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 megabytes of disk storage, 8,192 words of main memory, and the COS-300 operating system. The DS-340 is the lone remaining model among the original three announced; the former DS-320 and -330 have been discontinued in favor of the DS-340.

All systems 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 $37,180.

The philosophy behind DEC's entry into the small business computer 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 "systems houses." The primary characteristic of both of these marketplaces is their ability to develop their own software, thus reducing the amount of 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 an intermediary systems house.

What distinguishes the DEC Datasystem 340 from similar configurations otherwise available from Digital ▷

The flexible DS-340 Series of small business computers is based upon DEC's most popular minicomputer—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, 146 Main Street, Maynard, Massachusetts 01754. Telephone (617) 897-5111.

MODELS: DEC Datasystem 340-A, -B, -E, -F (based upon the PDP-8/E).

DATA FORMATS

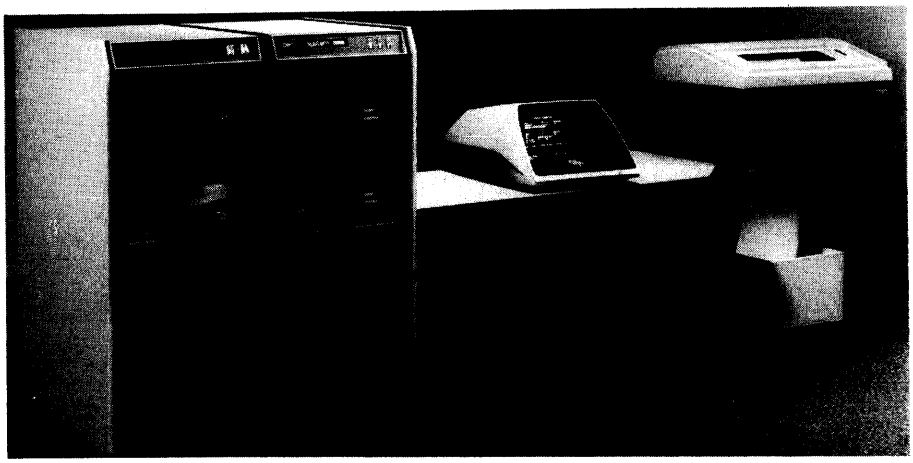
BASIC UNIT: 12-bit word with two characters per word.

FIXED-POINT OPERANDS: 12-bit words are standard.

FLOATING-POINT OPERANDS: No provisions are made.

INSTRUCTIONS: Under COS, a Digital Business Oriented Language (DIBOL) is available that 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.

With the optional Assembly Language software package, the DS-340 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. ➤



The PDP-8/E-based DEC Datasystem 340 can operate under a foreground/background multi-user option that permits simultaneous data entry at any of up to seven 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 $50,680.

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Equipment Corporation on a piecemeal basis is the fact that the components in the DEC Datasystems are physically packaged into special consoles, desks, and other functional office furniture. Further, DEC Datasystems are delivered, installed, and set up in operation under an automatic hardware initializer. On a direct comparison basis, then, packaged DS-340's cost more than the separately purchased DEC components. This difference is generally well worth the price for low-volume systems houses or sophisticated end users, since the difference results from repackaging and additional 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 usually does not need to be 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.

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. In the face of this strong competition, the relatively low cost and high performance of the DS-340's have earned DEC a modest but growing share of the small business computer marketplace, with about 250 installations as of September 1974.

The steadily increasing number of systems houses that make use of the DS-340's (as well as equipment from other vendors) 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

In order for 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.

For direct addressing, 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, 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. 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: ASCII.

MAIN STORAGE

STORAGE TYPE: Magnetic core; diode ROM (bootstrap).

CYCLE TIME: 1.2 microseconds.

CAPACITY: 8K to 32K words in 4K or 8K increments for main memory, and up to 32 words of diode ROM (bootstrap). The bootstrap ROM memory does not consume address space.

CHECKING: Optional.

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

CENTRAL PROCESSOR

GENERAL: The PDP-8/E minicomputer, which is used in all DS-340 models, 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.

REGISTERS: The DS-340 system has eight major registers. Six are 12-bit registers: one accumulator (AC), one general-purpose register for MQ use with the extended arithmetic option, a program counter (PC),

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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
LE8-W	132-position, 96-character (1)	230 lpm
PUNCHED CARD EQUIPMENT		
CM8**	Mark Sense Reader, 80-column (1)	300 cpm
CR8	Reader, 80-column (1)	300 cpm
PAPER TAPE EQUIPMENT		
PC8-E	Reader/Punch (1)	300/50 cps
TERMINALS		
LA30 DECwriter	Hard-copy, 64-character (1)	30 cps
VT05	A/N, 20 X 72 CRT	240 cps

* Numbers in parentheses refer to system chassis slot(s) required by a device.
**No longer offered as a replacement device on DS-340.

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 non-DEC sources.□

memory address (MA) register, switch register (SR) to manually load the contents of memory or other registers, and memory buffer (MB) register to transfer information between other registers and main memory. Also provided are a 3-bit instruction register (IR) that contains the operation code of the current instruction and a 1-bit link (L) register that handles AC overflow for 2's complement arithmetic.

Eight special 16-bit "auto indexing" registers are contained in locations 8 through 15 of the 128-word page "0" of each 4K-word memory module. When one of these locations is addressed indirectly by a memory reference instruction, its contents are automatically incremented by one, and it is used as an operand. When referenced directly, however, the auto index register locations act merely as another memory location.

INDIRECT ADDRESSING: Yes.

INSTRUCTION REPERTOIRE: Six memory reference instructions, 4 interrupt system control instructions, 3 flag processing instructions, and 41 "operate" instructions for logic control, etc.

INSTRUCTION TIMINGS: All times are for full-word, fixed-point operands, in microseconds.

Load/Store:	2.6
Add/Subtract	2.6/5.0
Multiply/Divide:	256.5/343.4
Compare and Branch:	3.8

INTERRUPTS: A single-line interrupt structure is provided, with 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.

PROCESSOR MODES: Two modes are 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/background multi-user option), direct I/O access is denied to user programs.

STACK ORGANIZATION: Automatic push-down stacks are implemented in software to facilitate sharable (reentrant) routines. The size of the push-down stacks is limited only by the size of available memory.

INPUT/OUTPUT CONTROL

OMNIBUS: This synchronous bus is provided with each processor to permit the plugging of memory/processor options or 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.

DIRECT MEMORY ACCESS: A standard 13-channel DMA ("data break") feature is provided for high-speed

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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.

CONFIGURATION RULES: The key to configuring DS-340's 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 for 20 more controller slots.

The basic machine with one CRT or LA30 terminal uses 17 slots in the Omnibus. The additional slots can be used for terminals, communications, or additional mass storage devices.

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 50 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 characters) of storage. The RK8E subsystem uses RK05-KB disk cartridges, is housed in one or more separate cabinets, and plugs into three Omnibus slots.

INPUT/OUTPUT UNITS

See Peripherals/Terminals table.

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 or H308 Null Modem Adapters 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: Provides an interface for Bell 201 or 300 series modems. The DP8 interface requires two of the required four 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's operate under the Commercial Operating System (COS-300)–a single-user, interactive or batch-oriented, disk-based system that supports program development using DIBOL (a DEC business-oriented language) and a sort/merge. COS-300 runs on a minimum DS-340 system with 8K words, 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; Utilities–SORT/Merge, Peripheral Interchange Program (PIP), Build, Update, 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 inlcudes 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 multi-terminal DIBOL package can be run under this option. The multi-user option permits the use of six additional VT05 CRT's in foreground partitions (concurrent with a background batch or terminal-oriented application) for keyboard-to-disk data entry, editing, and job input spooling. A display-oriented language is used to set up the data entry/editing function.

A minimum of 12K words is required for COS-300 when enhanced with the foreground/background capability servicing one additional terminal, 16K words when servicing two or three additional terminals, and 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's, LA30 output writers, 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.

PROGRAMMING: 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 accuracy to 15 places. This accuracy uses 4 words of memory for expressing 15 decimal digits. Further, the language offers program debugging from the console CRT or DECwriter, logical data files, program chaining, and an internal subroutine facility. Simple DIBOL commands, expressed in English statements, are classified according to type and function.

Compiler commands–statement type defined

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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.

APPLICATIONS: All applications programs must be developed either by the user or by a systems house. DEC does not directly provided applications packages such as payroll, inventory control, etc.

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.

COS-300 software is provided with each DEC Datasystem 340 at no additional charge, while the multi-user option is included in the price of the first additional terminal. A separate charge of $2,500 is made for the 2780 Remote Data Communications software.

SUPPORT: Separately priced hardware maintenance by DEC is available through a field support force of more than 1,500 personnel. Purchase of a DS-340 system includes full installation/setup of the hardware, a 90-day warranty, training credits, and COS-300 software. Basic and Commercial maintenance contracts are offered, with Basic being the lower-cost, one-shift type. The Commercial contract is available to systems houses and other large-quantity buyers.

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

BASIC DS-340: Processor with 8K words of core, line printer, two cartridge disk drives, one CRT console, and COS-300 software. Purchase price is $37,180.

MEDIUM DS-340: Processor with 16K words of core, line printer, two cartridge disk drives, four CRT terminals, and COS-300 with F/B. Purchase price is $52,845.■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.
DATASYSTEM 340 PACKAGED SYSTEMS			
DS340-A	DS-340 system including 8K words (16KB) of main storage, line printer, CRT console, two disk drives, and COS-300 software	$37,180	$313
DS340-B	DS-340 with LA 30 DECwriter instead of CRT console	37,030	322
DS340-E	DS-340 with LE8-V line printer instead of basic line printer	42,325	331
DS340-F	DS-340 with LA30 DECwriter and LE8-V line printer instead of CRT and basic line printer	42,175	340
DATASYSTEM 340 ADDITIONAL TERMINALS			
3D1	VT05 display, interface and multi-user software	4,675	34
3D2	VT05 display, interface	3,575	34
3D3	LA30 DECwriter, interface and multi-user software	5,075	42
3D4	LA30 DECwriter, interface	3,975	42
PROCESSOR FEATURES AND MEMORY			
BA8	20-slot Omnibus Expander and power supply	1,750	–
BE8	Omnibus Expander, additional 20 slots	600	–
H967-U	Short Expander cabinet with power supply	700	–
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
RK03	Disk Cartridge, 1.6 million words	107	–
I/O DEVICES			
CR8-F	Punched Card Reader, 300 cpm (1 slot)	4,860	53
LS8	Basic Printer, 165 cps (1 slot)	*	*
LE8V	Line Printer, 132 positions, 300 lpm (1 slot)	*	*
LE8IV	Line Printer, 132 positions, 230 lpm (1 slot)	*	*
PC8-E	Paper Tape Reader/Punch (1 slot)	3,900	37
TD8-EM	Dual DECtape Drive, 8.3K words/second	5,500	42
TM8-E	9-track, industry-compatible unit with control and 1 tape drive, 45 ips (4 slots)	13,500	101
VT05B	CRT Display, 20 lines, 72 chars./ line	2,795	–
COMMUNICATIONS			
3CA	2780 Communications Hardware (4 slots)	2,430	18
LK8-EG	Asynchronous Interface	375	–
H308	Null Modem Adapter	65	–
SOFTWARE			
QF306	2780 Remote Data Communications package	2,500	–
QFS8	OS/8 (operating system for DEC PDP-8 minicomputer)	300	14

*Printers cannot be bought separately, but rather form part of the various DS-300 packaged systems.