

Data General Commercial Systems Family

MANAGEMENT SUMMARY

The Series 200-C is the fourth system within the CS Series Family. Supporting both the Real-Time Disk Operating System (RDOS) and the Advanced Operating System (AOS), the Series 200-C is fully compatible with the earlier CS systems. Application software developed for any other CS computer will run without modification on the Series 200-C, and on the rest of Data General's computers, including the 32-bit MV/Eclipse family.

The Series 200-C features an Eclipse-based processor which is up to 50 percent faster than the Series 200-B, depending on the application and operating environment. Main memory for the 200-C ranges from 256K bytes to 2M bytes in single-board 15 x 15 inch modules and includes an Error Checking and Correction (ERCC) feature. The system supports up to 32 user terminals and over 1800M bytes of disk storage. The Series 200-C supports the same peripherals as the other Series 200 systems.

Designed for interactive processing, Data General's microEclipse-based CS Series 100-B is offered with 128K bytes of MOS main memory, expandable to 2M bytes in 128K-byte increments. Up to 150M bytes of disk storage is available consisting of two 50 megabyte disk drives and two 25M byte disk drives. The CS Series 100-B represents an enhancement of the earlier Series 100 which supported only the Real-Time Disk Operating System (RDOS) and up to nine Dasher display terminals. The new Series 100-B can support either RDOS or AOS and up to 16 terminals.

The other CS Series 200 systems may be configured with either a microEclipse or an Eclipse processor. The microEclipse-based CS Series 200-A has 256K bytes of MOS main memory expandable to 512K bytes, and runs under

Data General has expanded the Commercial Systems Family with the introduction of the Series 100-B, a replacement for the Series 100, and the new Series 200-C. The CS Series 100-B supports both the RDOS and AOS operating systems, representing an enhancement over the Series 100 which supported only RDOS. Based on the Eclipse processor, the new Series 200-C is up to 50 percent faster than the former top-of-the-line Series 200-B. Additional enhancements include an increase in maximum main memory to 2MB for the Series 100-B and Series 200-B.

MODELS: CS Series 100-B, Series 200-A, Series 200-B and Series 200-C.

MEMORY: 128K bytes to 2M bytes.

DISK CAPACITY: 15M bytes to 1,850M bytes.

WORKSTATIONS: up to 32.

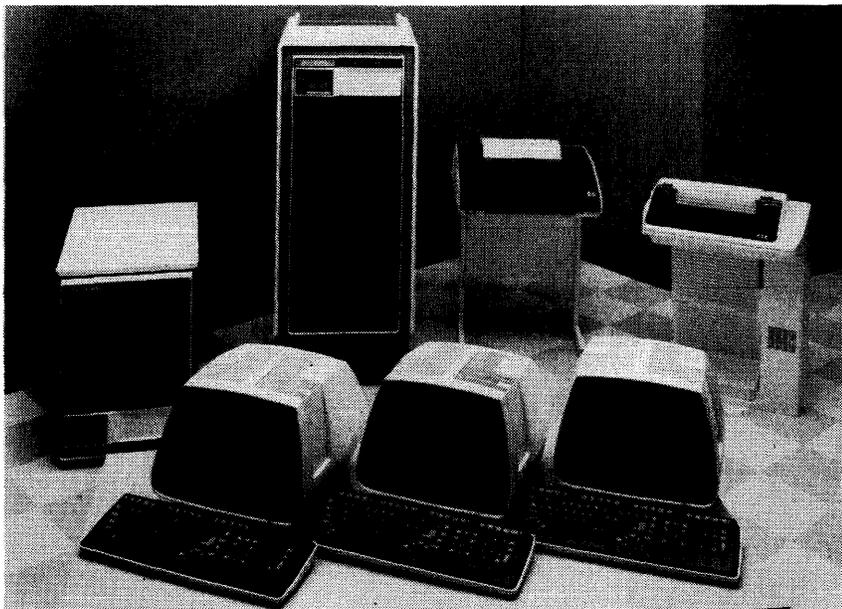
PRICE: \$17,550 to \$67,000.

CHARACTERISTICS

MANUFACTURER: Data General Corporation, 4400 Computer Drive, Westboro, Massachusetts 01580. Telephone (617) 366-8911.

CANADIAN ADDRESS: Data General Corporation, 180 Duncan Mills Road, Suite 606, Don Mills, Ontario, Canada M3B 3K3. Telephone (416) 445-8026.

Data General is a leading manufacturer of minicomputers, peripherals, and associated equipment, with more than 120,000 computers installed to date. The company maintains sales offices in most major North American cities and



The Commercial Systems family includes the CS Series 100-B available in either a 29-inch (pictured) or 60-inch cabinet, and the CS Series 200 (left, center) available in three models. All CS systems now support both the AOS and RDOS operating systems.

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CHART A. SYSTEM COMPARISON CHART

	CS Series 100-B	CS Series 200-A	CS Series 200-B	CS Series 200-C
SYSTEM CHARACTERISTICS				
Date of introduction	October, 1983	May, 1982	May, 1982	February, 1983
Date of first delivery	December, 1983	August, 1982	August, 1982	May, 1983
Operating system	RDOS or AOS	RDOS or AOS	RDOS or AOS	RDOS or AOS
Upgradable from	CS/10 or CS/30	—	CS/40, CS/50, CS/70	CS/60, or CS/70
Upgradable to*	MV/Eclipse	MV/Eclipse	MV/Eclipse	MV/Eclipse
MIPS	—	—	—	—
Relative performance based on a rating of the 200-B at 1.0	.70	.70	1.0	1.5
MEMORY				
Minimum capacity, bytes	128K	256K	256K	256K
Maximum capacity, bytes	2M	512M	2M	2M
Type	MOS	MOS	MOS	MOS
Cache memory	none	none	none	none
Cycle time, nanoseconds	500	500	400	150
Bytes fetched per cycle	—	—	—	—
INPUT/OUTPUT CONTROL				
Number of channels	8	5 or 16	16	16
High-speed buses	two	two	two	two
Low-speed buses	one	one	one	one
MINIMUM DISK STORAGE				
	5 Mb	15 Mb	15 Mb	15 Mb
MAXIMUM DISK STORAGE				
	150 Mb	628 Mb	1,452 Mb	1,850 Mb
NUMBER OF WORKSTATIONS				
	16	13 under RDOS 9 under AOS	25	32
COMMUNICATIONS PROTOCOLS				
	RJE80, HASP II, X.25 SNA, Xodiac			

*Systems are not field-upgradable to the MV/Eclipse family, but software written in the commercial languages (Business Basic, Interactive Cobol) can be transferred to the MV/Eclipse family without modification.

▷ either the RDOS or AOS operating system. The Eclipse-based CS Series 200-B is available with 256K bytes of main memory expandable to 2M bytes, and also offers either the RDOS or AOS operating system. The CS Series 200-B will support as many as 25 Dasher display terminals and up to 1400 megabytes of disk. Several printers are available, ranging in speed from 55 cps (letter-quality) to 600 lpm.

A choice of either Interactive Cobol or Business Basic languages is provided with all CS Series systems. Both languages are compatible with any other CS system of the same language type, or with any AOS- and AOS/VS-based system.

Other peripherals available on the CS Series include an 800/1600 bpi reel-to-reel tape drive, a 1600 bpi streaming reel tape drive, and a new 15MB cartridge tape. The cartridge tape is available in its own rack or can be housed in a chassis with a 5 or 15 megabyte Winchester disk subsystem.

Four new ergonomically designed Dasher terminals are available for the CS Series also. Each terminal has a 12-inch tiltable display housing physically smaller than those of previous DG terminals so that the terminals occupy less workspace. The keyboards are designed for more user comfort with a low, thin profile. The D210 and D211 are intended as replacements for the Dasher 200 terminal. The D410 and D460 support a complete set of editing commands, including windowing. In addition, the D460 has enhanced graphics capabilities allowing users to draw line and bar charts and to create character fonts for custom applications. ▷

▷ in South America, Europe, Australia, and the Far East. Manufacturing operations are located in Southboro, Massachusetts; Westbrook, Maine; Portsmouth, New Hampshire; and Sunnyvale, California. Assembly operations are also performed in Hong Kong, Thailand, and the Philippine Islands.

DATA FORMATS

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

FIXED POINT OPERAND: 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 OPERAND: The microEclipse-based CS Series 100-B and 200-A offer an optional high-speed hardware floating-point unit (FPU). The FPU is a single board which replaces the standard firmware floating-point, and consists of Schottky TTL bit slice microprocessors cascaded into a 28-bit ALU, with four 64-bit accumulators. Communication between the FPU and the CPU is handled directly over the high-speed memory bus, and is supported by dedicated hardware floating-point microinstructions in the CPU control store, as well as microcode resident in the floating-point unit itself. For the Eclipse-based CS Series 200, floating-point arithmetic is performed by either optional firmware or hardware. The floating-point capability of the CS Series 200 includes 64-bit double-precision operations, four 64-bit accumulators, and a monitoring Status Register. ▷

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TERMINALS

DEVICE	DESCRIPTION
Dasher D210/D211	Alphanumeric, asynchronous display terminal; 10 x 12 pixel character-cell; 24 x 80 character screen; baud rates to 19,200; ROM-resident 96 ASCII character set; Dasher 211 has an additional 96-character set and auxiliary serial printer port
Dasher D410/D460	Alphanumeric display terminal; 24 lines of 81 columns displayed in 10 x 12 dot matrix or 135 columns in a 12 x 12 dot matrix; ROM-resident 96 character set; enhanced character graphics facilities
Dasher G300	Desktop, intelligent graphics terminal with two interactive modes; bit-mapped raster scan display with 640 x 240 pixel-resolution

➤ All CS Series systems support the Real-Time Disk Operating System (RDOS). RDOS provides mapped foreground/background management of single-task and multi-task operations. In foreground/background processing, two independent programs run simultaneously with either the foreground at a higher priority or both grounds at the same priority. RDOS controls and allocates system resources to these address spaces as required. Utilizing memory management hardware, RDOS protects system and user address spaces from unauthorized access that might otherwise disrupt system operation. RDOS is available with all the Series 200 systems also.

All CS Series systems also now support the Advanced Operating System (AOS), an interactive, multiple-batch, real-time operating system. AOS features include monitoring and scheduling functions, dynamic memory management, fully integrated asynchronous and synchronous communications, and prioritized multi-tasking to handle multiple tasks within a user program including intertask and interprocess communications. Hierarchical file directories and structures are provided for file security and fast file access, and dynamic disk allocation is employed to provide more efficient use of disk space.

The Comprehensive Electronic Office (CEO) system, which integrates data processing, office processing and data communications, is available with CS Series systems using the Advanced Operating System (AOS). CEO Word processing features all standard WP functions, user-defined keys and commands and can be integrated with CEO Information Management. CEO Information Management software combines electronic mail and filing, and administrative support facilities in a menu-driven format. Any Dasher workstation can be used as part of the CEO network.

Data General's Data Base Management System (DG/DBMS) is also available for CS Series systems with AOS. DG/DBMS controls data access, helps centralize data to reduce redundancy, logs transactions, and performs backup and recovery. DG/DBMS complies with the 1978 and 1980 CODASYL recommendations for data base management systems.

Data General has implemented a marketing program to stimulate qualified independent software vendors to develop applications software for their systems. As part of this program, Data General will offer a catalog listing of quali-

➤ **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. For all memory reference instructions, bits 5 through 15 are used for addressing, using bits 8 through 15 as the displacement or direct address.

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: 500 nanoseconds for the CS Series 100-B and 200.

CAPACITY: Up to 2M bytes for the Series 100-B, Series 200-B and 200-C.

CHECKING: Standard on the CS Series 100-B and 200.

STORAGE PROTECTION: Standard on the microEclipse-based CS Series 100-B and CS Series 200, and optional on the Eclipse-based CS Series 200.

RESERVED STORAGE: None.

CACHE MEMORY: None of the CS Series systems have cache memory.

CENTRAL PROCESSOR

GENERAL: The CS Series 100-B and one model of the CS Series 200, the 200-A, feature a microEclipse-based processor with 16-bit word length, four general purpose accumulators, and four floating-point accumulators. The microEclipse hardware stack facility includes overflow protection, a stack pointer, a frame pointer, a stack fault address, and stack limit control. Microprograms control the processor's operation and implement its Eclipse instruction set. These microprograms are generated from both 35-bit horizontal and 18-bit vertical microinstructions. Vertical microinstructions have been coded to contain the address of a horizontal instruction and two microverbs indicating the source and the destination. These latter two fields can be selected and substituted for control fields in horizontal microinstructions (fields from certain instructions in the pipeline can also be selected and substituted). With this technique, a single horizontal microinstruction can be modified repeatedly to produce a number of different results, making it possible to create very sophisticated instructions from highly efficient microinstruction primitives.

The microEclipse CPU contains four 16-bit wide internal buses so that data can be written, read, and transferred to a variety of internal components concurrently. The A and B

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► fied third-party software vendors. Original equipment manufacturers who have already developed software for DG systems will also be included in the catalog.

COMPETITIVE POSITION

The CS Series of computers are targeted toward the small business and commercial segments of the market. Competition in these areas is from the Hewlett-Packard HP 250, IBM Series/1, the low-end of the Wang VS family, the VS 25 and VS 45, and the DEC Micro/PDP-11. All of these systems have roughly the same characteristics with a few exceptions. The Micro PDP-11 supports significantly more memory, up to 4MB, and the Wang VS 45 supports more disk capacity, up to 2.6 gigabytes. Prices for comparable configurations also are very close, with the exception of the Micro/PDP-11 and HP 250 which are a few thousand dollars less than the Wang VS 25 and almost \$10,000 less than a Series 200-B and IBM Series/1.

ADVANTAGES AND RESTRICTIONS

The ability to carry software and many peripherals from a CS Series system to other Data General systems is a significant advantage. This compatibility among DG systems serves to protect the user's investment, at least partially, by providing a growth path to the 32-bit MV/Eclipse systems.

The users of the CS Series of computers, as shown in the results of the User Survey, are happy with their systems and with Data General. Many of the users upgraded from a previous DG system and intend to stay with the current system they have. Little more can be added to the comments of the users—the CS Series of computers represents a good small business system.

One disadvantage may be the lack of application software available from DG. Software must be purchased from a third party and DG does have a supply list of independent software vendors who have developed applications for the CS Series.

USER REACTION

Thirteen users responded to the 1983 Datapro Computer User's Survey, representing a total of 14 systems with an average installation time of 34 months. Ten of these users purchased their systems and the remaining three are leasing from a third party.

The systems are generally being used for general accounting functions (10 users) and other accounting related applications; six reported order processing/inventory as a principal application, five reported payroll/personnel and sales/distribution, and four reported purchasing. Seven users reported using contract programming for their applications and only three use packaged programs from the manufacturer. Cobol is the predominate language with 11 users reporting it as the language used the most. ►

► buses transfer operands to the ALU and shifter. The C bus writes data into the registers either from the ALU and shifter, or from outside the chip. The M bus is used to transfer addresses directly from the register file or the program counter to the external system bus.

The CS Series 200-B and 200-C, with the Eclipse processor, consists of microprogrammed architecture with an asynchronous memory bus for combining storage types and communications/peripheral interfaces. Interfaces are contained on one or more individual boards which plug into the processor's chassis.

CONTROL STORAGE: The microEclipse-based CS Series 100-B and CS Series 200 include the basic Eclipse microprograms and the kernel of the Eclipse instruction set, which are resident on the CPU chip (64 horizontal microinstructions and 288 vertical instructions). In addition, the control store is extended by three high-speed external microcontroller (XMC) firmware chips, each of which contains 1,024 additional vertical microinstructions. These are transmitted to the CPU for modifications over a dedicated bus. The microprogrammed (Eclipse-based) CS Series 200 uses microinstructions automatically accessed from control storage. 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.

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

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.

INTERRUPTS: A 16-level programmed priority interrupt facility is used to recognize interrupts for I/O operations. Each device on the 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. An 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.

INPUT/OUTPUT CONTROL: An I/O bus and a Direct Memory Access (DMA) channel are standard on all CS ►

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MASS STORAGE

Models	6220	6222	6225/-D	6227/-D	6122/-A
Type	fixed	fixed	fixed	fixed	fixed
Controller model	built-in	built-in	built-in	built-in	built-in
Drives per subsystem/controller	one	one	one	one	four
Formatted capacity per drive, megabytes	5	15	5	15	277
Number of usable surfaces	2	6	2	6	19
Number of sectors or tracks per surface	245 tracks	245 tracks	245 tracks	245 tracks	815 tracks
Bytes per sector or track	512	512	512	512	512/sector
Average seek time	66ms	66ms	66ms	66ms	35ms
Average rotational/relay time	9.5ms	9.5ms	9.5ms	9.5ms	8.3ms
Average access time	75.5ms	75.5ms	75.5ms	75.5ms	143.3ms
Data transfer rate	625 kb/sec	625 kb/sec	—	—	—
Supported by system models	Series 100	Series 100	Series 200	Series 200	Series 200
Comments	-D includes 1.26 Mb diskette -TT= tabletop version	-D includes 1.26 Mb diskette -TT= tabletop version	-D includes 1.26 MB diskette	-D includes 1.26 Mb diskette	-A allows addition of 2nd, 3rd & 4th drives

MASS STORAGE

Models	6160/-A	6161/-A	6236	6237
Type	fixed	fixed	fixed	fixed
Controller model	built-in	built-in	built-in	built-in
Drives per subsystem/controller	two	two	one	three
Formatted capacity per drive, megabytes	73	147	354	1.062 GB
Number of usable surfaces	5	10	8	8
Number of sectors or tracks per surface	823 tracks	823 tracks	—	—
Bytes per sector or track	512/sector	512/sector	—	—
Average seek time	—	—	20ms	20ms
Average rotational/relay time	8.33ms	8.33ms	10ms	10ms
Average access time	—	—	30ms	30ms
Data transfer rate	1.209 Mb/sec	1.209 Mb/sec	1.68 Mb/sec	1.68 Mb/sec
Supported by system models	Series 200	Series 200	Series 200-B -C	Series 200-B -C
Comments	-A is add-on drive for Models 6160 or 6161	-A is add-on drive for Models 6160 or 6161		

*Data General also has 12.5 Mb and 25 Mb fixed disk drives available.

➤ All the users locate their system in a central processing site, with only three users reporting any distributed processing nodes. All users also have at least one local workstation attached to the system, with five users reporting from 6 to 15 local workstations. Only five users reported from one to five remote workstations. Only two users reported having a Data Base Management system and both are using an outside vendor package. Three users have integrated word processing functions on the system and three more users plan to implement word processing in the next year.

Memory on the systems ranged from 128KB to 1024KB with six users reporting memory sizes of between 256KB to 512KB. Disk storage varied between 256KB to 1200MB with eight users reporting total disk capacity between 20MB and 80MB and one user reporting between 600MB and 1200MB of disk capacity.

When asked to cite significant advantages of their systems, seven users reported the CS Series to be easy to expand or reconfigure. Six users were happy with the response time on the systems; four felt that programs and data carried over from other systems were compatible as promised by the vendor and that productivity aids helped keep programming costs down.

➤ 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.

The microEclipse-based CS Series 100-B and 200 have separate memory and I/O buses. The CS Series 100-B I/O bus, with microNova compatibility, has 300K bytes per second maximum input/output speeds and a maximum data channel latency of six microseconds. Maximum interrupt latency is 110 microseconds with 16-level priority interrupts. The CS Series 200 maximum input speed is 2.0M bytes per second, and 1.3M bytes per second output speed. Data channel latency is three microseconds, maximum interrupt latency is 110 microseconds, and 64 I/O device codes are recognized.

The Eclipse-based CS Series 200 uses programmed I/O for low-speed I/O devices, while the I/O bus and high-speed direct memory access (DMA) channel that is standard on all Eclipse systems is used for disk and magnetic tape I/O.

OPERATING ENVIRONMENT: Power requirements for the CS Series are 240/120 volts, 60 Hz. Recommended

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CHART D. PRINTERS

Models	4354	4353-P/4355/4356	4326/4328/4324-P	4323-P	4325/4327
Type	Dot Matrix	Dot Matrix	Band	Band	Band
Speed	340 cps	340 cps	230 lpm	300 lpm	300 lpm
Bi-directional printing	yes	yes	no	no	no
Paper size	15"	15"	15"	15"	15"
Character formation	7 x 7 dot	7 x 7 half-dot	solid	solid	solid
Horizontal character spacing	10 cpi	10 cpi	10 cpi	10 cpi	10 cpi
Vertical line spacing (per inch)	6 or 8	6 or 8	6 or 8	6 or 8	6 or 8
Character set	96	96	96	96	64
Buffer	—	—	—	—	—
Controller/interface	serial interface	PIO interface DCH interface with 4356	PIO interface; DCH includes 4328 interface	PIO interface	PIO interface w/4325 DCH interface w/4327
No. of printers per C/I	one	—	—	one	—
Printer dimensions (h x w x d)	7.9 x 26.1 x 23.3	7.9 x 26.1 x 23.3	44 x 33.3 x 25.2	44 x 33.3 x 25.2	44 x 33.3 x 25.2
Graphics capability	no	no	no	no	no
Comments		4353-P available for Series 100 only; 4355/6 available for series 200 only	4324-P available for Series 100 only; 4326/28 available for series 200 only	Series 100 only	Series 200 only

CHART D. PRINTERS

Models	4422-A	6041	6156	6191/6192
Type	Dot-Matrix	Dot-Matrix	Dot-Matrix	Dot-Matrix
Speed	150 cps	60 cps	80 cps	180 cps
Bi-directional printing	yes	yes	—	—
Paper size	15"	15"	—	—
Character formation	9 x 9 dot matrix	5 x 7 dot matrix	72 x 144 dot/inch	—
Horizontal character spacing	10 cpi	10 cpi	10 cpi	—
Vertical line spacing (per inch)	6 or 8	6	—	—
Character set	96	96	96	96
Buffer	one line	40 bytes	—	—
Controller/Interface	serial interface	serial interface	G300	PIO interface; DCH interface for 6192
No. of printers per C/I	one	one	—	—
Printer dimensions (h x w x d)	7 x 24 x 14	33.5 x 27.5 x 21	—	—
Graphics capability	yes	no	yes	—
Comments				Series 200 only

➤ Significant problems reported on the system were varied. Two users reported the computer proposed by the vendor was too small, the installation of the equipment was late, system costs exceeded expectations, all the promised software or support was not provided by the vendor, and that vendor enhancements or changes to hardware and software were hard to keep up with.

The ratings given the CS Series systems are shown in the following table:

	Excellent	Good	Fair	Poor	WA*
Ease of operation	5	7	0	0	3.4
Reliability of mainframe	7	5	0	1	3.4
Reliability of peripherals	4	7	0	1	3.2
Maintenance service:					
Responsiveness	5	8	0	0	3.4
Effectiveness	3	7	3	0	3.0
Technical support:					
Trouble-shooting	2	5	4	0	2.8
Education	0	4	5	1	2.3
Documentation	1	3	5	1	2.4
Manufacturers software:					
Operating system	1	7	3	0	2.8
Compiler & assemblers	1	6	1	1	2.8
Application programs	1	8	1	0	3.0
Ease of programming	1	6	1	1	2.8
Ease of conversion	1	5	0	0	3.2
Overall satisfaction	2	8	1	0	3.1

*Weighted Average on a scale of 4.0 for Excellent.

➤ temperature ranges between 40 to 90 degrees F, and suggested operating humidity from 40% to 80% non-condensing. Physical specifications of the different models are as follows:

	Height (inches)	Width (inches)	Depth (inches)	Weight (pounds)
Series 100-B	5.25	19.0	26.14	n/a
Series 200-A	5.25	19.0	26.14	40-50
Series 200-B	10.48	19.0	26.14	78-110

CONFIGURATION RULES

GENERAL: All CS Series systems are offered in either a base or packaged configuration. Base systems include the processor, memory, chassis, cabinet, operating system license and a commercial language run-time license. Packaged systems add disk, a backup device and a master console to the base configuration.

MAGNETIC TAPE: The CS Series 100-B supports an optional 1600 bpi streaming tape drive for system/data file backup to Winchester disk storage; the CS Series 200 offers an 800/1600 magnetic tape drive or 1600 bpi streaming tape drive for system/data file backup.

PRINTERS: A maximum of one parallel interface printer, with programmed I/O (PIO), is configurable on a CS Series 100-B system. A maximum of two parallel interface printers,

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CHART D. PRINTERS

Models	4363	4364	4320/4322
Type	Band	Band	letter-quality
Speed	436 lpm	600 lpm	55 cps
Bi-directional printing	no	no	no
Paper size	15"	15"	15"
Character formation	solid	solid	solid
Horizontal character spacing	10 cpi	10 cpi	10 or 12 cpi
Vertical line spacing	6 or 8	6 or 8	6 or 8
Character set	96	64	96
Buffer	—	—	none
Controller/interface	DCH interface	DCH interface	serial interface
No. of printers per C/I	one	one	one
Printer dimensions (h x w x d)	—	—	8.7 x 24.8 x 16.3
Graphics capability	no	no	no
Comments	Series 200 only	Series 200 only	Series 100-B and 200

➤ Three of the survey respondents were further interviewed to obtain additional insight into their experiences with the CS Series. The first user interviewed represented a retail/wholesale business in the South. The system has been installed since late 1980 and the user reported he was "real happy with it." He would recommend the system to another user provided "the user understood the limitations of it." When asked to explain, the user said he would "like it to run faster." The system has between 128KB and 256KB of memory and four terminals and they schedule jobs carefully so as not to degrade the system performance.

The second user, an Eastern Insurance firm, had indicated on the survey form that they had some problems. The user reported, however, that Data General "has improved this past year and things are now going smoothly." This system has been installed since June of 1980 and the user would also recommend it to another user.

The third user represented a retail company that installed a CS 200-A in late 1982. They are also using the Communications Access Manager (CAM) software package and are "pleased with the system." This user "has had no significant problems" with his system.

The user's ratings indicate overall satisfaction with the CS Series. Nine users would recommend these systems to another user, two said they would not, and one user was undecided. □

➤ with data channel (DCH) or programmed I/O (PIO), are configurable on a Series 200 system.

Serial interface printers (SER) are connected to CS Series 100 or 200 systems, either directly or indirectly, using one asynchronous communications line. Indirect connections include attachment to a modem (remote) and/or display (local or remote). The number of serial interface printers configurable on a system is limited to the number of asynchronous communication lines available.

MASS STORAGE

See CHART B.

INPUT/OUTPUT UNITS

See CHART C for workstations, CHART D for Printers and CHART E for Magnetic Tape Equipment.

COMMUNICATIONS CONTROL

GENERAL: The Data General Communications Subsystem (DG/CS) is a hardware and software system that is modular in nature. It is composed of the SLM-2 Series synchronous multiplexers, the ULM asynchronous and synchronous multiplexer, the 4251 Communications Chassis, and the DCU Data Control Unit. The CAM Communications Access Manager provides software support for teletypewriter terminals and Bisync line protocol.

Low-performance systems can utilize the ULM installed in the main chassis. Medium-performance applications use the ACM and SLM multiplexers in the 4251 chassis, which is connected directly to the host computer I/O bus. For high-performance applications, the DCU is inserted as a "peripheral processor" between the host CPU and the communications subsystem.

The DG/CS supports both full- and half-duplex operation. Line interface support is provided for EIA RS-232-C/CCITT V.24, 20-mA current loop, and 23-mA current loop.

The communications subsystem is supported by the AOS and RDOS operating systems. Other software support includes RJE80, Data General's HASP Workstation Emulator, DCU-resident physical I/O routines, and the aforementioned CAM.

ULM UNIVERSAL LINE MULTIPLEXER: Three models of this control are available. Model 4241 controls four asynchronous lines. Programmable line characteristics include parity type (odd, even or none); line speeds of 5 to 9600 bps; 5-, 6-, 7-, or 8-bit code level; and one or two stop bits. Line operation may be full- or half-duplex.

Model 4242 controls one synchronous line. Standalone unit or up to 56,000 bps Line operation may be either full- or half-duplex. Programmable line characteristics include parity type; 6-, 7-, or 8-bit code level; SYN (synchronous) and DLE (delete) characters; transmitter/receiver on or off; and either CRC-16 or CCITT-16 cycle redundancy check (CRC) polynomials, if the optional CRC Generator/Checker is installed. The internal clock is jumper-selectable to one of eight frequencies from 300 bps to 56,000 bps.

Model 4243 combines the 4241 and 4243.

SINGLE LINE SYNCHRONOUS SUBSYSTEM WITH CRC: Interfaces to medium-speed (9600 bps) synchronous/bisynchronous communications lines, and provides a full- and half-duplex EIA RS-232-C/CCITT V.24 interface and full character buffering on reception and transmission. When coupled with the CRC generator, the synchronous

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CHART E. MAGNETIC TAPE EQUIPMENT

Models	6026	6123/6125	6231
Type	reel-to-reel	streaming	cartridge
FORMAT			
Number of tracks	9	9	4
Recording density, bits/inch	800/1600	1600	6400
Recording mode	NRZI	NRZI	MFM
CHARACTERISTICS			
Controller model	included	included	included
Drives per controller	8	one	one
Max. storage capacity, bytes	—	25 Mb	15 M
Tape speed, inches/second	75	30 (streaming)	60
Data transfer rate, bps	60/120 kbs	1 Mb/20 seconds	2.5 bpm
Streaming technology	no	yes	yes
Start/stop mode; speed	—	120 ips	—
Switch selectable	yes	—	—

► line controller can select either of two standard check polynomials, CRC16 or CCITT16. Both idle and sync characters, as well as character size, parity, and loopback testing, are program-selectable. In receive mode, Model 4226 automatically synchronizes data and then strips out the sync character. Standard modem control is supplied for Bell 201, 203, 208, and 209 Series data sets. This synchronous controller also supports IBM Bisynch protocols with full transparency and is program code compatible with the SLM-2 Series synchronous multiplexer used on Data General Nova and Eclipse processors.

Up to four controllers can be configured with a single microNova minicomputer, allowing it to control a maximum of four synchronous lines. Only one CRC generator board is needed per system. This subsystem is available for the CS Series 100 only.

ASYNCHRONOUS INTERFACE BOARD: This single-line interface board for asynchronous terminals, performs character assembly/disassembly and provides program interrupt on completion. The board includes jumper-selectable device code for up to 30 devices, full/half-duplex operation, transmit and receive speeds of 110, 150, 300, 600, 1200, 2400, 4800, 9600, or 19,200 baud. Also included are EIA or 20-mA current loop operation, variable character length and stop bit combinations (5-bit character with 1½ stop bits, or 6-, 7-, or 8-bit character with 1 or 2 stop bits), and even, odd, or no parity. Other features include modem control for program control over carrier detect, data terminal ready, dataset ready, and ring indicator functions. This interface board is offered for the CS Series 100 only.

ALM-4 PROGRAMMABLE ASYNCHRONOUS LINE MULTIPLEXER: is a four-line programmable asynchronous line multiplexer with full- or half-duplex EIA RS-232-C, CCITT V.24 or 20-mA current loop compatibility. Full modem control and support for Bell 103, 202, or equivalent data sets is provided. Full character buffering and programmable line characteristics with speeds up to 19,200 bps are also provided. The ALM-4 is offered for the CS Series 100-B only.

DCU/200 DATA CONTROL UNIT: provides a high performance data channel synchronous interface to any Data General Computer. The DCU/200 performs all character oriented tasks associated with the line multiplexers. Local memory contains 4,096 words. The DCU/200 uses the 4251 communications chassis, and is offered with AOS-based CS Series 200s for the Xodiac character or bit synchronous communication line.

PROGRAMMABLE SYNCHRONOUS INTERFACE (CSI): The CSI is the one-line version of the programmable synchronous multiplexer. Offered with AOS based CS Series 200s for the Xodiac character communication line.

AMI-8 ASYNCHRONOUS MODEM INTERFACE: The AMI-8 provides full duplex operation and full modem control for eight lines. It also supports Bell 103, 202, or equivalent data sets, offers programmable line characteristics speed selection up to 19,200 bps, full character buffering, and compatibility to EIA-RS-232-C and CCITT V.24. The AMI-8 is available for the CS Series 200 only.

ATI-16 ASYNCHRONOUS TERMINAL INTERFACE: This interface handles 16 lines, either local or dedicated, with full duplex operation, providing programmable line characteristics, speed select up to 19,200 bps, and full character buffering. Offered for the CS Series 200 only.

BSI-1 BIT SYNCHRONOUS INTERFACE: This interface is offered with AOS-based CS Series 200s for the Xodiac bit synchronous communication line.

ASYNCHRONOUS SINGLE-LINE CONTROLLER: Provides a full-duplex interface for a single Teletype Model 37ASR or 37KSR; 6012 CRT display; or Bell System 103, or equivalent, with manual answer. Standard rate is 150 bps for 10- or 11-unit codes. Other rates are optionally available. The 4029 option adds modem control features for Bell System 202 units with Automatic Answer. Offered for the CS Series 200 only.

SOFTWARE

OPERATING SYSTEM: Two operating systems are offered with the CS Series family: RDOS (Real-time Disk Operating System), and AOS (Advanced Operating System).

Real-Time Disk Operating System (RDOS) is a full-scale operating system that supports multi-tasking, and 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 the hardware configuration and applications employed.

RDOS can be used either interactively from a console keyboard or in batch mode from job streams entered via card readers, disk files, cassette files, or magnetic tape files. RDOS 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 application 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 also 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. ►

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► RDOS includes a multi-partitioning system that gives users flexibility in overlaying programs from disk into main memory. Large user programs can be segmented into disk-resident overlays to allow efficient use of main memory and to make the programs more manageable. Tasks stored on the disk occupy main memory only when they are ready for execution. The dual-processor, shared-disk feature allows RDOS users to share peripherals and to access common data and programs on disk.

RDOS operates on any CS Series with 32K bytes of main memory, a console display, and disk. In addition, RDOS can support additional memory (up to 64K bytes), four million bytes of fixed-head disk storage, 28 disk cartridges or disk pack drives, and eight magnetic tape transports (either 7- or 9-track). Card readers, line printers, communications equipment, and analog and digital conversion equipment are also supported.

Also available to RDOS users is the Batch command interpreter and job supervisor. Batch calls in and controls execution of user and system programs. Any program that an on-line user can execute interactively from the console can be called. The Batch processor is not an integral part of RDOS and occupies no main memory when it is not being run.

RDOS supports Extended Basic, Business Basic, Extended Fortran IV, Extended Algol, DG/L, Extended Assembler and Macroassembler, and optimizing Fortran 5. Most RDOS configurations support RJE80, HASP and the Data General Communication Access Manager (CAM). Also, X.25 protocol software is available on systems configured with a multiprocessor communications adapter or synchronous communications line.

The *Advanced Operating System (AOS)* is an interactive time-sharing, multiple-batch, and real-time operating system, and is Data General's first multiprogramming operating system. AOS is characterized as heuristic; that is, it continually monitors all activities in the system, whether batch or a prioritized multi-task within a group of tasks, and schedules them on the basis of their previous use and the user's requirements.

In addition to its monitoring and scheduling functions, AOS provides dynamic memory management through the use of common code and overlays, extensive data management, fully integrated synchronous and asynchronous communications through support of such devices as the DCU Communications Processor and the Multiprocessor Communications Adapter, prioritized multi-tasking to handle multiple tasks within a user program including intertask and inter-process communication, and hardware/software protection.

Several elements make up the AOS data management facilities. Hierarchical file directories and structures are respectively provided for file security and fast file access. Dynamic disk allocation is employed to provide more efficient use of disk space. Finally, device-dependent I/O is implemented to free files from physical hardware constraints.

Convenience facilities include the Command Line Interpreter, the Intelligent Spooler, a Batch facility that supports multiple batch job streams, and hardware error logging and on-line reporting. The Command Line Interpreter allows all systems functions to be available to terminal users, while the Intelligent Spooler gives multiple users concurrent access to a single output device. The Batch facility gives operators full queue management. The hardware error logging and on-line reporting system is a valuable aid to systems maintenance. The system provides soft error handling and recovery.

AOS is process-oriented. Data General defines a process as a group of program tasks that share up to 64K bytes of

memory address space and compete for system resources as a unit. A process can execute a system program such as an editor of a user application program. Each process is allocated a set of resources and privileges which define how much CPU time and memory the process can use. All processes in the system are organized into a "family tree," and a parent process can, based on its own privileges, create offspring processes and define their privileges. Processes are user-defined as either permanently memory resident, preemptible, or always swappable.

Through the use of prioritized multi-tasking, multiple tasks within a process can run in parallel, communicating and synchronizing their activities. Through the use of dynamic memory management and the MAP hardware, every process is allocated up to 32 pages of 2K bytes each in a maximum memory space of 1024K bytes.

System management facilities include a User Profile Editor, an Error Logging and Reporting System, a Diagnostic Monitor, a Resource Usage Accounting System, and a Process Environment Display System. Application development facilities include Text and File Editors, a Symbolic Debugger, Binder and Library Utilities, a Macro Assembler, Fortran IV, Fortran 5, Basic, DG/L, PL/I, Cobol, RPG II, and Idea. The Binder links object files to produce an executable program file and overlay file.

An integrated hardware/software scheme is implemented to provide security at the process, file, and system levels. Process security is provided through the use of the Eclipse MAP. Data files are protected by the access control built into the family tree directory structure.

DATABASE MANAGEMENT SYSTEM: The Data General Data Base Management System (DG/DBMS) runs under the AOS operating system. It complies with the 1978 and 1979 CODASYL recommendations for data base management systems.

DG/DBMS features a CODASYL-compliant Data Definition Language (DDL), concurrency control, data integrity checks, data security, data independence, remote access and transaction processing utilities. An optional Present Information Presentation Facility is an end-user oriented query language, report writer and graphics utility for use with DG/DBMS. DBMS also performs the following functions:

- Maintains the logical data organization and internal indices,
- Logs transactions and performs backup and recovery functions,
- Controls data access,
- Controls concurrent updates by multiple on-line and batch programs, and
- Helps centralize data to reduce redundancy.

The system consists of two run-time monitors and four standalone utilities. The two monitors form the Data Base Control System (DBCS) which handles access to the data base and to the optional magnetic tape log. The Data Definition Facility (DDF) utility maintains the schema and subschema descriptions, and manages the physical allocation of the data base. The DDF allows data to be retrieved in the format desired rather than the format in which it is stored. The Interactive Data Manipulation Language (IDML) allows knowledgeable user to read, write and update data base records without using Cobol. A Rebuild utility allows users to reconstruct the data base from a log tape should a disk crash or other major problem occur. And the fourth utility, DBSCAN, allows authorized personnel to monitor the integrity of the data base structure and also provides statistics. ►