Data General Commercial Systems Family

MANAGEMENT SUMMARY

Data General has filled out its Commercial Systems family with the announcement of two low-end CS/10 models, Mod C1 and C3, and two high-end CS/70 models, C5 and C6, bringing the total number of CS models to 17. The packaged system line extends from the single-user, entry-level CS/10 to multiprogramming CS/70 models that support concurrent applications processing, program development, data communications, and utility functions.

The basic component of each of the CS systems is a Data General microNova, Nova 3, Nova 4, Eclipse S/130, or Eclipse S/140 processor equipped with floppy, cartridge, or disk pack storage and from one to 17 terminals. Other common denominators for the systems are an interactive COBOL compiler and Data General's Interactive COBOL Operating System (ICOS), an adaptation of the proven RDOS system. The COBOL compiler is implemented at either Level 1 or Level 2 of the 1974 ANSI standard. It is not the same as the compiler used in Data General's Eclipse, which boasts full Level 2 implementation.

The choice of COBOL as the programming language for the CS series seems to confirm Data General's basic OEM posture. It is not likely that small end users would hire a full-time COBOL programmer, but systems houses can tap the large pool of available COBOL programmers to develop both generalized and specialized applications programs efficiently. Data General has tied a wide range of processors together with compatible software to provide a broad choice of hardware for systems developers to build upon. ▷

Data General's packaged Commercial Systems line now includes two CS/10, one CS/20, two CS/30, four CS/40, three CS/50, three CS/60, and two CS/70 models. These systems are based on proven hardware and software. MicroNova, Nova, or Eclipse processors drive the systems, and ICOS, an adaptation of Data General's RDOS, is the operating system.

MAIN MEMORY: 64K to 512K bytes
DISK CAPACITY: 0.63 to 760 megabytes
WORKSTATIONS: Up to 17 active
PRINTERS: 30 cps to 900 lpm
OTHER I/O: Magnetic tape

CHARACTERISTICS

MANUFACTURER: Data General Corporation, 4400 Computer Drive, Westboro, Massachusetts 01581. Telephone (617) 366-8911.

Data General is a leading manufacturer of minicomputers, peripherals, and associated equipment. The company maintains sales offices in most major North American cities and in South America, Europe, and Australia. Manufacturing operations are located in Southboro, Massachusetts; Westbrook, Maine; Portsmouth, New Hampshire; Johnston Center, North Carolina; and Sunnyvale, California. Assembly operations are also performed in Hong Kong and in Thailand.

MODELS: CS/10 Mod C1 and C3; CS/20; CS/30 Mod C1 and C3; CS/40 Mod C3, C4, C5, and C6; CS/50 Mod C3, C5, and C6; CS/60 Mod C3, C5, and C6; and CS/70 Mod C5 and C6. ▶
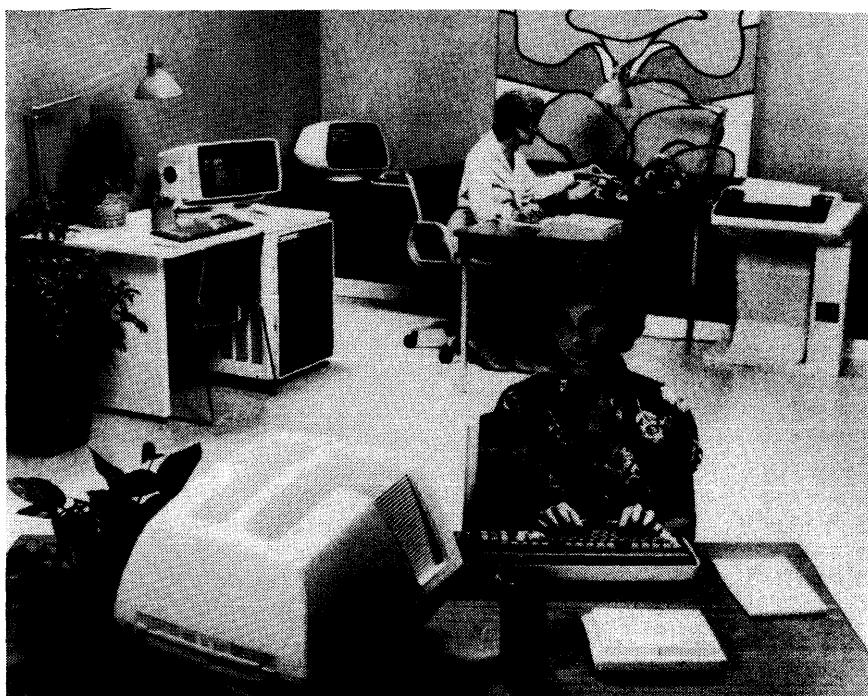
Data General Corporation's Commercial Systems CS/10 is a new low-end computer for companies in the $100,000 to $20 million range. The interactive COBOL-based system can expand from a single-station system with 2.4MB of diskette storage to a four display system with up to 50MB of disk storage.

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CS FAMILY CHARACTERISTICS

MODEL	CS/10	CS/20	CS/30	CS/40	CS/50	CS/60	CS/7█
Processor	microNova	microNova	microNova	Nova 3/D	Nova 4	Eclipse S/130	Eclipse S/140
Maximum number of terminals	4	1	4	9	9	17	17
Recommended number of terminals	1 to 4	1	1 to 4	1 to 9	1 to 9	1 to 17	1 to 17
Main memory capacity, bytes: Minimum Maximum	64K 128K	64K 64K	64K 64K	64K 192K	64K 256K	64K 512K	64K 512K
Disk capacity, bytes: Minimum Maximum	2.4M 50M	.63M 1.26M	10M 20M	10M 760M	20M 760M	20M 850M	20M 850M
Communications	Optional	Optional	Optional	Optional	Optional	Optional	Optional
Run-time monitor	Disk swapping or memory mapping	Single terminal	Disk swapping or memory mapping	Disk swapping or memory management	Disk swapping or memory management	Disk swapping or memory management	Disk swapping or memory mapping

▷ A summary of the seventeen currently available CS models follows:

- CS10—single or multi-user with microNova processor, up to 128K bytes of memory, 2.4 megabytes of floppy disk storage expandable to 50 megabytes of fixed disk storage, and one to four interactive terminals.

- CS/20—single-user system with a microNova processor, 64K bytes of MOS memory, and from .6 to 1.2 megabytes of floppy disk storage.

- CS/30 Mod C1 and C3—include 64K bytes of MOS memory, 10 to 20 megabytes of fixed/removable disk cartridge storage, and from one to four interactive terminals.

- CS/40 Mod C3 and C5—include a Nova 3/D processor, 64K (C3) or 128 to 192K (C5) bytes of MOS memory, 10 to 190 megabytes of disk cartridge storage, and up to four (Mod C3) or nine (Mod C5) interactive terminals.

- CS/40 Mod C4 and C6—also based on the Nova 3/D processor, with 64K (C4) or 128K (C6) bytes of MOS memory, a 9-track 800-bpi tape transport, and up to four (Mod C4) or nine (Mod C6) interactive terminals. 50-, 96-, or 190-megabyte disk pack drives are standard, but up to 200, 384, or 760 megabytes of disk storage are available.

- CS/50 Mod C3 and C5—include a Nova 4 processor, 64K (C3) or 128K (C5) bytes of MOS memory, 20 megabytes of fixed/removable disk cartridge storage, an 800 or 800/1600 bpi tape transport, and three interactive terminals.

- CS/50 Mod 6—also includes a Nova 4 processor with 128K bytes of MOS memory, 50 megabytes of disk pack storage, an 800 or 800/1600 bpi tape transport, and up to nine interactive terminals. ▷

▶ DATE ANNOUNCED: CS/10, July 1980; CS/20, May 1978; CS/30, April 1979; CS/40 Mod C3 and C5, May 1977; CS/40 Mod C4 and C6, December 1977; CS/50, February 1980; CS/60, May 1978; CS/70, July 1980.

DATE OF FIRST DELIVERY: CS/40 Mod C3 and C5, September 1977; CS/20, September 1978; CS/60, September 1978.

DATA FORMATS

BASIC UNIT: 16-bit word or 8-bit byte.

FIXED-POINT OPERANDS: 16-bit words can be interpreted as signed or unsigned binary numbers, logical words, memory addresses, or portions of decimal character strings.

Decimal numbers can be either character decimal or packed decimal. In character decimal format, each digit is an 8-bit ASCII character, and the sign is either carried separately as an extra character at the beginning or end of the decimal string or by modifying either the first or last digit in the string. The packed decimal format places each digit in 4-bit hexadecimal code with a separate sign character at one end of the string.

FLOATING-POINT OPERANDS: 32-bit single-precision operands with 7-bit exponent and signed 24-bit fraction; and 64-bit double-precision operands with a 7-bit exponent and signed 56-bit fraction. Single- and double-precision floating-point arithmetic is implemented through software subroutines. No hardware floating-point arithmetic is available.

INSTRUCTIONS: One-word instructions. There are four basic instruction types; each with different formats: Jump and Modify Memory, Move Data, I/O and Arithmetic and Logic. In all instructions, bits 0-2 specify the instruction type.

In Jump and Modify instructions, bits 3 and 4 identify the specific function (op code), and the rest of the word contains information used to calculate the effective address, including an 8-bit displacement, 2-bit index register specification, and 1-bit indicator to specify direct or indirect addressing.

In Move Data instructions, bits 3 and 4 address an accumulator, and the rest of the word is identical in structure to the Jump and Modify type above. ▶

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION	MANUFACTURER
MAGNETIC TAPE EQUIPMENT		
6021	Add-on transport and controller; industry-compatible, 9-track, 10.5-inch reels, 75 ips, 800 bpi, vacuum columns, 8 drives per controller; 60 KBS	Data General
6026	Transport and controller; industry-compatible, 9-track, 10.5-inch reels, 75 ips, 800/1600 bpi	Data General
LINE PRINTERS		
9129/9179/9185	Dasher LP2 Serial; 5 x 7 dot matrix, 132 positions, 64 ASCII character set, 10 or 5 characters per inch, 6 lines per inch; 180 cps	Data General
9125/4218/9260	Drum; 136 positions, 64 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12 channel VFU/DAVFU; 300 lpm	Dataproducts
9128/4219/9261	Drum; 136 positions, 96 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12 channel VFU-DAVFU; 240 lpm	Dataproducts
4216	Drum; 136 positions, 64 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12-channel DAVFU, 436 lpm	Dataproducts
4215	Drum, 136 positions, 64 ASCII character set, 10 character per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12-channel DAVFU, 600 lpm	Dataproducts
4245	Drum; 136 positions, 96 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12-channel DAVFU, 660 lpm	Dataproducts
4244	Drum; 136 positions, 64 ASCII character set, 10 characters per inch, 6 or 8 lines per inch, 4- to 16.8-inch paper, 12-channel DAVFU, 900 lpm	Dataproducts
TERMINALS		
6041	Dasher TP1 Serial; 5 x 7 dot matrix, 132 positions, 96 ASCII character set, 10 characters per inch, 6 lines per inch, RO, 30 or 60 cps	Data General
6076	Dasher TP2 Serial; 7 x 9 dot matrix, 132 positions, 96 ASCII character set, 16.6 characters per inch, 6 or 8 lines per inch, RO, 180 cps	Data General
4320	Letter quality printer; 96 character set, 136 positions, 10 or 12 characters per inch, 6 or 8 lines per inch, up to 55 cps	
6053	CRT display/keyboard, 1920 characters, 24 by 80, 96 ASCII character set, 5 x 8 dot matrix, detachable keyboard, 8 ftn. keys, 11-key data entry pad, and other features such as direct cursor positioning and programmable intensity	Data General
6093	Dasher D3 display/keyboard, 1920 characters, 24 x 80, 96 ASCII character set, 5 x 8 dot matrix, detachable keyboard, 18 function keys, and 15-key data entry pad	Data General
6120	Dasher D4 User Diagnostic Display (often used as master console)	Data General

▷ ● CS/60 Mod C3 and C5—include an Eclipse S/130 processor, 64K (Mod C3) or 128K to 256K (Mod C5) bytes of MOS memory, 20 to 40 megabytes of disk cartridge storage, a 9-track 800-bpi tape transport, and up to four (Mod C3) or nine (Mod C5) interactive terminals.

● CS/60 Mod 6—supports up to 17 interactive terminals using an Eclipse S/130 processor with 128K to 512K bytes of memory, up to four 50-, 96-, or 190-megabyte disk pack drives can be included for a maximum of 760 ▷

▶ In I/O instructions, bits 5 through 9 specify the function (indication of transfer direction, selection of an I/O device register, and/or specification of an operation). Bits 3 and 4 select an accumulator for transfer, and bits 10 through 15 indicate a specific device.

Arithmetic and Logic instructions are bits 1 and 2 to identify an accumulator containing a second operand (if present), bits 5 through 7 to specify primary function, and the rest of the word to specify secondary functions, if any.

For all memory reference instructions, bits 5 through 15 are used for addressing, using bits 8 through 15 as the ▶

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▷ megabytes of mass storage, and a 9-track 800-bpi magnetic tape transport is available for backup.

- CS/70 Mod C5—includes Eclipse S/140 processor, up to 256K bytes of MOS memory, 25 megabytes of fixed disk storage, 20 megabytes of cartridge disk storage, and up to nine terminals.

- CS/70 Mod C6—supports up to 17 interactive terminals using S/140 processor with 128K to 512K bytes memory; up to four 50-, 96-, or 190-megabyte disk pack drives; a 9 track 800/1600 bpi tape transport.

The interactive COBOL compiler allows programs written for the CS/10 to be run on the CS/20, 30, 40, 50, 60, and 70 models without recompilation. Down-loading, within hardware limitations, is possible. Menu selection control and fill-in-the-blanks data entry are featured.

The Interactive COBOL Operating System (ICOS) for the CS series is an adaptation of Data General's proven RDOS operating system. It provides data management facilities, multi-terminal control, program development aids, and spooling capability. Sequential, relative, and multiple-key indexed sequential (ISAM) access methods are included. ICOS can address up to 256K bytes of main memory and support up to 16 terminals in concurrent processing. It includes on-line program development and interactive debugging capabilities, and supports transaction-driven applications processing.

Three utility function areas are supported on the CS systems: sorting, data base backup, and data communications. Up to six files can be merged together, with larger systems sorting indexed sequential files on one of up to four alternate keys or the primary key. Records can be reformatted and fields can be deleted during the sort. The reorganization utility can convert indexed or relative files to sequential files and vice versa, and can also copy files from one media to another. Optional synchronous communications with other CS computers and either larger Data General or IBM-compatible host systems are supported. Batch data communications are controlled by DG's RJE-80 facility using IBM 3780/2780 protocols and HASP workstation emulators.

USER REACTION

Datapro received responses from 15 users of Data General's Commercial Systems line in the 1980 survey of computer users. There were 17 systems reported including one CS/30 system, eight CS/40 systems, and eight CS/60 systems. The system in longest use had been installed since December 1977, while the average age of all systems involved was 10.7 months. Two systems were being leased and the remaining systems were obtained by outright purchase.

Accounting was the most popular principal application, listed by 93% of the users. Also mentioned were payroll/personnel (47%), manufacturing (20%), service ▷

▶ displacement or direct address. Each instruction and address 256 words directly, or can use either relative or base register addressing.

INTERNAL CODE: ASCII and binary.

MAIN STORAGE

TYPE: Dynamic MOS RAM, requiring 64 refresh cycles every 1.8 milliseconds. Refresh is overlapped with CPU execution.

CYCLE TIME: 960 nanoseconds for the CS/20 and CS/30; 700 nanoseconds for the CS/40, CS/50, and CS/60; and 400 nanoseconds for the CS/70.

CAPACITY: 64K to 512K bytes in 16K or 64K increments.

CHECKING: None on the CS/20 or CS/30, optional even or odd software parity checking on the CS/40, and standard Error Checking and Correction (ERCC) on the CS/60 and CS/70.

STORAGE PROTECTION: None on the CS/10, 20, and 30, an optional memory management unit on the CS/40, 50, and 60. The memory management unit is standard on CS/70 systems. An optional memory allocation and protection unit (MAP) is available on the CS/60 and CS/70.

The CS/40 and CS/50 memory management unit divides main memory into 2K-byte pages and protects them through software support. I/O, validity, and runaway defer protection are also provided. Validity protection prevents users from altering or addressing physical memory assigned to another user or the supervisor, and runaway defer protection prevents infinite indirect loops.

The CS/60 and CS/70 MAP units also provides I/O, validity, and runaway defer protection, as well as write protection and data channel protection. MAP allocates memory in 2K-byte blocks, up to 32 blocks per user. MAP or the memory management unit is required if main memory is expanded beyond 64K bytes. Both translate 15-bit logical addresses into 20-bit physical addresses for loading programs and data into upper memory.

CENTRAL PROCESSOR

All of the Commercial System (CS) processors feature power monitor/auto restart, automatic program load, and a real-time clock.

The CS/10, CS/20, or CS/30 CPU and 4K RAM are built on one 7.5-by-9.5-inch printed circuit board, with asynchronous and general-purpose I/O boards as well as PROM memory boards included on a rack-mountable 18-slot chassis. A hand-held programmer's console is standard.

The CS/40, CS/50, and CS/60 processors, mounted on 15-inch-square boards, feature a hardware last-in, first-out stack facility as well as a hardware multiply/divide feature. Both are housed in a 12 slot chassis.

The CS/60 and CS/70 series is based on microprogrammed architecture with an asynchronous memory bus to accommodate various storage types and communications/peripheral interfaces. Programmed I/O transfer, a priority interrupt system, and a direct memory access channel are included. Variable-length stack frames with randomly accessible elements provide subroutine linkages and preserve contact integrity in reentrant coding. The floating-point capability is a 64-bit double-precision operation with four 64-bit accumulators and a monitoring status register. It is implemented in firmware, rather than as a separate processor. ▶

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The Commercial Systems CS/70 is Data General Corporation's new top-of-the-line model for its Interactive COBOL-based family of small business systems. The CS/70 is intended for companies with sales of over $20 million. It can support up to 17 display terminals and up to 760MB of disk storage. Prices for the new computer system start in the $40,000 range.

▷ bureaus (13%), retail (13%), medical/health care (13%), and transaction processing (13%) as principal applications. COBOL is the only programming language that can be used by the owners of these CS Series systems. Ten users reported that in-house personnel were the source of application programs, six users obtained their programs through contract programming, five users acquired proprietary software packages, and four users supplemented their programming needs with "ready-made" programs from Data General.

Main memory capacities ranged from 64K to 512K bytes, while disk capacities varied from 10 megabytes to the maximum, and one user reported having 350K bytes in diskette capacity. The largest number of workstations per system was 11 and the average was 4.1.

The table below summarizes the ratings provided by these users.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	4	9	1	1	3.1
Reliability of mainframe	5	8	0	2	3.1
Reliability of peripherals	5	6	2	2	2.9
Maintenance service:					
Responsiveness	1	11	3	0	2.9
Effectiveness	2	7	4	1	2.7
Technical support:					
Trouble-shooting	0	4	7	3	2.1
Education	1	4	8	1	2.4
Documentation	1	7	5	1	2.6
Manufacturer's Software:					
Operating system	4	7	3	1	2.9
Compilers & assemblers	3	7	2	1	2.9
Applications programs	1	4	2	1	2.6
Ease of programming	5	6	3	0	3.1
Ease of conversion	2	6	3	1	2.8
Overall satisfaction	4	8	0	2	3.0

*Weighted Average on a scale of 4.0 for Excellent. ▷

▶ The CS/60 and CS/70 programmer's console includes an Address Compare facility to aid in debugging real-time assembly programs. Three user modes are provided: Monitor, Stop/Address, and Stop/Store. In Monitor mode, the programmer can dynamically display the contents of any memory location via console data switches while a program is executing. Stop/Address mode allows a programmer to halt the CPU at a preset address or breakpoint; on the console are shown both the instruction and the address of the instruction attempting to access the preset location. Stop/Store mode halts the CPU only if a program tries to alter a preset storage location.

CONTROL STORAGE: 0.5K, 1K, 2K, or 4K words of PROM (programmable read-only memory) are available for the CS/10, CS/20 and CS/30. Each size of PROM module is separately mounted on a memory board. The CS/40 does not include control storage. The microprogrammed CS/50, CS/60, and CS/70 machines all run under the influence of microinstructions automatically accessed from control storage that is inaccessible to users. The read-only memory (ROM) consists of 2K 56-bit words with an access time of 200 nanoseconds.

REGISTERS: All CS processors have four 16-bit accumulators and a 15-bit program counter. Two accumulators can be used for address indexing. The CS computers also have a last-in/first-out (LIFO) push-down stack implemented in any 256 consecutive memory locations and two additional hardware registers, the stack pointer and the frame pointer. The stack pointer identifies the first memory location designated as the stack, and the frame pointer marks intra-stack boundaries to permit several "register saves" to be accumulated in the stack.

Beyond these hardware registers, the CS processors also have 16 reserved memory locations which function as auto-increment or auto-decrement registers when addressed indirectly.

ADDRESSING MODES: All CS processors have six addressing modes: direct (256 words), indirect (multi-level), indexed, indexed-indirect (pre-indexing), program-relative, and program relative-indirect. ▶

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▷ The larger sampling of Datapro's 1980 survey yielded a decline in every category over the previous survey compiled in 1979, which is most likely due to the fact that users are gaining experience with their CS Series systems. The negative comments cited by the users include late delivery/installation of equipment (47%), vendor did not provide all promised software/support (33%), and the system proposed by the vendor was too small (20%). Two users mentioned excessive static problems, and one user from a northwestern industrial company complained of excessive downtime—over 30% the first six months.

On the positive side, 53% of the users surveyed said the system was easy to expand/reconfigure, 33% of the users agree that programs/data were compatible as promised and that productivity aids help keep programming costs down, and 27% of the CS Series systems users were happy with response time.

Despite the lower weighted averages recorded this year, 79% of all users polled in this survey said that they would recommend this system to another user in the same situation.□

▶ When memory mapping is implemented, the 15-bit logical address coming from the CPU or data channel is translated to a 20-bit physical address. Memory access cycle time is unchanged.

The mapping information needed to service a CPU or data channel request is given to the address translation hardware by the operating system through I/O instructions that reference the address translation hardware. This information is transmitted before the supervisor enables either the user map or the data channel map.

All addresses can be mapped, including those acquired from DMA controllers.

INSTRUCTION REPERTOIRE: The CS/10, CS/20, CS/30, CS/40, and CS/50 processors have the same basic complement of 4 Jump and Modify Memory instructions, 2 Move Data instructions, 7-stack processing instructions, 16 I/O instructions, and 8 arithmetic and logic instructions. (There are 256 variations on each of the arithmetic and logic instructions.) Hardware multiply/divide instructions are standard. The CS/60 and CS/70 processor's complement of instructions includes: Arithmetic (30); Logical (15); Byte Manipulation (4); Bit Manipulation (7); Data Movement (2); Stack Manipulation (10); Program Flow Alteration (12); I/O (8); CPU (8); ERCC (3); Real-Time Clock (1); and Power Fail/Auto Restart (2).

INTERRUPTS: A 16-level programmed priority interrupt facility is used to recognize interrupts for I/O operations. Each device on CS/10, CS/20, CS/30, CS/40, and CS/50 systems is wired to one of 16 bus positions, and is either authorized or denied authorization to interrupt particular service routines by an Interrupt Disable Mask Bit that corresponds to the bus positions of the device. A CS/60 or CS/70 interrupt-handling instruction, Vector, provides servicing through device identification and vectoring to a device handler or through device identification, saving the machine state, switching stacks, and priority updating. The interrupt facility is implemented in hardware.

PHYSICAL SPECIFICATIONS: The CS/10, CS/20, and CS/30 are housed in an 18-slot chassis that is 5.25 inches high, 19 inches wide, and 27.5 inches deep. The CS/40, CS/50, CS/60, and CS/70 chassis are 10.5 inches high, 19 inches wide, and 23 inches deep. They weigh up to 130 pounds.

Power requirements for all chassis types are 110, 120, 220, or 240 VAC +10 percent, 47 to 63 Hz. Operating temperatures are 32 to 132 degrees F. A relative humidity of up to 90 percent, noncondensing, can be tolerated. The BTU/hour output of the processors ranges from 1023 to 4080.

INPUT/OUTPUT CONTROL

INPUT/OUTPUT CHANNELS: An I/O bus and a Direct Memory Access (DMA) channel are standard on all CS processors. The I/O bus is serial in nature, and it functions to provide communication between mainframe-based I/O boards and the CPU board. The DMA data channel provides a multiplexer-like capability, and can be seized by any device through a data channel request to handle 16-bit data transfers to and from main memory. DMA is used for disk and magnetic tape I/O, as well as for high-speed terminals. The channel transmission rates range from 148,000 to 1.25 million words per second for input, and from 173,000 to 714,285 words per second for output.

SIMULTANEOUS OPERATIONS: DMA input/output operations are overlapped with processing through cycle stealing so as to be concurrent on all systems. Within the CS/40, CS/50, CS/60, and CS/70 processors, overlapped execution of one instruction and fetching of the next (i.e., "pipelining") take place automatically.

CONFIGURATION RULES

The maximum configuration parameters for the Commercial Systems are as follows:

● Up to 512K bytes of main memory.

● Up to 760 megabytes of on-line disk storage.

● Up to 17 terminals (16 active with concurrent operations).

WORKSTATIONS: Up to 17 CRT's (16 in concurrent operation) and/or printers can be connected. One of the 17 can be a Dasher D4 or D5 diagnostic display which can operate either as a control console or as a remote diagnostic terminal. Concurrent operations require a second control console, with or without a second system printer.

Terminal Connection Units (TCU) contain a 4-line asynchronous multiplexer to support 4 CRT's, a master or concurrent console interface, and a programmed I/O printer interface. Mod C5's and C6's support up to 4 TCU's.

DISK STORAGE: Disk drives with 10, 12.5, 25, 50, 96, or 190 megabytes of storage are available. Up to 4 of the drives per controller are supported for a maximum storage capacity of 760 megabytes. All of the disk units are connected to the systems through a direct memory access channel.

MAGNETIC TAPE: The CS/40, CS/50, CS/60, and CS/70 systems can support one 800 bpi, or 800/1600 bpi tape unit.

PRINTERS: See WORKSTATIONS above.

MASS STORAGE

6038 FLOPPY DISK SUBSYSTEM: Consists of a four-drive controller and either a 6038 single drive or a 6039 dual drive. Each floppy disk stores up to 315K bytes on 77 tracks. Maximum storage capacity is 1.26 million bytes on a four-drive subsystem. Average head positioning time is 260 milliseconds, and average rotational delay is 83 milliseconds. Data transfer rate is 31K bytes/second. The 6038 drives feature IBM 3740 compatibility and are supported by Data ▶

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General's Interactive COBOL Operating System (ICOS). The controller occupies one slot. The 6038 drives are manufactured by Data General.

6045 CARTRIDGE DISK SUBSYSTEM: Each subsystem consists of a controller and one or two 10-megabyte, top-loading cartridge disk drives. The systems are being manufactured at Data General's Westbrook, Maine facility.

Each drive employs two platters, one fixed and the other an IBM 5440-type removable cartridge, both mounted on a common spindle. Each platter is capable of storing 5,013,504 bytes, or 2,506,762 bytes per surface. There are 200 tracks per inch, 408 tracks per surface, 408 cylinders per drive, and 4 surfaces per drive. Recording density is 2200 bits per inch. All tracks are divided into 12 sectors of 512 bytes each, yielding a formatted track capacity of 6144 bytes. Each cylinder consists of four tracks, giving a formatted cylinder capacity of 24,576 bytes. Total drive capacity is 10,027,008 bytes.

Drive rotational speed is 2400 rpm. Track-to-track, average, and full-stroke head positioning times are 8, 38, and 70 milliseconds, respectively. The data transfer rate is 312,500 bytes per second. Drive start-up to full operating speed takes 30 seconds, and the drive requires 25 seconds to come to a full stop.

6070 CARTRIDGE DISK SUBSYSTEM: Identical to the 6045 subsystem except that the recording density is doubled, giving each drive a capacity of 20 megabytes.

6101, 6102, 6014, 6105 DG/Disk Subsystems: Consist of a fixed 12.5- or 25-megabyte fixed disk pack drive and controller, and an optional 1.26-megabyte diskette. The rigid non-removable diskes employ Winchester-type technology. The 6101 and 6104 include integrated diskette subsystems for file back-up and interchange. Up to three diskette drives can be configured with either rigid disk.

Models 6101 and 6102 contain one platter with two usable surfaces while the 6104 and 6105 contain two platters with four useable surfaces. There are 32 512-byte sectors per track with 192 tracks per band and two bands per surface. Total surface capacity is 6.29 megabytes.

Disk rotation speed is 2,964 rpm. The average rotational delay is 10.1 milliseconds and the average access time is 70.1 milliseconds. The data transfer rate is 910K bytes per second.

6060, 6061, AND 6067 DG/DISK STORAGE SUBSYSTEMS: Consist of a 96-, 190-, or 50-megabyte disk pack drive and a controller for up to four drives. Thus, the same controller can handle from 50 to 760 megabytes of on-line storage. The drives are 3330-type units designed and manufactured by Data General at its Westbrook, Maine facility. Model 6060 is a 96-megabyte drive, Model 6061 is capable of storing 190 megabytes, and Model 6067 is a 50-megabyte drive. Data density is 4040 bits per inch for all three drives, although their track densities are different. The drives employ a servo track-following technique that allows 192 tracks per inch for a total of 411 tracks per surface on the Model 6060, and 370 tracks per inch for a total of 815 tracks per surface on the Model 6061 and 6067. These are a total of 411 or 815 cylinders, each containing 19 tracks on the 6060 and 6061, or 5 tracks on the 6067.

The Model 6060 employs an IBM 3336-type pack, while the Model 6061 and 6067 utilize an IBM 3336-11-type pack. The 6060 and 6061 disk packs contain 10 platters with 19 usable surfaces, while the 6067 contains 3 platters with 5 usable surfaces. There are 24 sectors per track and 512 bytes per sector, yielding 12,288 bytes per track. Total surface capacity is either 5,050,368, or 10,014,720 bytes per surface, depending on the model. Total formatted drive capacity is 95,956,992

bytes for Model 6060, 190,279,680 bytes for Model 6061, and 50,073,600 bytes for Model 6067.

Disk rotational speed is 3600 rpm, and average rotational delay is 8.3 milliseconds. Track-to-track head positioning time is 6 milliseconds, average head positioning time is 35 milliseconds, and average access time is 43.3 milliseconds.

The controller employed with these drives can handle up to four Model 6060, 6061, or 6067 drives in any combination. Software limitations restrict the number of controllers per system to two. The controller features independent command and read/write channels and reserve-and-trespass capabilities for users to transfer data. In multiple shared-disk environments, privileged file structures are allowed. The controller is connected directly to the standard Eclipse data channel. An error correction feature makes it possible to direct and correct all error bursts of 11 bits or less.

INPUT/OUTPUT UNITS

See Peripherals/Terminals table.

COMMUNICATIONS CONTROL

REMOTE JOB ENTRY CONTROL PROGRAM (RJE80): Allows for remote job entry and communications between CS processors and IBM 360/370 systems, or between CS processors and other Data General computers. Support is provided for four types of RJE systems:

- Point-to-point communications between a CS system emulating an IBM 2780/3780 and an IBM 360/370 host.

- Point-to-point communications between two Data General systems running RJE80.

- Multi-drop Data General systems emulating IBM 3780 slave terminals, communicating with an IBM 360/370 host.

- Multi-drop Data General Systems emulating IBM 3780 slave terminals, communicating with a Nova or Eclipse master system also running RJE80.

RJE80 is supported by ICOS. Features include horizontal and vertical printer format control; error detection on transmission and reception; and disk, tape, or card transmission to remote systems. Transmission between host systems may be to unattended RJE80 systems, and because of device-independent I/O capabilities, any combination of I/O devices can be utilized without additional software.

IBM HASP II WORKSTATION EMULATOR: Lets a CS/40, 50, 60, or 70 system emulate an IBM HASP remote job entry workstation. Its multileaving capability can include up to seven input and seven output data streams. Efficiency of data transmission is achieved by interleaving, and data compression. The emulator supports both disk and tape storage. Hardware requirements incude a card reader or magnetic tape drive, line printer, and a real-time clock.

SOFTWARE

OPERATING SYSTEM: *Interactive COBOL Operating System (IOCS)* is a full-scale operating system that supports multi-tasking, file management, and file access. It can schedule and allocate program resources to many different subprogram tasks. It is a comprehensive, modular system with a system generation procedure allowing the user to tailor the operating system to his hardware configuration and his COBOL applications.

ICOS can be used either interactively from a console keyboard or in batch mode from job streams entered via disk ▶

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files. On the larger systems, ICOS can simultaneously support both foreground and background tasks, so that users can run two jobs at the same time. The higher-priority job, which is normally a real-time or response-dependent system supervisor program, is run in the foreground, while the lower-priority job is run in the background. Data from a background job is typically processed while waiting for an event or for data from the foreground job. Background mode can be used to develop new programs without interrupting ongoing jobs. Foreground and background programs can be hardware-protected from each other and from the operating system.

Also available to ICOS users is the CLI command interpreter and job supervisor. Any program that an on-line user can execute interactively from the console can be called.

ICOS supports only the interactive COBOL programming language.

On the Nova 3/D, Nova 4, and Eclipse-based systems, ICOS supports two-partition multiprogramming with 32K-word user program areas and an operating system area of up to 32K words (typical size is 8K to 12K words). Mapped ICOS provides an extensive file management capability. It features a common I/O interface, checkpointing for a background task, program segmentation, and communication between tasks. Mapped ICOS supports systems of up to 256K words, with each partition protected from the remainder of main memory. Mapped ICOS foreground/background designations are merely a reference to the usual priority designations, which are set up by the user and can be altered at any time. The two partitions could even be given equal priority.

ICOS supports sequential, relative, and indexed files. Sequential file records can be of fixed or variable length. Relative record numbers can range up to 65,535. Indexed file keys are alphanumeric strings of up to 100 characters in length. Primary, alternate, generic, or sequential keys can be used. CS/40, 50, 60, and 70 support up to 4 alternate keys.

Printer spooling under ICOS can be either automatic or operator-controlled.

LANGUAGE: *Interactive COBOL*, the only programming language currently supported on the CS systems, implements the Level 1 ANSI COBOL-1974 Nucleus, Table Handling, Sequential I/O, Relative I/O, Indexed Sequential (ISAM) I/O, and Library modules, and includes several Level 2 modules. It provides for complex conditions (AND, OR, NOT, and parentheses) and sign conditions, and supports the standard 96-character ASCII set and floating-point data formats. Nested IF and PERFORM UNTIL statements are provided for structured programming.

A Screen Section is included in the Data Division for entry and inquiry/response formats. Screen interaction is allowed through the ACCEPT and DISPLAY verbs.

Interactive COBOL supports sequential, relative, and indexed sequential (ISAM) access methods. ISAM allows up to five search keys, and a duplicate key feature is supported on the CS/40, 50, 60, and 70. ISAM keys can be up to 100 bytes long, and records up to 4K bytes in length are allowed. Record and file lockout are provided for multi-user applications. The Printed Access Scheduling System (PASS) allows the operator to determine the printing sequence of print files.

UTILITIES: The utility library for the CS systems includes standard file sort/merge, copy, and reorganization programs as well as an RJE80 communications subsystem and a HASP workstation emulator. Program development utilities include a text editor and an interactive debugger. Special features of the text editor include text insertion from other files, global search and replace, and relocation of multiple sections. The interactive debugger allows programmers to start, stop, or suspend program execution, to set traps (break points), and to show the results of the current process on the CRT. While execution is suspended, the programmer can examine and change the contents of storage, using COBOL-like verbs, and then rerun the program from the previous breakpoint. The following standard utilities are also included: Sort/Merge, Copy, Filestats, Analyze, Reorg, Delete, Append, Rename, Xfer, and Print.

APPLICATIONS: The packaged CS systems are intended to be sold primarily to OEM's and system development houses. No separate application packages have been announced for the CS series to date.

PRICING

POLICY: Data General offers the CS series on a purchase-only basis. With the On-Call Service contract, all parts and labor are included at no additional cost.

Normal prime-time on-call contract service hours are 9 a.m. to 5 p.m. Charges quoted in the price list are applicable to customers within 100 miles of a service center. Additional but uniform monthy charges are in effect beyond 100 miles of a Data General service center. These charges are $150 for customers between 100 and 300 miles from the center and $225 for customers beyond 300 miles.

Data General software is licensed and bundled so that it is included without additional charge on a system with sufficient hardware to operate it.

The Data General Software Subscription Service provides automatic updates and documentation for Data General software at a price ranging from $50 to $350 per software product, and for $75 per product on any order totalling $1,000 or more.

The Hardware Subscription Service provides automatic updates, additions, and notification of new documentation on all Data General hardware for a fixed yearly fee. It is available to any owner of Data General equipment. This includes owners who have purchased their equipment through another vendor. Initial subscriptions include updates for one year. Prices are as follows: CS processors, $980; peripherals, $920; and communications and I/O, $920. Additional log books for any of the above topics are $500 each without updates. Yearly renewal rates are $480 for CS processors, $420 for peripherals, and $420 for communications and I/O. A 40 percent discount applies for additional updates beyond the first to the same type of log book, ordered at the same time and deliverable to the same address.

Under a Depot Service contract, any portion of a system may be covered, the minimum contract being $75. The customer assumes all transportation and insurance costs. For non-contract on-site service, the hourly maintenance rates are $40 for prime time and $48 for all other times. A $135 regular-time or $165 premium-time minimum charge applies. Depot service hourly labor charges are $45 for prime time and $55 for all other times.

Data General provides training courses for customers at its Westboro, Massachusetts headquarters; at its Western Training Center in El Segundo, California, in Chicago, Illinois; and at its United Kingdom Training Center in Greenford, Middlesex, England. Two training credits are given for each system purchased (end user) or two training credits per purchase agreement (OEM). One training credit entitles a cusotmer to approximately one man-week of training. Schedules for training courses can be obtained at any Data General field office.

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On-site training is available when necessary. Costs involve $600 per day (with a three-day minimum) for instructional charges including the instructor's daily expenses, instructor's travel expenses, $100 per weekend for subsistence when incurred, and a per-student charge for actual documentation used.

The Data General Users' Group provides a forum for interchange of programs. The programs are available for a fee to cover reproduction and distribution costs.

Prices shown in the Equipment Prices list are for single-unit quantities. Standard OEM three-to-five quantity discounts of 19 percent apply. Discounts of about 40 percent are available for quantities of 200 or more units.

EQUIPMENT: The following typical system purchase prices include interactive COBOL, system utilities, and all required control units, adapters, and cables.

CS/10 SYSTEM: Includes microNova processor with 64K bytes memory, CRT control console, 12.5 megabyte fixed disk with 1.2 megabyte diskette subsystem, 60 cps printer, and cabinet. Purchase price is $15,300.

CS/30 MOD C3 SYSTEM: Includes microNova processor with 80K bytes of MOS memory, Dasher CRT console and additional terminal, 10-megabyte disk cartridge subsystem, 180 cps Dasher LP2 printer, and cabinet. Purchase price is $27,775.

CS/50 MOD C5 SYSTEM: Includes Nova processor with 128K bytes of parity MOS memory, 5 Dasher CRT's, 20-megabyte disk cartridge subsystem, magnetic tape subsystem, 300 lpm printer, synchronous communications line, and RJE software. Purchase price is $67,355.

CS/70 SYSTEM: Includes Eclipse S/140 processor with 512K bytes ERCC MOS memory, 190 megabyte disk, 800/1600 bpi, 9-track magnetic tape, 12 Dasher D200 CRT's with multiplexer controller, 600 lpm data channel printer, and dual bay cabinet. Purchase price is $117,200.■

EQUIPMENT PRICES

		Purchase Price	On-Call Service
BASIC SYSTEMS			
All CS/10 systems include a microNova processor, CRT console, NMOS memory, and interactive COBOL; no printer is included.			
9320	Mod C1 with 64K bytes of memory; dual 1.2 megabyte diskette subsystem	$10,950	$127
9321	Same as 9320 except with 12.5 megabyte Winchester-type disk and integral 1.2 diskette	12,850	116
9321-W	Same as 9321 with second 1.2 megabyte diskette	16,150	166
9322	Same as 9320 except with 25 megabyte Winchester-type disk and integral 1.2 megabyte diskette	15,750	124
9322-W	Same as 9322 with addition of second 1.2 megabyte diskette	19,050	174
9323	Mod C3 with 128K bytes of memory; memory selector; 4 line mux; 12.5 megabyte Winchester-type disk; integral 1.2 megabyte diskette	17,340	132
9323-W	Same as 9323 with addition of second 1.2 megabyte diskette	20,640	182
9324	Same as 9323 except with 25 megabyte Winchester-type disk and integral 1.2 megabyte diskette	20,240	140
9324-W	Same as 9324 with addition of second 1.2 megabyte diskette	23,540	196
All CS/20 systems include microNova processor, CRT console, 64K bytes of NMOS memory, and interactive COBOL; no printer is included.			
9172	With dual-diskette 630K-character subsystem	10,945	96
9173	With 3-diskette, 945K-character subsystem	13,845	137
9174	With 4-diskette, 1260K-character subsystem	14,845	145
All CS/30 systems include microNova processor, 64K bytes of NMOS memory, master console interface, automatic hardware diagnostics, and interactive COBOL			
9187	Mod C1 with 10 megabytes of F/R cartridge disk	17,540	109
9250	With 12.5 megabytes of fixed disk, 1.2 megabytes of floppy disk	15,040	101
9251	Same as 9250 except 25 megabytes of fixed disk	17,940	109
9188	Mod C3 same as 9187 plus 4-line asynchronous mux	18,790	128
9252	Same as 9250 plus 4-line asynchronous mux	16,290	120
9253	Same as 9252 plus 4-line asynchronous mux	19,190	128
All CS/40 systems include a Nova 3/D processor, MOS parity memory, terminal connection unit, and multi-user COBOL			
9202	Mod C3 with 64K bytes of memory, 10-megabyte F/R cartridge disk, diskette	28,530	305
9202N	Same as 9202 except no diskette	26,130	263
9203	Same as 9202 except 20-megabyte disk	29,030	283
9204	Mod C4 with 64K bytes of memory, 50-megabyte disk subsystem, 800 bpi magnetic tape drive, 4 50-megabyte disk packs	51,380	448
9205	Same as 9204 except 96-megabyte disk subsystem and 96-megabyte disk pack	55,380	478
9206	Same as 9204 except 190-megabyte disk subsystem and 190-megabyte disk pack	60,580	478
9207-K	Mod C5 with 128K bytes of memory, 10 megabytes of F/R cartridge disk, diskette	35,385	357
9207-M	Same as 9207-K except 192K bytes of memory	38,695	397
9207-KN	Same as 9207-K except no floppy disk	32,985	315
9207-MN	Same as 9207-KN except 192K bytes of memory	36,295	355
9208-K	Same as 9207-K except 20 megabytes of storage and 6 10-megabyte disk cartridges	35,885	335
9208-M	Same as 9208-K except with 192K bytes of memory	39,195	375