

DEC Datasystem 300 Series

MANAGEMENT SUMMARY

When announced in June 1972, the DEC Datasystem 300 Series included Models 320, 330 and 340 for both interactive and batch operations. The primary difference between these systems lies in their auxiliary storage configurability. The basic Model 320 has dual DECTape drives, the basic Model 330 has one dual DECTape unit and one 3.2-million-character disk cartridge, and the basic Model 340 has two 3.2-million-character disks.

All systems run under the COS-300 operating system, and an extra-cost, disk-based foreground/background multi-programming option is available with Models 330 and 340 to support up to seven terminals for shared-processor data entry applications. The DDS-300 systems start at less than \$30,000 purchase for Model 320, and reach to \$33,735 for the basic Model 340, although expanded configurations can cost up to \$87,000.

The philosophy behind DEC's entry into the small business computer marketplace is quite interesting and deserves comment. The DEC Datasystems are sold as new packaged configurations of standard DEC equipment, together with 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 not turnkey systems dedicated to specific problem solutions with pre-programmed applications. Rather, application programs must either be developed directly by the end user or prepared for him by an intermediary systems house.

As one of the most flexible small business computer systems available today, the DDS-300 Series includes three current models based upon DEC's most popular minicomputer — the 12-bit PDP-8/E. The DDS-300 Series offers the Commercial Operating System designed to support general business applications, including shared-processor data entry applications in both batch and interactive modes.

CHARACTERISTICS

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

MODELS: DEC Datasystem 320, 330, and 340 (all based upon the PDP-8/E).

DATA FORMATS

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

FIXED-POINT OPERANDS: 12-bit words standard, with optional 24-bit double-precision operands.

FLOATING-POINT OPERANDS: No provisions made.

INSTRUCTIONS: At the user level, 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 DDS-300 offers one-word instructions, although no



The PDP-8/E-based DEC Datasystem 340 shown here is operating under the foreground/background multi-programming option that permits simultaneous data entry at any of three terminals concurrent with background batch processing.

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➤ That which distinguishes the DEC Datasystems 300 systems from another configuration that is 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 consoles, desks, and other functional office furniture, plus the fact that the DEC Datasystems are delivered, installed, and set up in operation under an automatic hardware initializer for the user's choice of operating system residency (tape or disk). On a direct comparison basis, packaged DDS-300's cost more than the separately purchased DEC components, and this difference is generally well worth the price for low-volume systems houses or sophisticated end users.

The basic marketing strategy for DEC's DDS-300 is to promote distributed systems as an alternative to or satellite for centralized computing facilities in large or geographically dispersed companies that have small-to-medium sized interactive or batch processing requirements at the remote site, and data processing budgets of about \$30,000 to \$40,000 per site.

Each of the DDS-300 systems also has a communications option that can make the system look like an IBM 2780 batch terminal for data communications networks.

Although the DDS-300's are not marketed directly against installed IBM equipment, DEC's DIBOL business language is very similar to COBOL, and DEC often does encounter competition from the IBM System/3 Model 6, as well as from the Burroughs L 8000, NCR 399, Basic/Four, and a variety of other small business or small accounting computers. In all, however, the relatively low cost and high performance of the DDS-300's have earned DEC a modest but growing share of the small business computer marketplace (with about 75 installations as of July 1973).

The steadily increasing number of systems houses that make use of the DDS-300'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 DDS-300'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 DDS-300 basic package available directly from DEC, but also to the availability of turnkey packages from non-DEC sources. □

➤ 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 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 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.

INTERNAL CODE: ASCII.

MAIN STORAGE: 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 PROCESSORS

GENERAL: The PDP-8/E minicomputer which is used in all DDS-300 models is a simple, single-address parallel machine using 2's complement arithmetic on 12-bit binary numbers with an accumulator and multiplier/quotient architecture and direct accumulator-to-device and device-to-accumulator I/O transfers. The DDS-300 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 DDS-300 systems each 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), 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

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	SPEED
MAGNETIC TAPE UNIT TD8-EM	Dual Drive DECTape, 97 ips, block addressable, 189K words capacity	8,325 words/sec.
LINE PRINTERS LS8 LE8 J/F	132-position, 64-character 80/132 position, 64-character	165 cps 245-1110/ 356-1110 lpm
PUNCHED CARD EQUIPMENT CM8 CR8	Optical Reader, 80-column Reader, 80-column	300 cpm 300 cpm
PAPER TAPE EQUIPMENT PC8-E	Reader/Punch	300/50 cps
TERMINALS LA30 DECwriter VT05	Hard-copy, 64-character A/N, 20 X 72 CRT	20 cps 300 bps

► 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 any other memory location.

INDIRECT ADDRESSING: Yes.

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

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

Load/Store:	2.6
Add/Subtract:	2.6/5.0
Multiply/Divide:	256.5/342.4
Compare and Branch:	3.8

INTERRUPTS: A single line in interrupt structure is provided, with software polling of I/O devices required to determine the precise nature and priority of the 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 multiprogramming), direct I/O access is denied to user programs.

STACK ORGANIZATION: Automatic push-down stacks are implemented in software to facilitate shareable (re-entrant) 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 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 DDS-300'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 18 more controller slots.

The basic machine with one terminal uses 16 slots (DDS-320), 18 slots (DS-330), or 17 slots (DS-340) 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 ►

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► RK8E subsystem uses RK05-KB disk cartridges, is housed in a separate cabinet(s), 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 interface 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 modem or H308 Null Modem Adapters are used with the KL8 subsystem. Up to 7 KL8 terminal interfaces can be attached to a DDS-300, with one Omnibus slot required per KL8, and one slot per modem controller.

DP8 SYNCHRONOUS DATA COMMUNICATIONS SUB-SYSTEM: Provides interface for Bell 201-type modems or Bell 300 series modems. The DP8 interface requires two Omnibus slots.

SOFTWARE

OPERATING SYSTEM: The DDS-300's operate under the Commercial Operating System (COS-300) – a single-user, interactive or batch-oriented disk-based system that supports program development for DIBOL (a DEC business oriented language) and a sort/merge. COS-300 runs on a minimum DDS-300 system with 8K words, two dual DECTapes or two disk drives, an operator console, and a line printer.

A Foreground/Background option is also available for COS-300 at a separate purchase cost of \$1,000. This option permits the use of three 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 (multi-

programming) capability servicing one additional terminal, and 16K words servicing two or three additional terminals.

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.

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

PRICING

POLICY: The DEC Datasystem-300's are available for purchase, or on third-party full payout leases, for one-, three-, and five-year terms (arranged by DEC through Digital Leasing, a subsidiary of U.S. Leasing Corporation). Five-year terms, for instance, call for a monthly payment of 2.2% of the purchase price. COS-300 is provided with each DEC Datasystem-300 at no additional charge, while the data entry (multiprogramming) option is \$1000 additional.

SUPPORT: Separately-priced hardware maintenance by DEC is available through a field support force of more than 1000 personnel. Purchase of a DDS-300 system includes full installation/setup of the hardware, a 90-day warranty, training credits, and COS-300 software.

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

DDS-330: Processor with 8K words of core, line printer (165 cps), CRT Console, two DECTape drives, one cartridge disk drive, and COS-300 software. Purchase price is \$33,600.

DDS-340: Processor with 8K words of core, line printer, two cartridge disk drives, one CRT console, and COS-300 software. Purchase price is \$33,800.

DDS-340: Processor with 16K words of core, line printer, two cartridge disk drives, four CRT terminals, COS-300 with F/B. Purchase price is \$49,600. ■

EQUIPMENT PRICES

DATASYSTEM 320		<u>Purchase Price</u>	<u>Monthly Maint.</u>
DS320-A	DDS 320 (includes 8K words, serial printer, CRT, 4 DECTape drives, COS-300)	\$29,875	\$333
DS320-B	DDS 320 with LA30 DECwriter instead of CRT	29,775	247
DS320-C	DDS 320 with LE8-JA line printer instead of basic serial printer	41,460	265
DS320-D	DDS 320 with LA30 DECwriter and LE8-JA line printer instead of CRT and basic serial printer	41,340	274
DATASYSTEM 330			
DS330-A	DDS 330 (includes 8K words, serial printer, CRT, 2 DECTape drives, one disk drive, COS-300)	33,530	268
DS330-B	DDS 330 with LA30 DECwriter instead of CRT	33,410	277
DS330-C	DDS 330 with LE8-JA line printer instead of basic serial printer	45,115	295

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EQUIPMENT PRICES		Purchase Price	Monthly Maint.
DATA SYSTEM 330 (Continued)			
DS330-D	DDS 330 with LA30 DECwriter and LE8-JA line printer instead of CRT and basic serial printer.	\$44,995	\$304
DATASYSTEM 340			
DS340-A	DDS 340 (includes 8K words, serial printer, CRT, two disk drives, COS-300)	33,735	288
DS340-B	DDS 340 with LA30 DECwriter instead of CRT	33,615	297
DS340-C	DDS 340 with LE8-JA line printer instead of basic serial printer	45,320	315
DS340-D	DDS 340 with LA30 DECwriter and LE8-JA line printer instead of CRT and basic serial printer	45,200	324
DATASYSTEM 300 UPGRADES			
DS320-U	DDS 320 to DDS 330 (includes one disk drive)	8,600	98
DS320-V	DDS 320 to DDS 340 (includes two disk drives)	13,700	182
DS330-U	DDS 330 to DDS 340 (includes one disk drive)	5,100	84
MEMORY/PROCESSOR FEATURES			
BA8	20-slot Expander	1,620	—
BE8	Omnibus Expander	540	—
H967-E	Short Expander cabinet	465	—
H967-U	Short Expander cabinet with End Panels	700	—
MM8-E	4K words of main storage	2,500	28
MM8-EJ	8K words of main storage	3,900	56
MASS STORAGE			
RK05	Disk Cartridge Drive (1.6 million words)	5,100	84
RK03	Disk Cartridge (1.6 million words)	107	—
I/O DEVICES			
CM8-F	Optical Mark Card Reader, 300 cpm	5,290	—
CR8-F	Punched Card Reader, 300 cpm	4,860	—
LS8	Serial Printer, 165 cps	—*	—*
LE8 J	Line Printer, 80 pp, 245-11/0 lpm	—*	—*
LE8 F	Line Printer, 132 pp, 356-11/0 lpm	—*	—*
PC8-E	Paper Tape Reader/Punch	3,900	—
TD8-EM	Dual DECtape Drive, 8.3K words/second	5,000	—
VT05B	CRT Display, 20 lines, 72 chars./line	2,795	—
COMMUNICATIONS			
KL8-EG	Asynchronous Interface	375	—
H308	Null Modem Adapter	65	—
SOFTWARE PRICES			
QF300	Data Entry Software for Foreground/Background	1,000	—
QFS8	OS/8 (operating system for DEC PDP-8 minicomputer)	300	—

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