processing. CTS-500 also offers data management services (RMS-11) to meet specific requirements of on-line access to data stored for interactive data processing applications, allowing indexed random, indexed sequential, and relative access file structures. DEC-FORM is a group of utility programs designed for screen formatting, data entry, and file review operations, and is compatible with the CTS-300 version.

In addition, CTS-500 provides concurrent batch processing with on-line transaction processing, on-line program development, file maintenance utilities, and "Big Block Send and Receive," which allows 256 words (512 bytes) of data to be transmitted from one program to another. The idea here is to allow specific routines to be shared by other programs. For example, no matter how many jobs are running, the user may need only one disk accessing routine and one screen formatting routine. The other user programs can send data to those routines and receive responses, thus eliminating the need for every job to have its own disk accessing software. A better term might be "software resource sharing."

RSX-11M: This system is designed for dedicated application environments where application "tunability" is important. Developing an application under RSX-11M may take more time and skill than under CTS-500. Both CTS-500 and RSX-11M allow upward growth to VAX-11 systems.

RSX-11M is a real-time, event-driven, disk-based system. It can be generated as either a mapped or unmapped system. Memory is divided into partitions in which tasks can be loaded under either user or system control. Task checkpointing allows tasks to be displaced to enable a higher priority non-resident task to execute. RSX-11M requires a minimum of 64K bytes of main memory and one hard disk, plus one other disk (which can be a floppy) or a tape unit as a backup device.

The RSX-11M file system provides space allocation and file structures for all block-structured devices. Features include sequential, random, and relative file organizations, and file protection.

RSX-11M-PLUS: This disk-based, priority structured, event driven operating system is designed to maximize performance on 11/70 systems and to provide upward

address consists of three bits to specify address mode and three bits to specify the register used to calculate the address.

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. All PDP-11 based Datasystem processors have the same basic instruction set, with the large processors having larger sets. 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 condition code operators group. Operation codes vary from 4 bits to 16 bits in length.

INSTRUCTION TIMINGS: Please refer to the Instruction Times chart in Report M11-384-301 for details.

INTERRUPTS: Four-level automatic priority interrupt system, plus seven additional software-supported levels of interrupts for all models. Each of the interrupt levels can attach multiple, independently prioritized peripheral devices.

PHYSICAL SPECIFICATIONS: All Datasystems are generally 21 inches wide, 60 or 42 inches high, and 30 inches deep. The 11/34A-based system weighs 330 pounds, and the 11/70-based systems weigh 660 pounds. All systems require 115 VAC, 60 Hz (or 230 VAC, 50 Hz) power with a voltage tolerance of +10 percent. The operating temperature range for all Datasystems is 65 to 75 degrees Fahrenheit.

INPUT/OUTPUT CONTROL

UNIBUS: All PDP-11 based Datasystems have a single, common data path Unibus that treats all components or modules of a system as equal-level devices for data access/transfers, including the processor, memory modules, and peripherals. The priority of any device connected to the busses is determined by its physical position, and the processor is normally attached so that it has the highest priority.

There is no logical limit to the number of device attachments that can be made to the Unibus, with the bus access and control handled by the interrupt system. The maximum Unibus data transfer rate is 2.5 million words/second, and it always operates in a master/slave manner.

32-BIT BUS: In addition to a standard Unibus, a special expanded-capability bus has been added to the PDP-11/70. This bus is not accessible to normal programming needs such as loading registers, etc., but only to DMA transfers between cache memory and mass storage peripherals. Only special high-speed controllers interface this special bus, which handles four eight-bit bytes per transfer.

CONFIGURATION RULES

For a detailed explanation of the PDP-11 configuration guidelines, please refer to Report M11-384-301.

Maximum configuration parameters for the medium scale Datasystems are as follows:

- Up to 4096K bytes of main memory.
- Up to 2048 megabytes of on-line disk storage.
- Up to 127 terminals.
- Up to 8 magnetic tape drives.
- Up to 8 line printers.

DEC Datasystem D500, SM, and SN Series

DISK STORAGE CHART

OPERATING SYSTEM	CTS-500	RSX-11M	RSX-11M-PLUS
DISK MODEL (CAPACITY)			
2 RLO1 (10.4 mb)	11/34A	11/34A	—
2 RLO2 (20.8 mb)	11/34A; 11/44	11/34A	—
2 RK07 (56.0 mb)	11/34A; 11/44	11/34A; 11/44	—
1 RMO2 (67.0 mb)	11/34A; 11/44	11/34A; 11/44	11/44
1 RMO3 (67.0 mb)	11/70	11/70	11/70
1 RPO6 (176 mb)	11/34A; 11/70	11/70	11/70
1 RMO5 (300 mb)	11/70	11/70	11/70

➤ growth from RSX-11M. The system includes such features as overlapped disk seeks, two new spooling utilities, CPU usage accounting, and re-entrant task support. The overlapped disk seek feature enables I/O intensive applications to improve by as much as 30 percent in throughput. Re-entrant task support makes more efficient use of main memory. Another new feature called a "shadowed disk" stores data on more than 1 disk at a time. This aids in increasing system uptime for those applications requiring extra reliability.

As for programming languages, DEC offers BASIC-PLUS II, COBOL, and a Macro Assembler for use under all of the Datasystem operating systems; FORTRAN IV and RPG II for use under CTS-500 or RSX-11M, and 11M-PLUS; and APL and DIBOL for use under CTS-500 only. DEC's version of RPG II is said to be closely compatible with IBM's System/3 Model 10 RPG at the source level. In addition, DEC's RPG II offers some additional features, such as the support of terminals as I/O devices.

Communications software products include IBM HASP, 3780, and 3271 emulators and the extensive DECnet communications network software.

For data base users, DEC offers DBMS-11, a data base management software system based on Cullinane Corporation's IDMS. This makes two powerful data base management systems available for PDP-11 systems, since Cincom Systems has developed a version of its popular TOTAL system for use on PDP-11's. DEC chose to go with the Cullinane system because it conforms to CODASYL recommendations. DBMS-11 is available with the RSX-11M operating system.

DATATRIEVE, a query, report, and data maintenance RMS-11 system, has been recently enhanced to handle variable length records and cross-file views. This system is now considered to be one of the most powerful query languages available.

INDENT, a data entry and forms management product for DIBOL, COBOL, or BASIC-PLUS-2 users under CTS-500, has recently been introduced for DEC users.

A substantial library of user-generated, but not DEC-supported, software is available from three groups within DEC. DECUS, the DEC USers Society, offers a catalog of software packages that includes languages, editors, ➤

➤ **WORKSTATIONS:** A maximum of 127 terminals are supported on an 11/70 running under CTS-500; 16 terminals by RSX-11M; and 32 terminals by RSX-11M-Plus. The terminals attach to the UNIBUS by either a single line asynchronous interface or an asynchronous multiplexer.

DISK STORAGE: The Datasystem medium to large scale systems support a wide range of disk storage media. The capacities vary with the processor model and operating system. The basic system configurations are outlined in the Disk Storage Chart on page M11-385-405. The RX02 floppy disk subsystem, consisting of a controller and two drives, is also available for the Datasystem series. Each drive has a capacity of 512K bytes for a capacity of 1024K bytes per subsystem.

MAGNETIC TAPE UNITS: The Datasystems make extensive use of magnetic tape units as backup devices for disk storage. Three variations of the 9-track, 45 ips, 800/1600 bpi configuration are available. A 9-track, 125 ips, 800/1600 bpi unit is also available. A DECTape II cartridge drive is available in rack-mountable or tabletop versions with .25 megabytes per cartridge or .5 megabytes per system. Data transfers are jumper selectable from 150 to 34,800 baud with a high speed search providing a 9-second average access time and a 30-second maximum access time. The TU58 cartridge system is supported by CTS-500, RSX-11M, and RSX-11M-PLUS. A microprocessor is incorporated into the system to perform tape housekeeping chores and to simplify communications protocols.

LINE PRINTERS: The number of line printers supported per system is dependent upon resource limitations. A broad line of printers is available with speeds ranging from 204 to 900 lines per minute.

MASS STORAGE

RX02 FLOPPY DISK: A floppy disk subsystem consisting of a controller and two drives. Each drive has a capacity of 512K bytes, for a capacity of 1024K bytes per subsystem. Data is recorded on 77 tracks on one side of the diskette. Each track is formatted into 26 sectors of 128 bytes each. Head movement time is 10 milliseconds per track plus 20 milliseconds head setting time. Rotational speed is 360 rpm, giving an average rotational delay of 83 milliseconds. Average access time is 357 milliseconds. The data transfer rate is 61,000 bytes per second. Track capacity is 3328 bytes, and the total capacity of one diskette is 256,256 bytes. The subsystem is manufactured by DEC.

RL01 5.2-MEGABYTE CARTRIDGE DISK DRIVE: This is a top-loading drive employing a removable cartridge. Features provided in the RL01 include an embedded servo, allowing control information to be dispersed on each data track for data integrity. Disk rotational speed is 2400 rpm, and average rotational delay is 12.5 milliseconds. Average head positioning time is 55 milliseconds. Data transfer rate is 512K bytes per second. The drive is manufactured by DEC. All subsystems include a controller for up to 4 drives. ➤

DEC Datasystem D500, SM, and SN Series

➤ numerical functions, utilities, display routines, and various other types of applications software. Also, the Educational Products Group publishes the Index and Description of Educational Applicational Software (IDEAS), which lists software packages developed by users specifically for educational purposes. Some of the programs listed in the IDEAS catalog are from the DECUS catalog. Users can obtain copies of these programs on various media for a nominal charge by contacting either of these organizations. Finally, the Datasystems are covered in the AIP (Applications Interchange Program) catalog distributed by the Commercial Products Group. These are not customized software solutions but rather a directory of industry oriented applications. Contact your local sales office for information.

Although DEC sells most of its products on a purchase basis, leasing arrangements are available either through DEC's joint venture with U.S. Leasing Corp. or through TEC Leasing Corp. of New York. Lease rates vary with the prime interest rate, the buyer's volume of business with DEC, and the value of the equipment being leased. DEC software is not sold; rather, it is licensed. Users purchase licenses and distribution rights separately.

Hardware and software maintenance are offered through several levels of optional service. Hardware maintenance options vary from several off-site plans to on-call service and guaranteed four-hour service. Software maintenance is offered through several levels of optional service ranging from a periodic software newsletter to automatic updates of software and manuals via a subscription service.

Probably the greatest strength of the Datasystem family is its growth potential. DEC isn't giving its users a reason for switching to a competitor because of software limitations. And with a top end of 4 million bytes of memory, 2 billion bytes of disk storage, and 127 terminals, there should be little justification for switching because of insufficient hardware capabilities.

USER REACTION

Unfortunately, only 1 user of a medium to large-scale PDP-11 based Datasystem responded to our 1980 User Survey, making it impossible to extrapolate any trends to present here. As it is not DEC's policy to provide user references, we were unable to do any personal interviews. The results of our 1980 User Survey, however, do cover the bulk of the PDP-11 processors used in the Datasystems. A review of those responses will reinforce the general impression of quality and reliability that pervade the PDP-11 reputation. □

➤ **RL02 10.4-MEGABYTE CARTRIDGE DISK DRIVE:** A dual-density version of the RL01, announced in November 1979.

RK07 28-MEGABYTE CARTRIDGE DISK DRIVE: This drive accepts a top-loading, dual-platter disk cartridge em-

ploying a technology similar to that of the IBM 3330 through the use of a track-following servo system. With this system, the bottom surface of one platter is dedicated to servo control and tracking information. Disk rotational speed is 2400 rpm, and average rotational delay is 12.5 microseconds. The data transfer rate is 538K bytes per second (3.72 microseconds per 16-bit word). Average access time is 49 milliseconds.

RK07 packaged products include the RK711-EA subsystem for the Unibus PDP-11 and the RK711-PA for the PDP-11/44. Both subsystems consist of one drive and a controller for up to eight drives. The RK07 drives are manufactured by DEC.

RM02 67-MEGABYTE DISK PACK DRIVE: This drive, like other disk pack drives offered by DEC for the PDP-11, employs a technology similar to that of the IBM 3330 through the use of a track-following servo system. In this system, one disk surface of each pack is dedicated to servo control and tracking information. The pack contains five platters, with the top and bottom platters employed for protection. Data is recorded on five surfaces. The drives rotate at 2400 rpm, resulting in an average rotational delay of 12.5 milliseconds. Average head positioning time is 30 milliseconds, and data transfer rate is 806K bytes per second. All subsystems include a controller for up to 8 drives.

RM03 67-MEGABYTE DISK PACK DRIVE: This drive is functionally similar to the RM02 drive. Recording is on five surfaces at 6038 bits per inch and 384 tracks per inch. Data is recorded at 512 bytes per sector and 823 tracks per surface (including 15 spare tracks). Formatted capacity is 67 megabytes. The drives rotate at 3600 rpm, resulting in an average rotational delay of 8.3 milliseconds. Track-to-track, average, and across-all-tracks head positioning times are 6, 30, and 55 milliseconds, respectively. Head positioning is performed by a closed-loop proportional servo system driving a voice-coil. Each subsystem includes a controller for up to 8 drives.

RP06 176-MEGABYTE DISK PACK DRIVES: Employs a 12-platter disk pack and utilizes a technology similar to that of the IBM 3330, through the use of a track-following servo system. The bottom surface of the pack is dedicated to servo control and tracking. The drive rotates a 360 rpm, resulting in an average delay of 8.3 milliseconds. The peak data transfer rate is 806K bytes per second (2.5 microseconds per 16-bit word). Average access time is 38.3 milliseconds. Each subsystem includes a controller for up to 8 drives.

RM05 300-MEGABYTE DISK PACK DRIVES: Employs a 12-platter disk pack with 19 read/write surfaces and one read-only servo surface. It has a formatted capacity of 256 megabytes and a recording density of 384 tracks per inch or 6038 bits per inch. With up to eight drives, 2048 megabytes can be connected to each controller.

INPUT/OUTPUT UNITS

Please refer to the Peripherals/Terminals table on page M11-384-403.

DATA COMMUNICATIONS

Please refer to Report M11-384-301 for a discussion of the DL11 and DUP11 interfaces and the DZ11 and DH11 multiplexers.

COMMUNICATIONS CONTROL

Communications options are available to provide an interface to DEC and non-DEC computers. Both single- and multiple-line interfaces are offered for local and remote communications. Utilizing both synchronous and asynchronous connections, these interfaces provide services such as: ➤

DEC Datasystem D500, SM, and SN Series

- Programmable speeds and formats.
- 20-mA and EIA modem control.
- Dial-up characteristics.
- Program-selectable features (such as full- or half-duplex operation).
- Speeds up to 9600 bits/second.

Remote data communication with other computer systems can be done on a Datasystem through emulator options such as an IBM 2780 or 3271 emulator. Operating concurrently with the execution of user programs, the 2780 hardware/software packages permit on-site processing and RJE compatibility with an IBM 2780 Model 1 Data Transmission Terminal. Other features include:

- Automatic answering of incoming calls.
- Interactive mode for direct control of files by a system operator.
- Data transmission rates up to 4800 bits/second.

DECNET is a hardware and software programming tool which allows interconnection of other Digital computer systems in a network and provides the ability to communicate with other mainframes using industry-compatible protocols.

DECNET permits users to create communications networks merely by adding appropriate software and hardware to existing computer systems. It is actually a number of specific products aimed at several broad markets, consisting of a series of hardware and software extensions to standard systems.

DECNET is not a turnkey solution. Customers must purchase communications links, one or more of DEC's communications interfaces for each computer in the network, and modems. Some of the more complicated applications will require considerable programming, as well.

DECNET allows customers to:

- Transmit data files across a room or around the world.
- Share expensive peripherals among several CPU's, some of which may be remote.
- Use another tool in the creation of high-availability (super-reliable) systems, adding to the Unibus links and multi-port options that Digital already supplies.
- Make more extensive use of memory-only systems.

DECNET is also the collective name for the set of software products which extend various DEC operating systems so they can be interconnected with each other to form computer networks. The DECNET user can configure a variety of networks by choosing the appropriate CPU's, line interfaces (and speeds), and operating systems software. Such networks typically fall into one of three classes: 1) those that move data from one physical location to another; 2) file-oriented networks, often the case for remote job entry systems; or 3) line-oriented networks, as occurs with the concentration of interactive terminal data.

SOFTWARE

OPERATING SYSTEMS: Operating systems for the medium to large scale PDP-11 based Datasystems include: 1) the CTS-500 general-purpose time-sharing system; 2) the RSX-11M real-time multi-programming system; and 3) the RSX-11M-PLUS priority-structured, event-driven operating system. The following discussion of these operating systems is augmented by the Operating Systems Comparison Table which appears on page M11-385-408.

CTS-500 (Commercial Transaction System-500): The four versions of the CTS-500 operating system combine the Resource-Sharing Timesharing System/Extended (RSTS/E)

time-sharing operating system with combinations of the COBOL, BASIC, or DIBOL language processors, single- or multiple-key data management systems, and DEC's SORT-11. CTS-500 is a time-sharing system designed to accommodate large numbers of interactive users. The interactive language is BASIC-PLUS II, an enriched version of the popular BASIC language, or DEC's business language, DIBOL-11. RPG II and FORTRAN IV are also available. CTS-500 requires a PDP-11/34A, 11/44, or 11/70 with hardware memory management for memory expansion and protection. A wide range of communications interfaces is supported to allow mixes of local and remote terminals with varying characteristics. For a normal job mix, up to 24 concurrent users can be supported on a PDP-11/34A based system, 32 on an 11/44 based system, while up to 127 can be supported on an 11/70-based system.

CTS-500 supports a wide range of peripherals, including up to eight line printers, punched card equipment, punched tape equipment, all types of mass storage devices, communications interfaces, and IBM 2741-compatible terminals.

CTS-500 supplies a comprehensive file system. User files may be random or sequential, numeric or alphanumeric. Files can be created, updated, extended, and deleted interactively from a user terminal or under program control. Files can be protected from access on an individual, group, or universal basis; can be accessed by many terminal users simultaneously; and can be updated on-line.

RMS-11K is a file management system that runs under CTS-500, RSX-11M, or RSX-11M-PLUS on a PDP-11/34A, 11/44 or 11/70. RMS-11K is a multi-key indexed sequential (ISAM) file management system that supports the ANSI-74 COBOL Level 2 Indexed I/O Module specification. The system permits both fixed- and variable-length records and provides RSTS/E users with sequential, relative, and indexed file organization. This allows sequential, random, dynamic, or direct physical access to data records. Combinations of the above modes can also be invoked. Other significant features of RMS-11K are multi-level privacy control and both generic and approximate key searches in multi-keyed indexed processing. The system manager can, for each user, specify the programmer and project number, the password, the maximum logged-out disk space, and the maximum number of files.

DMS-500 is the single-key access method included in the CTS-500 packages. It provides data management file services for organizing and processing information stored in sequential, indexed sequential, and relative access data files.

Access to peripheral devices is generally open to all CTS-500 users under the resource sharing concept on a first-come, first-served basis. However, the capability is available to the system manager to intervene in peripheral assignment and permit assignment as he sees fit.

"Big Block Send and Receive" is available with CTS-500. The maximum number of bytes that can be transferred in a block is 512 bytes. The purpose is to allow one specialized program or group of programs to be shared. For example, one program group would handle screen I/O, another might handle disk access, and still another might handle other tasks. By swapping information back and forth, each job could share programming expertise while cutting down on the total memory requirements.

CTS-500 requires a system with a console terminal, real-time clock, and 128K bytes of parity memory with the memory management option (at least 248K bytes of memory are required to support RMS-11-based languages). In addition, the system requires a disk pack system or a dual-drive fixed-head disk or disk cartridge. Magnetic tape is also generally required for software distribution.

DEC Datasystem D500, SM, and SN Series

OPERATING SYSTEMS COMPARISON TABLE

	CTS-500	RSX-11M	RSX-11M-PLUS
Hardware utilization:			
PDP-11/34A	Yes	Yes	No
PDP-11/44	Yes	Yes	Yes
PDP-11/70	Yes	Yes	Yes
Programming language support:			
APL	Optional	No	No
BASIC	Standard	Optional	Optional
BASIC-PLUS II	Std./Opt.	Optional	Optional
COBOL	Optional	Optional	Optional
DIBOL	Std./Opt.	No	No
FORTRAN IV	Optional	Optional	Optional
FORTRAN IV Plus	No	Optional	Optional
Macro Assembler	Standard	Standard	Standard
RPG II	Optional	Optional	Optional
Type of operating system:			
Single-user	No	No	No
Multi-user	Yes	Yes	Yes
Single-job	No	No	No
Foreground/background	Yes	Yes	Yes
Multiprogramming	No	Yes	Yes
Time-sharing	Yes	Yes (quasi)	Yes (quasi)
Multi-user data base mgmt.	No	No	No
Dynamic memory allocation	Yes	Optional	Yes
Memory mgmt. support (swapping)	Yes	Yes	Yes
Program scheduling:			
By operator	Yes	Yes	Yes
By event interrupt	No	Yes	Yes
By another program/task	Yes	Yes	Yes
By time of day	No	Yes	Yes
No. of terminals in use simultaneously	127	16	32
Number of concurrent jobs	63	NSL*	NSL*
Min. memory required (bytes)	128K	16K	256K
DBMS-11 support	No	Yes	Yes
Re-entrant I/O	—	Yes	Yes
I/O spooling	Yes	Yes	Yes
Concurrent batch & I/O spooling	Yes	Yes	Yes
Fixed & variable-length records	Yes	Yes	Yes
File access methods:			
Sequential	Yes	Yes	Yes
Index sequential	Optional	Yes	Yes
Direct access	Yes	Yes	Yes
Multi-keyed index sequential	Optional	Optional	Optional
Hierarchical	No	Yes	Yes
Usage accounting	Yes	No	Yes
Sharable data files	Yes	Yes	Yes
Program priority levels	255	250	250
Disk/memory program swapping	Yes	Yes	Yes
System generation on target equipment	Yes	Yes	Yes
Security:			
System level	Yes	Yes	Yes
File level	Yes	Yes	Yes

*NSL (no software limitation); limited by hardware configuration or performance.

RSX-11M Real-Time Operating System: RSX-11M features event-driven multiprogrammed responses to real-time stimuli. The system handles many tasks (programs) concurrently, with requests for system resources handled on a priority basis. RSX-11M is a less flexible, lower-overhead subset of more powerful RSX operating systems. It supports checkpointing, and memory allocation is automatic. Hardware memory management is not required, but it can be utilized for memory protection and expansion.

Multi-user program development is accomplished using either of two supplied editors from terminals. The full range of language processors is available. A foreground-only (i.e., real-time execution only) system can operate in as little as 32K bytes, with program development taking place when no

tasks are executing. RSX-11M is disk-based and requires a backup/distribution device in addition to the system disk drive.

The RSX-11M file management system uses the same file system used in CTS-500 (RMS-11K), providing keyed-access data file support in the form of a multi-key indexed sequential file organization. RMS-11K is composed of a set of run-time service routines and utility programs that enable keyed access data files to be defined, populated, updated, and maintained on direct-access storage devices. The RMS-11K run-time service routines provide an interface between PDP-11 multi-programmed operating systems and user-developed application programs. User programs can include RMS-11K function calls that provide logical record input/output access to data files.

DEC Datasystem D500, SM, and SN Series

RSX-11M has a program logical space extension feature that allows execution of very large application programs without requiring disk overlays. A single program can occupy all user space (less the resident system). This feature permits faster execution of larger programs, but at some expense to smaller, lower-priority programs that must be stored on disk while the larger program occupies main memory.

The minimum configuration for RSX-11M requires a central processor with 64K bytes of memory, a console terminal, a disk system, and a backup device. Memory can expand to 248K bytes on systems with the memory management unit, or to 3840K bytes on the PDP-11/70.

RSX-11M supports a wide range of laboratory, industrial control, and communications equipment, including the AR11 Analog Real-Time Subsystem, LPS11 Lab Peripheral Systems (local and remote), modem control multiplexers, and the DMS Unibus link. Standard peripheral devices, such as floppy disks, cassettes, a card reader, paper tape reader/punch, and line printer, are also supported.

RSX-11M-PLUS Operating System: An extension to the RSX-11M operating system designed to maximize performance on PDP-11/44 and 11/70 processors. The operating system announced in April 1979 is disk-based, event-driven, and priority-structured.

RSX-11M-PLUS supports memory sizes ranging from 256K bytes to 3840K bytes. The system divides memory into task partitions. The placement of tasks within partitions and automatic memory compaction are two ways the system minimizes memory fragmentation.

Complete program development capabilities in addition to a real-time response system form the backbone of RSX-11M-PLUS. Program development, real-time tasks, and batch streams can execute concurrently. The user, through the system's software priority levels, can compile, assemble, debug, install, and execute tasks without significantly affecting response time.

Programs can be written in MACRO-11 assembly language which is standard with RSX-11M-PLUS. Alternatively, FORTRAN, COBOL, and BASIC are all available as options.

Shadowed disk support is included among the other RSX-11M-PLUS features. When a user has two disks of the same type, one unit can be designated as a shadowed backup of a mounted file-11 volume. Any writes to the primary drive are automatically written to the secondary unit. In case of a read failure on the primary unit, the system will automatically read the data from the secondary drive.

RSX-11M-PLUS supports a Power-fail Restart to allow the system, upon power restoration, to continue to execute, restarting all interrupted I/O activities, and notifying any active task through a power-fail asynchronous system trap entry point.

Minimum system requirements for RSX-11M-PLUS include 256K bytes of memory, a console terminal, clock, disk system, and backup magnetic tape unit.

LANGUAGES: Compilers are available for the following programming languages.

API-11 is a conversational language that is particularly well suited for operating on numeric and character array-structured data. Using API-11, variables can be examined and changed; statements can be altered without recompilation; and program action can be readily traced. Features of API-11 include dynamically variable user's workspace size,

chaining of API programs to previously prepared run-time programs, multiple statement lines, standard PDP-11 file naming formats, and extended single operators which allow the user to fully evaluate character strings and write user-defined functions to perform output formatting and function editing. The language is built around a set of unique symbols, each of which represents a desired operation. The nature of the language is such that complex expressions are easily constructed by the programmer. According to DEC, API-11 produces concise code.

API-11 requires a processor with 48K bytes of memory and any valid CTS-500 configuration.

BASIC-11 for the PDP-11 is implemented as an incremental interactive interpreter, which retains the interactive nature of the language while providing increased execution speeds over conventional interpreters. It is an enhancement of Dartmouth standard BASIC that includes support for string and arithmetic functions. Peripheral support includes routines that can directly interface to the laboratory peripheral systems (AR11, LPS11) and graphics display systems (VT11, GT41, GT43, GT62) through BASIC.

The **BASIC-PLUS II** language is an enhanced version of Dartmouth BASIC, featuring more than 40 basic commands, 35 built-in functions, and 3 different data types; integer, string, and floating-point (single and double precision). A commercial extension package is available to provide output formatting features such as comma insertion, floating dollar sign, trailing minus, asterisk protect and sort, line printer spooling, and indexed access file method routines.

BASIC-PLUS II supports indexed sequential (ISAM) files, and thus supports DEC's RMS-11 record management system. It also features the CALL statement found in BASIC-11 and is compatible with other DEC BASIC language processors. BASIC-PLUS II also includes debugging aids such as breakpoints, step mode, and change of variables. Other important features include support for block-mode terminals, long variable names, record I/O, and a decimal arithmetic package.

COBOL can be run in a conversational remote job entry mode simultaneously with several interactive BASIC-PLUS jobs. Both can access the same sequential files. This allows the user to create files interactively using BASIC-PLUS and then process that data in conversational remote job entry mode, through COBOL. The COBOL compiler requires an average of 40K to 48K bytes of memory to compile and execute all elements of the COBOL language. Because of COBOL's interpretive architecture, the program size is almost unlimited. The procedure division resides in virtual memory as a string of blocks that are called in as needed.

DIBOL-11 is an enhanced version of the DIBOL language that was available on the Datasystem 300 family and other DEC computers. DIBOL-11 provides software compatibility throughout the Datasystem family, from the 11/03 to the 11/70-based systems. The Datasystem 310 can be included in this family through the use of DITRAN, which translates DIBOL-8 into DIBOL-11, thereby providing the multi-user programming elements that allow several application programs to run simultaneously.

FORTRAN IV is available on all medium to large scale PDP-11 based Datasystems. It has been used mostly in problem-solving areas, although process control, information retrieval, and commercial data processing programs are sometimes written in FORTRAN.

DEC Datasystem D500, SM, and SN Series

As a final polish to each program, the FORTRAN IV compiler does extensive "peephole" organization, examining each sequence of operations and substituting a shorter, faster group if possible.

FORTRAN IV operates in interactive or batch mode under the CTS-500, RSX-11M, or RSX-11M-PLUS monitor and provides assembly language subprogram support, using the macro assembler. Although the assembly language subprogram cannot issue any monitor calls, the macro assembler provides a path to further enhance computational performance.

The FORTRAN IV compiler runs in a minimum partition of 16K bytes. If run in a larger partition, it uses the extra space for program and symbol table storage.

The Datasystem 500 version of *RPG II* is said to be closely compatible with the *RPG II* that is used on the IBM System 3 Model 10. In addition, the DEC version offers extensions such as the use of terminals as I/O devices.

UTILITIES: Featured below are a few of the DEC Datasystem utilities. Please refer to Report M11-384-301 for a full discussion of the subject.

DATATRIEVE-II is an inquiry and report writing system that allows interactive data retrieval, sorting, and updating; report generation and creation; and maintenance and accessing of data dictionary entries that define RMS-11K records. *DATATRIEVE-II* runs under all of the medium to large scale PDP-11 based Datasystems. The system has capabilities to handle RMS-11K files created by COBOL, BASIC-PLUS II, DIBOL, and macro assembler programs. *DATATRIEVE-II* provides 10 query commands, 6 parameters for report writing, 5 commands for report writing, 5 statistical functions, and a process for storing often-used statements in the data dictionary as procedures.

DATATRIEVE-II requires a Datasystem configuration including memory management hardware, 64K bytes of user memory, and hardware multiply/divide.

DATATRIEVE version 2.0 has been extended through variable length record support, cross-file "views" and a revised and expanded documentation set. The cross-file view capability allows a user to define logical records that are retrieved from multiple RMS-11 files.

DECFORM is an easy-to-use generative programming aid that allows a customer to tailor screen formatting, file interaction, and editing procedures. *DECFORM* is capable of screen formatting, checking, prompting, file examination with update, and inquiring. It runs under both CTS-500 and CTS-300 (for Datasystem 150 and 300 Series).

There are five basic tasks that can be performed:

- Add—for basic data entry.
- Inquiry—for examination without change.
- Change—for file maintenance.
- Verify—pre-selected fields may be re-keyed.
- Delete (not available for sequential files).

Screen formatting is simply a matter of building a table describing field size, field name, horizontal position, and vertical position for each field on the screen that is desired. This table is passed over to the *DECFORM* compiler along with the name of the file to be accessed. The *DECFORM* compiler then generates a DIBOL-11 program. Formats can be divided into multiple screens to allow for more logical layouts and to eliminate crowding. Provisions are also made for passwords and other security procedures as well as format

menus. Once the format is displayed, the operator may begin keying in data. Prompting and error messages are also displayed.

Editing functions of *DECFORM* include: display leading zeros, stop after every field is entered, retain previous screen when starting a new record, override checks through special characters, automatic duplication of fields, automatic incrementing of fields, establish initial values for fields, check digits, perform arithmetic functions (extensions, taxes, etc.), hide a field, and list running totals.

The following checks are available in *DECFORM*: alphanumeric, numeric, field required, field must be filled, constant insertion, range checks on numeric fields, table look-up, cross field comparisons, field protection (unalterable), subfield checking to individual character level, and data retrieval from other files. According to DEC, it is possible to use the above procedures to extend, discount, and tax an invoice while pulling alphanumeric descriptions from a table.

INDENT is a data entry and forms management product for commercial applications programs written in DIBOL, COBOL, or BASIC-PLUS-2. *INDENT* supports the VT52 and VT100 terminals and both asynchronous and synchronous commands. *INDENT* form definitions are created using a text editor. The English-like source code is compiled using the *INDENT* compiler and task builder. Forms are controlled using standard subroutine calls which support both single and multi-terminal applications.

DITRAN, a recent software offering of the Digital Equipment Computer Users Society (DECUS), is a translator that converts DIBOL-8 into DIBOL-11. This enables users of the DEC PDP-8-based Datasystem 310 to convert to a larger Datasystem with a minimum of effort. Since *DITRAN* is not provided by DEC, the company offers no guarantees, and may not officially support *DITRAN*.

APPLICATION SOFTWARE: All applications software must be developed either by the user or by a systems house. DEC does not directly provide application packages at this time.

Applications software for DEC Datasystems is covered in the AIP (Application Interchange Program) catalog distributed by the Commercial Products Group. The applications are grouped by industry and application. DEC acts as a clearinghouse only and has no role in any contractual agreements with the supplier.

PRICING

POLICY: DEC generally provides the Datasystems on a purchase basis, with separately priced maintenance agreements. Leasing arrangements are available through DEC's joint venture with U.S. Leasing Corp. or through TEC Leasing Corp. of New York. Lease rates vary with the prime interest rate, the customer's volume of business with DEC, and the value of the equipment being leased.

Software maintenance is offered through several levels of optional service, ranging from a periodic software newsletter to automatic updates of software and manuals (software subscription service). In addition, software components, including documents and updates, can be purchased separately from Digital's Software Distribution Center.

DEC has set up a 24-hour-a-day, 7-day-a-week Telephone Support Center (TSC) for users with CTS/500, CTS-300, COS-310, and RSX-11M operating systems, among others. Users under warranty or who are subscribing to Digital's post warranty software services have access to TSC. DEC claims that greater than 90 percent of their customer's problems can be solved by TSC.

DEC Datasystem D500, SM, and SN Series

The Digital Equipment Computer Users Society (DECUS) is a voluntary, non-profit users' group supported by DEC. DECUS provides an extensive program library, users' groups, special interest groups, and workshops/symposia. Technical symposia are sponsored twice a year in the United States and once a year in Europe, Canada, and Australia. In terms of documentation, the society has the responsibility of maintaining the DECUS program library and publishing a library catalog, the proceedings of symposia, and a periodic newsletter, *DECUSCOPE*.

Training credits are issued with the systems, allowing the customer to obtain free training in programming techniques and systems operation and applications. Each individual student week of instruction or fraction thereof requires one training credit. Training is offered in 17 DEC facilities found in Japan, Australia, Great Britain, Germany, France, The Netherlands, Sweden, Italy, Canada, and throughout the United States. At present, over 100 courses are offered. Digital also offers on-site instruction in both standard and customized courses and self-paced audio/visual (A/V) courses. A/V courses are presented through mixed media of audio/film-strip cartridges, video cassettes, and workbooks. DEC's Special Systems group offers training in both hardware and software areas on-site and in DEC training centers.

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 its Product Repair Center (PRC), with 17 locations throughout the world. Services provided by PRC include return-to-PRC agreements which cover all repairs (user performs troubleshooting) on a specific CPU, peripheral, or system for one year; exchange service providing teletypewriters, punches, and selected disk drive exchange at a flat rate; a fixed quote service, which provides a quote on equipment repair before any work is performed; and a loose piece module repair plan for modules and subassemblies. Under the repair plan, DEC estimates a typical turn-around repair time of 20 working days after receipt at the customer returns area (CRA). PRC also offers a module exchange service on a yearly contract basis, allowing a customer to replace a defective module within seven working days from the time it is received at the CRA. DEC supplies special mailers for both the loose piece module repair plan and the module exchange service. Also available for this class of customer is a customer spares program, which includes component and subassembly spares, engineer-designed spares kits, memory stack spares, maintenance test equipment, maintenance documentation service, and emergency parts service.

On-site field service is offered worldwide through a network of 300 offices, 190 of which are located in North America. These offices provide both field service and spare parts inventory. Over 4000 service representatives are assigned to these offices.

Per Call On Site Service is offered to customers for whom downtime may not be critical and who have sufficient expertise to perform first-line maintenance, or as a supplementary program for standard service agreement customers if remedial maintenance is required outside their normal hours of coverage. Labor rate charges are portal-to-portal; parts and travel expenses are rated separately. Labor rates from 8 a.m. to 5 p.m. Monday through Friday are \$63 per hour; all other times, including Digital holidays, are priced at \$75 per hour. A two-hour minimum is in effect for per call service. Travel charges are based on a portal-to-portal rate of 16 cents per mile plus any commercial travel expenses incurred. Normal response for per call service is one to two days. If unanswered in three working days, per call requests are placed in the same category as standard service agreement or warranty customers.

The basic field service agreement includes remedial maintenance; preventive maintenance; an assigned service representative; all parts, material, and labor; engineering modifications; and documentation. Hours of coverage are 8 a.m. to 5 p.m. Monday through Friday. (Preventive maintenance time is extended by 3 hours to 8 p.m. on weekdays.) Extensions are available to allow coverage up to 24 hours a day, 7 days a week.

The DECservice agreement is the same as the basic field service agreement except for these additions: response time of four hours or less if a call is made during coverage hours; continuous service until system level repairs are complete; and no extra charge for service continued after coverage hours.

The newest field engineering service is Remote Diagnosis for the PDP-11/70. This process consists of an electronic console, the Digital Diagnosis Center (DDC) with its host computer, and the Service Response Hot-Line/Remote Diagnosis. The electronic console replaces the regular PDP-11/70 front panel and permits initiation of operating commands through the system terminal. Both the DDC and the response group operate 24 hours per day and 7 days a week, and are responsible for decisions on the use of remote diagnosis and analysis of results.

EQUIPMENT: A large number of packaged PDP-11 systems appear in the Equipment Price List which follows.■

EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
DATASYSTEM 500 BASIC SYSTEMS UNDER CTS-500			
CTS-500 Level 2 is based on the RSTS/E operating system which includes the BASIC-PLUS language processor, RMS-11K data management system, and SORT-11. Level 2 also incorporates DMS-500 data management system.			
CTS-500 Level 3 is based on the RSTS/E operating system which includes the BASIC-PLUS language processor, RMS-11K data management system, and SORT-11. Level 3 also incorporates DMS-500, DATATRIEVE, and DIBOL-11 with DECFORM.			
PDP-11/34A PACKAGED SYSTEMS (D530 SERIES)			
PDP-11/34A	Packaged systems include 256K bytes of MOS memory, programmer's console, bootstrap loader, serial line interface, real-time clock, hardware memory management, Extended Instruction set (EIS), and an LA120 console.		
D532A-FA	With two RL02 disks (20.8 megabytes total) and controller, and CTS-500 level 2 software license	\$44,700	\$287
D532E-FA	Same as D532A-FA except CTS-500 level 3 software license included	47,800	287

DEC Datasystem D500, SM, and SN Series

EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>
PDP-11/34A PACKAGED SYSTEMS (D530 SERIES) (Continued)			
D533A-FA	With RP06 disk (176.0 megabytes total) and controller, and CTS-500 level 2 software license	88,500	397
D533E-FA	Same as D533A-FA except CTS-500 level 3 software license included	91,600	397
D535A-EA	With only 128K bytes of MOS memory, two RLO1 disks (10.4 megabytes total) and controller, and CTS-500 level 2 software license	43,400	229
D535E-EA	Same as D535A-EA except CTS-500 level 2 software license included	46,500	229
D536A-FA	With one RM02 disk (67.0 megabytes total) and controller, and CTS-500 level 2 software license	67,200	347
D536E-FA	Same as D536A-FA except CTS-500 level 2 software license included	70,300	347
D538A-HA	With two RK07 disks (56.0 megabytes total) and controller, and CTS-500 level 2 software license	68,500	419
D538E-HA	Same as D538A-HA except CTS-500 level 3 software license included	71,600	419
PDP-11/44 PACKAGED SYSTEMS (D540 SERIES)			
PDP-11/44 packaged systems include 256K bytes of ECC MOS memory, 8K bytes of parity cache memory, memory management with UNIBUS map, line frequency clock, a diagnostic bootstrap loader, a microprocessor-controlled ASCII LA120 console, and two serial units.			
D542A-AA	With two RLO2 disks (20.8 megabytes total) and controller, and CTS-500 level 2 software license	56,700	300
D542E-AA	Same as D542A-AA except CTS-500 level 3 software license included	59,800	300
D546A-AA	With one RM02 disk (67.0 megabytes total) and controller, and CTS-500 level 2 software license	75,000	342
D546E-AA	Same as D546A-AA except CTS-500 level 3 software license included	78,100	342
D546E-BA	Same as D546E-AA plus 256K bytes of ECC MOS memory (512K bytes total), COBOL-11, and the Commercial Instruction Set processor	94,900	403
D548A-AA	With two RK07 disks (56.0 megabytes total) and controller, and CTS-500 level 2 software license	72,500	432
D548E-AA	Same as D548A-AA except CTS-500 level 3 software license included	75,600	432
D548E-BA	Same as D548E-AA plus 256K bytes of ECC MOS memory (512K bytes total), COBOL-11, and the Commercial Instruction Set processor	92,300	493
PDP-11/70 PACKAGED SYSTEMS (D570 SERIES)			
PDP-11/70 packaged systems include 512K bytes of ECC MOS memory, 2K bytes of parity bipolar cache memory, battery backup, bootstrap loader, serial line interface, real-time clock, integral memory management, and an LA120 console.			
D573A-DA	With one RP06 disk (176.0 megabytes total) and controller, and CTS-500 level 2 software license	143,200	582
D573E-DA	Same as D573A-DA except CTS-500 level 3 software license included	146,300	582
D576A-DA	With one DM03 disk (67.0 megabytes total) and controller, and CTS-500 level 2 software license	116,900	532
D576E-DA	Same as D576A-DA except CTS-500 level 3 software license included	120,000	532
BASIC SYSTEMS UNDER RSX-11M			
RSX-11M operating system includes automatic memory management, task checkpointing, dynamic memory allocation, configuration flexibility, and a complete set of system utilities. MACRO-11 assembly language is standard.			
PDP-11/34A PACKAGED SYSTEMS			
SM-30LLD-AA	Processor with 128K bytes of parity MOS memory, hardware memory management, Extended Instruction set (EIS), bootstrap loader, serial line interface, real-time clock, parity control, programmer's console, two RLO1 disks (10.4 megabytes total) and controller, and one LA38 console	31,000	214
SM-30HHC-CA	Processor with 256K bytes of parity MOS memory, hardware memory management, EIA, bootstrap module with diagnostics, serial line interface, real-time clock, programmer's console, two RK07 disks (56.0 megabytes total) and controller, one LA120 console	53,700	419
SM-30MMC-AA	Processor with 256K bytes of parity MOS memory, hardware memory management, EIA, bootstrap loader with diagnostics, serial line interface, real-time clock, programmer's console, two RLO2 disks (20.8 megabytes total) and controller, one TE16 magnetic tape subsystem, and one LA38 console	36,400	273
PDP-11/44 PACKAGED SYSTEMS			
SM-40MMA-CA	Processor with 256K bytes of ECC MOS memory, 8K bytes of parity cache memory, memory management with UNIBUS map, line frequency clock, diagnostic bootstrap loader, microprocessor-controlled ASCII console, two serial line units, one LA120 console, two RLO2 (20.8 megabytes total) and controller	47,100	302

DEC Datasystem D500, SM, and SN Series

EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>
PDP-11/44 PACKAGED SYSTEMS (Continued)			
SM-40MMB-CA	Same as SM-40MMA-CA except FORTRAN-IV-PLUS compiler and FP-11 Floating Point Processor included	51,000	316
SM-40HHA-CA	Same as SM-40MMA-CA except two RK07 disks (56.0 megabytes total) in place of two RLO2 disks	62,900	432
SM-40JAA-CA	Same as SM-40MMA-CA except one RM02 disk (67.0 megabytes total) and controller, and a TS11 magnetic tape subsystem in place of two RLO2 disks	76,500	417
PDP-11/70 PACKAGED SYSTEMS			
SM-70TAA-CA	Processor with 512K bytes on interleaved ECC MOS memory, integral memory management, integral EIS, bootstrap loader, serial line interface, real-time clock, programmer's console, one LA120 console, one RM03 disk (67.0 megabytes total) and controller, and one TS11 magnetic tape subsystem	111,300	588
SM-70TVC-CA	Same as SM-70TAA-CA except a TWE16 subsystem in place of TS11 subsystem	119,700	660
SM-70TBA-CA	Same as SM-70TAA-CA except a TWU77 subsystem in place of TS11 subsystem	135,400	748
SM-70CAA-CA	Processor with 512K bytes of interleaved ECC MOS memory, 2K bytes of cache memory, integral memory management, integral EIS, bootstrap loader, serial line interface, real-time clock, programmer's console, one LA120 console, one RPO6 disk (176.0 megabytes total) and controller, and one TS11 subsystem	137,500	638
SM-70CVC-CA	Same as SM-70CAA-CA except a TWE16 subsystem in place of TS11 subsystem	158,500	830
SM-70CBA-CA	Same as SM-70CAA-CA except a TWU77 subsystem in place of TS11 subsystem	174,300	918
BASIC SYSTEMS UNDER RSX-11M-PLUS			
RSX-11M-PLUS is an extension to the RSX-11M operating system. It also includes a multistream BATCH facility and multi-keyed ISAM capabilities.			
PDP-11/44 PACKAGED SYSTEMS			
SN-40JAA-CA	Processor with 256K bytes of ECC MOS memory, 8K bytes of parity cache memory, memory management with UNIBUS map, line frequency clock, diagnostic bootstrap loader, micro-processor-controlled ASCII LA120 console, two serial line units, one RM02 disk (67.0 megabytes total) and controller, and a TS11 magnetic tape subsystem	80,200	417
PDP-11/70 PACKAGED SYSTEMS			
SN-70TAA-CA	Processor with 512K bytes of interleaved ECC MOS memory, 2K bytes of cache memory, memory management with physical address extension, bootstrap module with diagnostics, one LA120 console, single line asynchronous EIA/CCITT interface, line frequency clock, one RM03 disk (67.0 megabytes total) and controller, and one TS11 magnetic tape subsystem	115,000	588
SN-70TVA-CA	Same as SN-70TAA-CA except one TWE16 subsystem in place of TS11 subsystem	123,400	660
SN-70TBA-CA	Same as SN-70TAA-CA except one TWU77 subsystem in place of TS11 subsystem	139,100	748
SN-70CAA-CA	Processor with 512K bytes of interleaved ECC MOS memory, 2K bytes of cache memory, integral memory management and EIS, bootstrap loader, one LA120 console, serial line interface, real-time clock, programmer's console, one RPO6 disk (176.0 megabytes total) and a TS11 magnetic tape subsystem	141,200	638
SN-70CVA-CA	Same as SN-70CAA-CA except 1024K bytes of interleaved ECC MOS memory, and a TWE16 subsystem in place of TS11 subsystem	162,200	809
SN-70CBA-CA	Same as SN-70CAA-CA except a TWU77 subsystem in place of TWE16 subsystem	178,000	918
PROCESSOR OPTIONS			
For the 11/34A:			
FP11-A	Floating Point Processor; offers single or double precision operands	3,100	23
For the 11/44:			
FP11-F	Floating Point Processor	3,100	16
KE44-A	Commercial Instruction Set (CIS) Processor	7,500	16
For the 11/70:			
FP11-C	Floating Point Processor	6,000	32
MEMORY			
For PDP-11/34A systems:			
KK11-A	2K-byte RAM cache memory	4,150	17
MS11-JP	32K-bytes MOS module	2,350	25
MS11-LB	128K-bytes parity MOS module	4,300	40
MS11-LD	256K-bytes parity MOS module	6,400	75
H775-CA	Battery backup for MS11-J and MS11-L MOS memory	1,400	7

DEC Datasystem D500, SM, and SN Series

EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>
MEMORY (Continued)			
For PDP-11/44 systems:			
MS11-MB	256K-byte ECC MOS module	6,400	45
MS11-MC	512K-byte ECC MOS module	11,800	90
MS11-MD	768K-byte ECC MOS module (not for D546E and D548E)	16,100	135
H7750-BA	Battery backup for MS-11M ECC MOS memory	1,600	14
For PDP-11/70 systems:			
MK11-BA	128K-byte ECC MOS unit; includes box, power supplies, control, and battery backup	24,100	70
MK11-BE	128K-byte ECC MOS expansion module; mounts in MK11-BA	11,600	30
MK11-BF	512K-byte ECC MOS expansion module; mounts in MK11-BA	21,400	120
MK11-BJ	1024K-byte ECC MOS expansion module; mounts in MK11-BA	34,200	240
MK11-BG	1024K-byte ECC MOS unit; includes box, power supplies, control, and battery backup	46,800	280
MK11-CA	512K-byte ECC MOS unit; includes box, power supplies, control, and battery backup	33,900	160
MK11-CE	512K-byte ECC MOS expansion module; mounts in MK11-CA	21,400	120
MK11-CF	1024K-byte ECC MOS expansion module; mounts in MK11-CA	34,200	240
MASS STORAGE			
RX211-BA	Dual (RX02) floppy disk subsystem; .5 megabytes each, 61K bytes/seconds transfer rate, 263-msec. average access time	4,150	45
RK711-EA	RK07 Single-access subsystem; 28.0-megabyte disk cartridge drive and controller, 538K bytes/second transfer rate, 49-msec. average access time; expandable to eight single-access RK07 drives	15,500	145
RK07	Single-access 28.0-megabyte disk cartridge drive	11,200	115
RK711-PA	RK711-NA for PDP-11/44 based systems	15,500	145
RL211-AK	RL02 Single-access subsystem; 10.4-megabyte disk cartridge drive and controller, 512K bytes/second transfer rate, 67.5 msec. average access time, expandable to four single-access RL01/RL02 drives	6,900	68
RL11-AK	RL01 Single-access subsystem; 5.2 megabyte disk cartridge drive and controller, 512K bytes/second transfer rate, 67.5-msec. average access time, expandable to four single-access RL01/RL02 drives, for PDP-11/34A	5,500	58
RL01-AK	Single-access 5.2-megabyte disk cartridge drive	4,050	50
RL02-AK	Single-access 10.4-megabyte disk cartridge drive	5,600	60
RJM02-AA	RM02 Single-access subsystem; 67.0-megabyte disk pack drive and controller, 806K bytes/second transfer rate, 42 msec. average access time, expandable to eight RM02 drives; for PDP-11/34A and PDP-11/44	25,700	170
RM02-AA	Single-access 67.0 megabyte disk pack drive	19,300	140
RJP06-AA	RP06 Single-access subsystem; 176.0-megabyte disk pack drive and controller, 806K bytes/second transfer rate, 36.0 msec. average access time, expandable to eight RP06 drives; for PDP-11/34A and PDP-11/44	44,000	220
RP06-AA	Single-access 176.0-megabyte disk pack drive	34,000	190
RWM03-AA	RM03 Single-access subsystem; 67.0-megabyte disk pack drive and controller, 1,229K bytes/second transfer rate, 38-msec. average access time, expandable to eight RM03 drives; for PDP-11/70	26,800	170
RM03-AA	Single-access 67.0-megabyte disk pack drive	20,300	140
RWP06-AA	RP06 Single-access subsystem; 176.0-megabyte disk pack drive and controller; 806K bytes/second transfer rate, 36-msec. average access time, expandable to eight RP06 drives; for PDP-11/70	44,000	220
RWM05-AA	RM05 Single-access subsystem; 300.0 megabytes disk pack drive and controller; 1.2 megabytes/second peak transfer rate, 38.3 msec. average access time, expandable to eight RM05 drives; for PDP-11/70	44,000	310
RM05-AC	Additional drives for RM05 subsystem	34,000	240
MAGNETIC TAPE EQUIPMENT			
TJE16-AA	Magnetic Tape Subsystem; 45 inches/second, 9-track 800/1600 bpi; includes one TE16 transport and controller; expandable to eight TE16 transports; for PDP-11/34A or PDP-11/44	20,200	147
TWE16-AA	Same as TJE16-AA except for PDP-11/70 only	20,200	147
TE16-AE	Magnetic Tape Transport; 9-track; 800/1600 bpi, 45 inches/second	12,800	87
TS11-BA	Magnetic Tape Subsystem; 45 inches/second, 9-track 1600 bpi, includes transport and controller; expandable to four TS11 subsystems per CPU	15,400	75
TS11-CA	TS11-BA for PDP-11/44 based Datasystems	15,400	75
TJU77-AB	Magnetic Tape Subsystem; 125 inches/second, 9-track 800/1600 bpi; includes one TU77 transport and controller, expandable to four TU77 transports; for PDP-11/34A or PDP-11/44 systems	30,000	235

DEC Datasystem D500, SM, and SN Series

EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>
MAGNETIC TAPE EQUIPMENT (Continued)			
TWU77-AB	Same as TJU77-AB except for PDP-11/70 systems	30,000	235
TU77-AF	Magnetic Tape Transport; 9-track, 800/1600 bpi, 45 inches/second	20,900	175
TU58-EB	Cartridge DEctape system; .5 megabytes total; 150 to 34,800 baud; 9 second average access; 30 second maximum access	1,750	15
PRINTERS			
LA11-PA	132 positions; 96 characters; 7 x 7 matrix; 180 cps (LA180)	4,050	55
LP11-WA	132 positions; 96 characters; drum; 240 lpm	15,000	155
LP11-VA	132 positions; 64 characters; drum; 300 lpm	12,600	155
LP11-CA	132 positions; 64 characters; drum; 900 lpm	25,700	185
LP11-AA	64 characters; 285 lpm (LP25)	7,800	90
LP11-BA	64/96 characters; 204/285 lpm (LP25)	8,400	90
TERMINALS			
LA34-AA	DECwriter IV; 30 cps; 9 x 7 dot matrix; adjustable character width; 7 character sets; superscripts and subscripts	1,600	
LA38-HA	DECwriter IV printing terminal; variable horizontal tabs and margins; four character sizes; six line spacings; numeric keypad, 30 cps; 300 bps	1,700	16
LA-38GA	Tabletop version of LA38-HA	1,600	16
LA120-DA	EIA version high-speed hardcopy terminal; 7 x 7 dot matrix; 180 cps; 9600 bps	2,800	30
LA120-RA	DECprinter I hardcopy receive only terminal; EIA/CCITT interface; 180 cps (LA180)	4,050	55
VT100-AA	High performance video display terminal; 24 x 80- or 14 x 132-characters, 83-character keyboard, operates on full-duplex	2,050	17
VT100-NA	Same as VT100-AA except DECforms keycaps; for CTS-500, or RSX-11M systems only	2,050	17
VT1XX-AA	20mA current loop adaptor for VT100-AA	130	3
VT1XX-AB	Advanced Video option for VT100; provides BOLD, BLINK, UNDERLINE, and REVERSE VIDEO attributes and adds 10 lines of 132-column to terminal	290	65
VT1XX-AC	Printer Port option for VT100; Local or remote print capability; requires VT1XX-AB and new modem cable	385	
VT55-FE	EIA version, table-top CRT with graphics and alphanumeric capabilities, integral hardcopy device	5,400	65
VT55-FA	Current loop version of VT55-FE	5,400	65
COMMUNICATIONS EQUIPMENT			
SINGLE-LINE ASYNCHRONOUS INTERFACE			
DL11-E	Modem-Controlling EIA CCITT Interface; switch-selectable speed, character size, parity, and stop bit size	820	7
DL11-WC/WA/WB	Serial Line Interface and Real-Time Clock; EIA/CCITT interface; selectable character size, parity, and stop bit size	820	6
SINGLE LINE SYNCHRONOUS INTERFACE			
DUP11-DA	Full/Half Duplex Synchronous Interface; programmable characteristics; speed to 9600 bps; character or bit-oriented protocol	1,500	10
ASYNCHRONOUS MULTIPLEXERS			
DZ11-A	EIA/CCITT Asynchronous 8-Line Multiplexer; speeds and formats are programmable on a per-line basis	2,450	29
DZ11-B	EIA/CCITT 8-Line Multiplexer Expansion Unit for DZ11-A	1,950	25
DZ11-C	DZ11-A for current loop terminals	2,550	29
DZ11-D	20mA current loop 8-line Multiplexers Expansion Unit for DZ11-C	2,000	25
DZ11-E	EIA-CCITT Asynchronous 16-Line Multiplexer; speeds and format are programmable on a per-line basis	4,100	50
DZ11-F	DZ11-E for current loop terminals	4,250	50
DH11-AD	Programmable Asynchronous 16-Line Multiplexers; EIA/CCITT interface and modem controls; cables not included	8,100	61
DH11-AE	Programmable Asynchronous 16-Line Multiplexer; EIA/CCITT, no modem control	7,200	51

DEC Datasystem D500, SM, and SN Series

EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>
COMMUNICATIONS OPTION			
KG11-A	Parity Check option; computes cyclic redundancy check (CRC), longitudinal redundancy check (LRC), and block check characters (BCC); requires DUP-11	1,350	6
KMC11-A	High speed, general purpose MSI microprocessor that interfaces to PDP-11 UNIBUS, requires RSX-11M	2,350	21
NETWORK LINE MODULES			
DMC11-AL/AR	Network line DDCMP microprocessor module (local or remote) requires DECnet Phase II	1,700	29/19
DMC11-DA	Network link remote line unit module; interfaces EIA/CCITT synchronous modems; operates at full- or half-duplex up to 19,200 bps; includes data set control	1,200	6
DMC11-FA	Network line remote line unit module; interfaces CCITT V.35/DDS synchronous modems; operates at full- or half-duplex up to 250,000 bps	1,200	6
DMC11-MA/MD	Network Link local link unit module; data transmissions of 56,000 or 1,000,000 bps; provides full- or half-duplex connection to another DMC11	1,200	6

SOFTWARE PRICES

CTS-500 SYSTEMS

QJ906-C	APL-11/CTS-500; without support services	950
QJ916-A	CTS-500 BASIC-PLUS-2; with support services	5,100
QP011-A	COBOL-11; with support services	8,900
QR435-A	CTS-500 FORTRAN IV; with support services	2,100
QP552-A	RPG II; with support services	6,300
QP300-A	DATATRIEVE-11/CTS-500 UPGRADE; with support services	4,500
QP529-A	CTS-500 Level 2 to Level 3 UPGRADE; with support services	6,300
QR430-W	CTS-500 Level 2A and Level 3A to Level 2 UPDATE; with support services	380
QP526-W	CTS-500 Level 2B and 3B to Level 3 UPDATE; with support services	250
QP690-A	DECNET/E; with support services	3,100
QPD10-A	CTS-500/2780 Emulator; with support services	5,100
QR006-A	CTS-600/2780/3780 Emulator; with support services	5,800
QR005-A	CTS-500/3271 Protocol Emulator; with support services	5,800

RSX-11M SYSTEMS

QP240-A	BASIC-11/RSX; with support services	950
QJ918-A	BASIC-PLUS-2; with support services	5,100
QP012-A	COBOL-11, VERSION 4; with support services	8,900
QP066-A	CORAL 66; with support services	7,600
QP230-A	FORTRAN IV; with support services	1,000
QJ668-A	FORTRAN IV-PLUS; with support services	5,800
QP554-A	RPG II; with support services	6,300
QP301-A	DATATRIEVE-11/RSX-11M; with support services	4,500
QP311-A	DATATRIEVE-11/RSX-11M UPGRADE; with support services	6,750
QP376-A	DBMS-11; with support services	19,000
QJS60-A	RJE/HASP; with support services	8,600
QP602-A	SORT-11; with support services	430
QP901-A	RMS-11K; with support services	3,150
QJ684-A	DECNET-11M; with support services	3,500
QJD68-A	RSX-11M/2780 Emulator; with support services	3,500
QJD76-A	RSX-11M/3271 Protocol Emulator; with support services	5,200
QJ908-A	APL-11/RSX; with support services	3,450
QJ715-A	FMS-11/RSX; with support services	2,700

RSX-11M-PLUS SYSTEMS

QP240-A	BASIC-11/RSX-11-PLUS; with support services	950
QJ918-A	BASIC-PLUS-2; with support services	5,100
QP012-A	COBOL-11, VERSION 4; with support services	8,900
QP230-A	FORTRAN IV; with support services	1,000
QJ668-A	FORTRAN IV-PLUS; with support services	5,800
QP301-A	DATATRIEVE-11/RSX-11M-PLUS; with support services	4,500
QP602-A	SORT-11; with support services	430
QR580-A	DECNET-11M-PLUS; with support services	5,000