

DEC Datasystem 340

MANAGEMENT SUMMARY

Announced in June 1972, the DEC Datasystem 340 Series provides interactive and batch operations for performing EDP functions particular to small businesses. A typical DS-340 system includes a video display terminal, line printer, 6.4 million bytes of disk storage, 16,384 bytes of main memory (these "bytes" have only 6 bits), and the COS-300 operating system. The DS-340 is the lone remaining model among the three originally announced; the former DS-320 and -330 have been discontinued in favor of the DS-340.

The Datasystem 340 is based on the PDP-8/E minicomputer, which is the most powerful member of DEC's PDP-8 family (see Report M11-384-101). Its standard type of disk storage is a cartridge. In January 1975, DEC announced a new, low-cost member of its Datasystem 300 Series, the Datasystem 310 (Report M11-385-101), which is based on the microcomputer-sized PDP-8/A and uses flexible diskettes.

Datasystem 340's run under the bundled COS-300 operating system, which is designed for business accounting use. A disk-based multi-user option is also available to support up to seven terminals. The DS-340 systems start at a purchase price of \$36,210.

The philosophy behind DEC's entry into the business minicomputer marketplace is quite interesting and deserves comment. DEC Datasystems are sold as packaged configurations of standard DEC equipment, together with an enhanced operating system (and appropriate program development aids, such as language processors, debug tools, utilities, edit programs, etc.), either to sophisticated end users or to "business OEM's." The primary characteristic of both of these marketplaces is their ability to develop their own software, thus reducing the amount of

The flexible DEC Datasystem 340 Series of business minicomputers is based upon DEC's most popular computer—the 12-bit PDP-8/E. The associated Commercial Operating System supports business applications and permits shared-processor data entry in both batch and interactive modes.

CHARACTERISTICS

MANUFACTURER: Digital Equipment Corporation, Business Products Group, 146 Main Street, Maynard, Massachusetts 01754. Telephone (617) 897-5111.

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

MODELS: DEC Datasystem 340 Models, H, J, K, and L, based upon the DEC PDP-8/E minicomputer as the Datasystem 340 central processing unit (CPU).

DATA FORMATS

BASIC UNIT: The PDP-8/E uses 12-bit words; programmers, however, see only 6-bit modified ASCII for numeric or alphanumeric data.

FIXED-POINT OPERANDS: The PDP-8/E uses 12-bit binary words; programmers, however, see the system as having fixed-point decimal capability only, with precision of 15 digits, due to the standard software.

FLOATING-POINT OPERANDS: None provided.

INSTRUCTIONS: One-word single-address machine instructions, as is common to the PDP-8 line. But since the only programming language that is normally available to users is DIBOL, users see the instruction format in terms of the DIBOL syntax, and the repertoire in terms of the DIBOL command list. Under COS, the Commercial



It was nearly two years ago that DEC first presented Datasystem 340 configurations like this one, with a then-new foreground/background programming capability that would permit execution of any application or utility program in the background concurrently with up to six foreground data entry terminals.

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▷ hand-holding support needed directly from DEC. The DEC Datasystems are thus not turnkey systems dedicated to specific problem solutions with preprogrammed applications. Rather, application programs must be either developed directly by the end user or prepared for him by a business OEM (i.e., a systems or software house). DEC states that in "99 percent of the cases," DEC's business OEM customers buy all of the equipment that they subsequently sell exclusively from DEC.

What distinguishes the DEC Datasystem 340 from similar configurations otherwise available from Digital Equipment Corporation on a piecemeal basis is the fact that the components in the DEC Datasystems are physically packaged into special cabinets, desks, and other functional office furniture.

But, even more importantly, Datasystems are seen by their users as "DIBOL engines." DEC's COS-300 operating system for the Datasystem 340 insulates the user from considering the PDP-8/E within the system as a computer in the traditional minicomputer sense of the word. Indeed, the PDP-8/E central processor is hidden from view in the cabinet that contains the disks. A simple two-button operation turns power on and loads the operating system from the disk.

Further, DEC Datasystems are installed by DEC field service engineers. Although on direct comparison a DEC Datasystem would cost slightly more than the same system when purchased separately from DEC on a component-by-component basis, the difference is generally well worth the price for low-volume business OEM's or sophisticated end users, since it includes the costs of repackaging and testing to reduce installation woes.

The basic marketing strategy for DEC's DS-340 is to promote distributed systems as an alternative to or satellite for centralized computing facilities. This is particularly true in large or geographically dispersed companies that have small-to-medium-sized interactive or batch processing requirements at remote sites and data processing budgets of about \$40,000 to \$50,000 per site. As an additional attractive feature, each DS-340 system also has a communications option that can make the system look like an IBM 2780 remote batch terminal for data communications network.

Provided with the DS-340 is DIBOL, Digital's Business Oriented Language. As a result, the DS-340 user is never concerned with assembly-language program development when writing his applications programs. Use of the DIBOL compiler includes an on-line debugging facility, DIBOL Debugging Technique, which is similar to DEC's long-known DDT. The DIBOL debugger can halt program execution, allowing a programmer to examine program status. In addition to the powerful DIBOL compiler (a typical program compiles in less than 10 seconds) and DDT, COS-300 offers a sort utility for administering data files, as well as other utilities for program and data file generation, backup, and updating. ▷

▶ Operating System, DIBOL (Digital Business Oriented Language) provides English-like procedural verbs with comprehensive arguments: Accept, Call, Chain, Display, End, Fini, Form, Go To, If, Incr, Init, On Error, Read, Return, Stop, Trace/No Trace, Trap, Write, and Xmit. These verbs, combined with data manipulation statements, provide the user with easy-to-use syntax for the development of applications programs.

DEC can make available, but officially de-emphasizes, the optional Datasystem 340 Assembly Language software package, which offers one-word instructions, although no decimal instructions are available. Memory reference instructions use the first three bits to specify the instruction, and the last nine bits to specify the operand address.

In order for the assembly-language memory reference instructions to access memory directly, each 4K-word memory module is logically divided into 32 pages of 128 addresses each for page addressing. Seven of the nine bits are used to specify current page or page "0" within the module, and one bit is used to specify whether direct or indirect addressing is used.

Also, for direct addressing in the assembly language, a memory reference instruction can reference any of 128 addresses on its own page, or any of 128 addresses on page "0" of its own 4K-word module. With indirect addressing, any location in memory can be referenced. For manipulation and/or testing of data, a group of "operate" instructions is available that specify shift, clear, complement, and test (and skip) operations on the accumulator and its associated link bit. The first three bits specify an operate-type instruction, the fourth bit specifies one of two groups of commands, and bits 5 through 11 are predefined by position to indicate particular functions.

Thus, using the assembly language, up to seven one-bit indicators can be "turned on" in each operate instruction, with each one-bit flag referred to as a "micro instruction" (not to be confused with microprogramming). For I/O instructions, the first three bits specify I/O, the next 6 bits select a device, and the last three bits specify the operation to be performed. But it must be reiterated that, typically, the DS-340 user is not concerned with assembly-language programming when developing applications since DIBOL, DEC's COBOL-like language, is used primarily.

INTERNAL CODE: Binary, as in the PDP-8 line. But users normally make no reference to machine code; they see alphanumeric data in DIBOL data structure, coded in 6-bit modified ASCII.

MAIN STORAGE

TYPE: Magnetic core.

CYCLE TIME: 1.2 microseconds.

CAPACITY: 8K to 32K 12-bit words, in 4K or 8K increments (K=1,024). DEC also refers to capacities in "bytes" or characters. A DECbyte is six bits; hence, the capacities could be quoted as 16K to 64K six-bit bytes in 8K and 16K byte increments.

Non-DEC main storage is also available. See Report M13-100-101, *Minicomputer Add-On Memories*.

CHECKING: Optional.

STORAGE PROTECTION: Read/Write or Read-Only protection is standard. ▶

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION*	SPEED
MAGNETIC TAPE UNITS		
TD8-EM	Dual Drive DECtape, 97 ips, block addressable, 189K-word capacity (1)	8,325 words/sec.
TM8-E	Industry-compatible, 9-track, 45 ips, 800 bpi (4)	36 KBS
LINE PRINTERS		
LS8	132-position, 64-character (1)	165 cps
LE8-V	132-position, 64-character (1)	300 lpm
PUNCHED CARD EQUIPMENT		
CR8	Reader, 80-column (1)	300 cpm
PAPER TAPE EQUIPMENT		
PC8-E	Reader/Punch (1)	300/50 cps
TERMINALS		
LA36 DECwriter II	132-position, 64-character, up to 6 copies, vertical format control (1)	30 cps

*Numbers in parentheses refer to system chassis slot(s) required by each device.

▷ Although the DS-340 is not marketed directly against installed IBM equipment, DEC's DIBOL business language is very similar to COBOL. As a result, DEC often does encounter competition from the IBM System/3 with RPG, as well as from the Burroughs L 8000, NCR 399, Basic/Four, and a variety of other small business computers including the host of recently announced business minicomputer systems, headed by IBM's System/32. Among these are the newer disk-based NCR 399 systems and the smaller NCR 299, Basic/Four's new Model 600, the recently revitalized Burroughs B 700 Series, NCR's Century 8200 (a mini-based NCR Century 101 emulator), and also offerings from General Automation, GRI Computer, Microdata, Qantel, and others.

While detailed reference services such as this one permit you to scrutinize all the important entries in the business minicomputer marketplace, your "first cut" should be based on careful prior examination of Report M11-050-201, *Minicomputer Specifications-Business*. Also, the peripheral reports behind Tab 13-*Peripherals* in Volume 2 tell present and prospective users of business minicomputers from major vendors such as DEC where they can find bargains in add-on main memory, disk drives, magnetic tape units, printers, and card and paper tape equipment.

Despite strong and steadily intensifying competition, the relatively low cost and high performance of the DataSystem 340's have earned DEC a modest but growing share of the business minicomputer marketplace, with about 350 installations as of April 1975.

▶ **RESERVED STORAGE:** 4K words of memory for COS 300. The system disk cartridge also has a reserved section for COS-300 and system utility programs. About 5 percent of a disk cartridge's capacity is dedicated to the system.

CENTRAL PROCESSOR

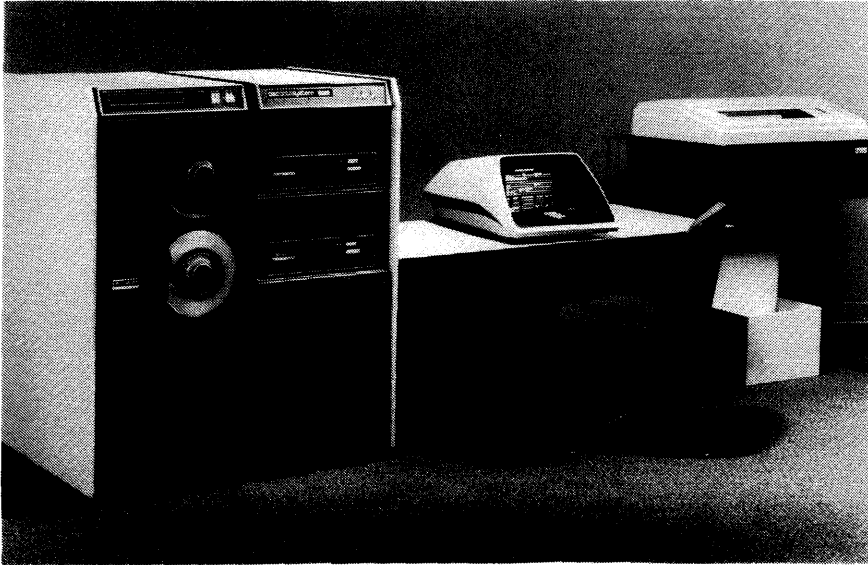
GENERAL: The CPU is a DEC PDP-8/E minicomputer programmed to act as a "black box" to users, and is not even visible to the user. Detailed information on the PDP-8/E is contained in Report M11-384-101, and a brief sketch is presented below.

The PDP-8/E is a simple, single-address parallel machine using 2's complement arithmetic on 12-bit binary numbers with an accumulator, multiplier/quotient architecture, and direct accumulator-to-device and device-to-accumulator I/O transfers. The DS-340 processor incorporates a patented, synchronous Omnibus for I/O and a programmer console interface. The instruction set includes a byte (6-bit) swapping instruction for character handling, and four interrupt control instructions. Also, a general-purpose register handles extended arithmetic or serves as temporary storage during standard operations.

CONTROL STORAGE: None is accessible to users. The DataSystem 340 contains, for example, 32 words of diode bootstrap read-only memory, which does not consume address space and is used to load the operating system.

REGISTERS: The PDP-8-style "autoindex" registers are used by COS-300 and are not accessible to DIBOL programmers. The CPU has the normal complement of PDP-8 registers for the operating system to use: 12-bit accumulator, general-purpose register, program counter, memory address register, memory buffer register, 3-bit operation code register, and 1-bit link carry register for arithmetic overflow. None of these registers is accessible to DIBOL programmers.

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The PDP-8/E-based DEC Datasystem 340 can operate under a foreground/background multi-user option that permits data entry at multiple terminals concurrently with background batch processing. This system, complete with operator's CRT, printer, two cartridge disk drives, 9-track tape drive, and COS software, costs \$54,765.

➤ The steadily increasing number of business OEM's that make use of Datasystem 340's in applications-oriented turnkey systems presents an interesting and attractive alternative to the do-it-yourself programming approach for end users. Prospective small business computer users can expect to find the DS-340's sold under a wide variety of third-party names as time goes on, and users are well advised to give serious consideration not only to the DS-340 basic package available directly from DEC, but also to the availability of turnkey packages from DEC business OEM's.

USER REACTION

Datapro's customary survey of user opinion was a little more difficult to carry out for the Datasystem 340 Series than usual, because DEC declined to furnish a list of installed systems as it has in the past. Strange, too, because the company had nothing to fear (except perhaps fear itself).

Delving into our own research files, we were able to come up with four owners of 340's, two with nine systems between them, and the remaining two owning one apiece. Our good fortune held further when it was discovered that one of the multi-system owners was an OEM vendor, selling the DS-340's as turnkey systems with specialized application software. The second multisystem user was a service bureau with installations in four states, providing us with some insights into DEC's service organizations in those areas. The third and fourth DS-340 owners fitted into the more conventional image one normally expects when dealing with these systems: the small business user. Thus, our survey reflects user opinions based on experience with 11 systems in a broad spectrum of situations for periods ranging from 8 months to 2 years.

In general, the users' reactions to their 340's would have made any manufacturer happy. Everyone interviewed had very good comments about the system, particularly the ➤

➤ **INDIRECT ADDRESSING:** Yes; single level.

INDEXING: Yes, through the autoindex registers. These eight registers are automatically incremented when implied in a memory reference instruction, but act as normal memory locations when addressed explicitly as memory.

INSTRUCTION REPERTOIRE: The CPU has the basic PDP-8 instruction set: 6 memory reference instructions, 4 interrupt control system instructions, 3 flag processing instructions, and 41 "operate" instructions for logical control. But only DIBOL is normally available to programmers. DIBOL has field manipulation instructions and add, subtract, multiply, divide, numeric content check, numeric field formatting, truncation, and rounding available in any combination in a single DIBOL statement. DIBOL also provides the system's I/O instructions, logical functions, and branching.

INSTRUCTION TIMINGS: Timings are given in *microseconds* for both CPU (machine-level) instructions and DIBOL operations on 15-digit operands:

	CPU	DIBOL
Load/store	2.6	100*
Add/subtract	2.6/5.0	1,000
Multiply/divide	257/343	5,000
Compare & branch	3.8	200*

* For 15 characters. The time can vary widely, since DIBOL permits the operation on fields 1 to 4096 characters in length.

INTERRUPTS: A single-line interrupt structure is provided. Software polls the interrupting device for its identification. Interrupts are handled by COS-300, and the programmer is normally not concerned with them.

The single-line interrupt structure includes software polling of I/O devices required to determine the precise nature and priority of each interrupt. Through I/O instructions, a device can be programmed to generate a specific interrupt.

Interrupts switch the system between the two modes provided—user and executive (for systems with "extended" memory, i.e., more than 4K words). In executive mode, full access is available to all programmable machine functions. In user mode (invoked for time-sharing or foreground/ ➤

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➤ software. The DIBOL compiler was rated one of the fastest they had ever seen, with one user mentioning a 12K compilation in 1½ minutes, and another saying that he had never seen a 2K compilation take more than 30 seconds. One user had written more than 500 program modules for business applications and therefore felt very qualified to make these statements. The utilities were also considered quite good, with the sort program singled out as very fast and efficient. The only negative comment on utilities was directed at DDT, the debugging program, as having some minor unspecified problems.

All hardware aspects of the 340 Datasystem except the line printers merited equally good words. The line printer problem was the only discordant note sounded with regularity among the users; the problem was not limited to the Centronics unit but applied to the Dataprinter 300-lpm model as well. All of the users had purchased their systems from DEC, and the configurations ranged from 16K to the full 32K words of main memory. All but one system used two DECTape units, and all but one system used from two to four RK05 disks (IBM 2315-equivalent).

Usage for the systems included the usual accounts receivable, accounts payable, payroll, billing, inventory, control, etc., but only one of the users was using DEC's applications packages for these traditional business applications. The others were writing their own software packages to perform the same general types of functions for specialized businesses such as petroleum products marketing, where prices are fluctuating rapidly.

One user reported only fair responsiveness of maintenance service, which contradicted the experiences of the other three. This user, however, owns six systems and has recently concluded an extensive survey on this aspect. He reported that, although the problems he encountered were only minor, waiting periods of from one to two days for service had reduced his uptime to about 90 percent. All others queried on this point reported uptimes well in excess of 95 percent.

Tabulated below are the results of the four interviews. One user felt his comments on DEC's technical support would not be germane because, to date, he had had no occasion to use this service. Further, no average rating is given to DEC's application programs, since three of the four users interviewed had developed their own packages and were not using the manufacturer's. In fairness to DEC, however, it should be noted that the one owner utilizing the DEC applications software rated it excellent.

	<u>Excellent</u>	<u>Good</u>	<u>Fair</u>	<u>Poor</u>	<u>WA*</u>
Ease of operation	3	1	0	0	3.8
Reliability of mainframe	2	2	0	0	3.5
Reliability of peripherals	2	1	1	0	3.3
Maintenance service:					
Responsiveness	3	0	1	0	3.5
Effectiveness	3	1	0	0	3.8
Technical support	0	3	0	0	3.0
Compilers and assemblers	4	0	0	0	4.0

➤ background multi-user option), direct I/O access is denied to user programs.

Automatic push-down stacks are implemented in software to facilitate sharable (re-entrant) routines. The size of the push-down stacks is limited only by the size of available memory. These re-entrant routines, combined with the software that handles device interrupt requests, facilitate foreground partition multitasking for, say, multi-terminal data entry.

PHYSICAL SPECIFICATIONS: (Please refer also to the photographs in this report.) The Datasystem 340 consists of the push-down stacks measuring 60 inches wide, 33 inches high, and 30 inches deep, plus a cabinet that contains the standard disk storage and central processing unit and is 50 inches tall, 22 inches wide, and 30 inches deep. The magnetic tape cabinet is the same size. The basic shipping weight of a system is 1,000 pounds.

No raised flooring is required for the system, nor is special air conditioning required; the system works in a normal office environment. Power is supplied from a standard wall socket (single-phase, 3-wire grounded duplex, 110-120 VAC, 60 Hz); and the power consumption of a basic system is 2,000 watts, with heat output of 7,000 BTU/hour. Optional peripherals, printers, etc., vary in size. They connect to the mainframe via short cables (supplied and draw power from the CPU power supply).

INPUT/OUTPUT CONTROL

Thirteen cycle-stealing channels on the Omnibus are included. The synchronous Omnibus is provided with each processor to permit the plugging of memory/processor options of I/O devices into any available slot location in the CPU chassis. Thus, the Omnibus structure eliminates the need for back panel wiring. The maximum Omnibus data transfer rate is 134K words/second. The rate is more than adequate for the low-speed I/O devices available to the system.

Additionally, a standard 13-channel DMA ("data break") feature is provided for high-speed block data transfers between memory and higher-speed peripheral/terminal devices on a cycle-stealing basis, and is an integral part of the Omnibus. Any peripheral/terminal controller with a DMA interface can operate directly to memory. In conjunction with the DMA feature, multiple external devices can directly increment multiple memory locations, and external data can be combined (add/subtract) directly to memory locations without processor intervention. The maximum DMA data transfer rate is 833K words/second.

SIMULTANEOUS OPERATIONS: Full peripheral overlap is provided by the hardware and COS-300. The keyboards and serial printers are buffered; disk access is overlapped with serial or line printer output; and COS-300 includes a standard line printer spooler.

CONFIGURATION RULES: Most systems are packaged by DEC itself or by DEC business OEM's, but the key to configuring a Datasystem 340 for yourself is the Omnibus. Peripheral controllers can be plugged into the Omnibus in any order; and when the 20 available controller slots in the Omnibus are all occupied, an Omnibus Expander can be added to provide 20 more controller slots.

The basic machine with one CRT or LA36 terminal uses 17 slots in the Omnibus. The additional slots can be used for terminals, communications, or additional mass storage devices. ➤

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	Excellent	Good	Fair	Poor	WA*
Operating systems	2	2	0	0	3.5
Applications programs	1	0	0	0	**
Overall satisfaction	2	2	0	0	3.5
Credibility of vendor	1	3	0	0	3.3

* Weighted Average on a scale of 4.0 for Excellent.

** Not rated because only one user was using DEC applications software.

Out of the 40 responses tabulated above, 38, or 95 percent are in the good-to-excellent range. Although the sample size was small, the users we interviewed were unusually well satisfied. □

➤ Refer to the Peripherals/Terminals table and Price List for specific device slot requirements.

MASS STORAGE

RK8E REMOVABLE DISK CARTRIDGE AND CONTROLLER: Provides storage for 1.6 million 12-bit words (3.2 million characters) with an average access time (including head movement) of 70 milliseconds, and a data transfer rate of 120K words/second. Each disk cartridge records on both surfaces of a single disk, on 200 cylinders, with 2 tracks per cylinder, 16 sectors per track, and 256 words per sector. Up to three RK05 Disk Cartridge Drives can be added to the basic RK8E system for a total of 6.4 million words (12.8 million DECbytes) of storage. The RK8E subsystem uses RK05-KB disk cartridges, is housed in one or more separate cabinets, and plus into three Omnibus slots. The disk cartridges are physically compatible with the IBM 2315 Disk Cartridges used on IBM's 1130 systems.

For information on attachable non-DEC disk drives, please refer to Report M13-100-201, *Minicomputer Add-On Disk and Drum Storage*.

INPUT/OUTPUT UNITS

Please refer to the Peripherals/Terminals table on the third page of this report. Also, compatible non-DEC magnetic tape units can be found in Report M13-100-301, alternative printers can be located in Report M13-100-401, and available punched card and punched tape units are listed, respectively, in reports M13-100-501 and M13-100-601.

COMMUNICATIONS CONTROL

KL8 ASYNCHRONOUS DATA COMMUNICATIONS: A variety of KL8 serial line interface models provide EIA-compatible interfaces for send/receive communications at speeds varying from 110 to 2400 bits/second. KL-8-M Modem Control interfaces for Bell 103 and 202 series modems are used with the KL8 subsystem. Up to seven KL8 terminal interfaces can be attached to a DS-340, with one Omnibus slot required per KL8 and one slot per modem controller.

2780 DATA COMMUNICATIONS SUBSYSTEM: This hardware, which consists of a DP8 Interface, DK8 Clock, and KG8 CRC (check character) unit for error correction, provides an interface for Bell 201 or 208 series modems. The DP8 interface requires two of the four available Omnibus slots. The subsystem includes all necessary hardware in one package and occupies four slots. The 2780 communications hardware package permits operation of the DS-340 as a remote batch terminal replacing an IBM 2780.

SOFTWARE

OPERATING SYSTEM: The DS-340 operates under the Commercial Operating System (COS-300)—a single-user, interactive or batch-oriented, disk-based system that supports program development using DIBOL (Digital Business-Oriented Language) and a sort/merge plus other utilities. COS-300 runs on a minimum DS-340 system with 16K bytes (8K words) of main memory, two disk drives, an operator console, and a line printer.

The COS-300 software comprises the following system components: Operating System—Monitor, System Generator (SYSGEN), and COMpiler; User Language—DIBOL; and Utilities—SORT/Merge, Peripheral Interchange Program (PIP), Build, Update, Print, and various conversion routines.

The Monitor, which controls system operation, exists in two segments: a core-resident version and a version resident on the system disk. The Monitor includes a command language processor, I/O device handlers, loaders, file handlers, editors, and operator messages. The System Generator makes logical device assignments, prints table/device assignments, and configures I/O device handlers. The COMpiler converts DIBOL source programs into machine-executable instructions.

A multi-user option is also available with COS-300 and is included in the price of the first additional terminal. Either a Foreground/Background (F/B) mode or a multiterminal DIBOL package can be run under this option. The multi-user option permits the use of six additional VT05 CRT terminals in foreground partitions (concurrently with a background batch or terminal-oriented application) for keyboard-to-disk data entry, editing, and inquiry. A display-oriented forms language is used to create the foreground program.

A minimum of 24K bytes (12K words) is required for COS-300 when enhanced with the foreground/background capability servicing one additional terminal, 32K bytes (16K words) when servicing two or three additional terminals, and 40K bytes (20K words) when servicing four to six additional terminals.

Included in DEC's multi-user package for the DS-340 is multi-terminal DIBOL (MTD). This package permits any DIBOL application program to control up to seven terminals. All such terminals can simultaneously spool output to a common line printer as well as share and update a single shared data base. The complement of terminals supported can be VT05 CRT displays, LA36 DECwriter II hard-copy terminals, or any combination of the two types up to seven.

Rudimentary multiprogramming can be achieved by incorporating several predefined tasks into a single MTD program. Then, under MTD, a terminal can be dedicated to a single task or be permitted to access any task within the program. Single-user DIBOL programs work with little or no change under MTD. Line printer spooling is automatic, and eight new DIBOL statements are used for file and record sharing and lockout.

LANGUAGE: DIBOL (Digital Equipment Corporation Business Oriented Language) is used to write business application programs. DIBOL consists of data definition and procedure statements similar to a Level 1.5 COBOL.

In arithmetic operations, DIBOL provides decimal arithmetic precision to 15 places. One decimal digit is stored per byte; thus, 1 to 15 bytes are used to store a decimal field onto disk. Further, the language offers ➤

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► program debugging from the console CRT or DECwriter, logical data files, program chaining, and an internal sub-routine facility. Simple DIBOL commands, expressed in English statements, are classified according to type and function:

- Compiler commands—statement type defined
- Control commands—program execution sequence
- Data manipulation—calculations and data movement in main memory
- Data specification—size, type and position of data
- Debug facility—program step trace
- File control—data file open and close
- I/O control—data movement into and from memory.

UTILITIES: With the COS-300 SORT/Merge, the user can specify one to eight subfields in the sort key. The SORT utility also has a file merge capability. The system's editor is interactive, allowing various types of input. The Peripheral Interchange Program (PIP) transfers files from one device to another. The BUILD utility creates data files from a data entry terminal. An UPDATE routine maintains master files. Conversion programs allow the use of OS/8 data files in COS-300 installations. A PRINT utility is used to generate reports.

COMMUNICATIONS SOFTWARE: COS-300 supports an optional IBM 2780 Remote Data Communications emulator package. Its price is \$200 without installation or \$1,700 with installation.

APPLICATIONS SOFTWARE: Applications programs can be developed by users or developed and/or supplied as part of a package by a business OEM. Also, DEC has several general applications packages, such as payroll, general ledger, and accounts receivable. Each DEC applications package bears a one-time license fee of \$1,500.

PRICING

POLICY: The DEC Datasystem 340's are available for purchase or on third-party full-payout leases for one-, three-, or five-year terms (arranged by DEC through Digital Leasing, a subsidiary of U.S. Leasing Corporation). Five-year term leases, for instance, call for a monthly payment of 2.2 percent of the purchase price. Contact DEC for OEM discount information.

Installation and COS-300 software are provided with each Datasystem 340 at no additional charge, while the multi-user option is included in the price of the first additional terminal. A one-time license fee of \$200 (\$1,700 with installation) is made for the 2780 Remote Data Communications software, and there is an additional charge of \$2,600 for the corresponding hardware.

Separately priced hardware maintenance by DEC is available through a field support staff at sites in the United States and Canada and at additional worldwide locations. Purchase of a Datasystem 340 includes a 90-day warranty (parts and labor) and training credits. Basic and Critical Application contracts are offered, with Basic being the lower-cost, one-shift type. Critical Application contracts are available in metropolitan areas to customers needing high-priority field service.

EQUIPMENT: The following typical purchase prices include controllers, adapters, and software.

BASIC DATASYSTEM 340: Processor with 16K bytes (8K words) of core, line printer, two cartridge disk drives, one CRT console, and COS-300 software. Purchase price is \$36,210.

MEDIUM DATASYSTEM 340: Processor with 32K bytes (16K words) of core, line printer, two cartridge disk drives, four CRT terminals, and COS-300 with Fore-ground/Background mode. Purchase price is \$46,675. ■

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EQUIPMENT PRICES

		<u>Purchase Price</u>	<u>Monthly Maint.</u>
DATASYSTEM 340 PACKAGED SYSTEMS			
DS340-H	DS-340 system including 8K words (16K bytes of main storage, CRT console, two disk drives, and COS-300 software	\$30,010	\$243
DS340-J	DS-340 with LA36 DECwriter II instead of CRT console	29,065	245
DS340-K	DS-340 with 32K bytes of main storage, CRT console, two disk drives, and COS-300 software	32,030	286
DS340-L	DS-340 with LA36 DECwriter II instead of CRT and 32K bytes of main storage	31,085	288
DATASYSTEM 340 ADDITIONAL TERMINALS			
DS3D1	VT05 display, interface and Multi-User software	4,730	34
DS3D2	VT05 display, interface	3,305	34
DS3D3	LA36 DECwriter II interface and Multi-User software	3,785	36
DS3D4	LA36 DECwriter II interface	2,360	36
PROCESSOR FEATURES AND MEMORY			
BA8	20-slot Omnibus Expander and power supply	1,850	—
BE8	Omnibus Expander, additional 20 slots	650	—
H967-H	Short Expander cabinet with power supply	800	—
MM8-E	4K words of main storage (3 slots)	2,500	21
MM8-EJ	8K words of main storage (3 slots)	3,900	42
MASS STORAGE			
RK05	Disk Cartridge Drive, 1.6 million words (3 slots)	5,100	64
RK05K	Disk Cartridge, 1.6 million words	99	—
I/O DEVICES			
CR8-F	Punched Card Reader, 300 cpm (1 slot)	4,860	53
LS8-F	Basic Printer, 165 cps (1 slot)	5,900	58
LE8-V	High-Speed Line Printer, 300 lpm (1 slot)	10,500	72
PC8-E	Paper Tape Reader/Punch (1 slot)	4,200	37
TD8-EM	Dual DECTape Drive, 8.3K words/second (1 slot)	5,800	42
DS3TM	9-track, industry-compatible unit with control and 1 tape drive, 45 ips and software utility for IBM format compatibility (4 slots)	14,255	101
COMMUNICATIONS			
DS3CA	2780 Communications Hardware (4 slots)	2,900	18

SOFTWARE PRICES

QF306	2780 Remote Data Communications package	200*	—
QF015	OS/8 (operating system for DEC PDP-8 minicomputer)	300	14
—	Multi-User Option (for COS 300)**	—	—

*Without installation; price with installation is \$1,700. The hardware costs an additional \$2,600.

**See DS3D1 and DS3D3