Centurion Business Computers

MANAGEMENT SUMMARY

Centurion Computer Corporation was incorporated in 1972 under the name Warrex Computer Corporation as the successor to Warrex Computer Services, a company founded in 1971 by John Warren to provide consulting and programming services. That same year, Centurion entered the business of selling and supporting magnetic tape cassette systems. By August 1974, Centurion had designed and manufactured its first minicomputer, combined it with peripherals and software, and delivered it as the initial member of the Centurion family of small business computers. As a result of industry recognition of the Centurion name, the company formally changed its name from Warrex to Centurion Computer Corporation in March 1980.

The Centurion 100, Centurion 200, Centurion III, and Centurion 6000 Series systems are designed to meet the requirements of users who need in-house computer services in environments that may include multiple on-line users, multiple terminal use, high-volume I/O requirements, and real-time access demands. Centurion systems can also serve as time-shared, terminal-operated systems on which many unrelated tasks can be performed simultaneously under a multiprogramming operating system.

The Centurion 100 is a diskette-based system that includes the CPU with 32K bytes of MOS memory, expandable to 64K bytes, and two dual-density floppy disk drives. Each of these drives has a capacity of 616K bytes. A 150-cps matrix printer and upper/lower-case CRT display/keyboard terminal are standard on the Centurion 100. The system can support up to three floppy disk drives and can be expanded to include two CRT's and two printers. ▷

The Centurion family of business computer systems extends from single-user configurations to multi-terminal, multiprogramming systems with remote data entry/output capabilities. Options include six printer models. Software is provided and can be customized. Dealers provide support, maintenance, and training. Single-user Centurion configurations are priced from $15,000 to $40,000.

MAIN MEMORY: 32K bytes to 256K bytes

DISK CAPACITY: 616K bytes to 635.2 megabytes

WORKSTATIONS: One to thirty
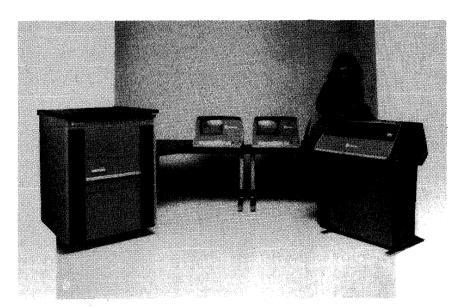
PRINTERS: 75 cps to 600 lpm

OTHER I/O: None

CHARACTERISTICS

MANUFACTURER: Centurion Computer Corporation, 1780 Jay Ell Drive, Richardson, Texas 75081. Telephone (214) 699-8400.

Centurion Computer Corporation was incorporated in January 1972 under the name Warrex Computer Corporation as a successor to Warrex Computer Services, a consulting and programming services firm. In 1972, Centurion began selling and supporting cassette tape systems and two years later designed and began manufacturing the Centurion minicomputer systems. In March 1980, the company formally changed its name from Warrex to Centurion Computer Corporation.

DEALERS: To sell and support Centurion systems, independent dealers have been established in Amarillo, Houston, ▶

This Centurion 6300 has a 64K-byte CPU, a four-port multiplexer, a 20.8-megabyte cartridge disk drive, two CRT's, and a 300-lpm chain printer. Price as shown above is $43,278.

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▷ The Centurion 200 and Centurion III are disk-based systems that include the CPU with 32K bytes of memory, expandable to 64K bytes, one 10.4-megabyte disk drive, and one upper/lower-case CRT terminal. A 150-cps matrix printer is standard. The Centurion 200 can be expanded to include two disk drives, and the Centurion III can include four disk drives. Both systems can support up to four CRT's and multiple printers. The Centurion III has an expanded frame to house a second disk drive.

The Centurion 6000 Series includes four models—the 6100, 6200, 6300, and 6400. The 6100 is a self-contained diskette-based desk model with 64K bytes of memory, expandable to 256K bytes, two dual-density diskette drives, a 1920-character CRT, and a 150-cps printer. Upgrading will allow the 6100 to support rigid disk drives.

The 6200 is a self-contained disk-based desk model with 64K bytes of memory, expandable to 128K bytes, a fixed/removable disk drive with a 10.4-megabyte or 20.8-megabyte capacity, a 1920-character CRT, and a 150-cps printer. The system will support a second disk drive and up to eight CRT's. The use of fewer CRT's allows memory to be increased to 256K bytes. Line printers rated at 150, 300, and 600 lpm are available.

The 6300 is an upright cabinet model with 64K bytes of memory, expandable to 256K bytes, a fixed/removable 10.4-megabyte or 20.8-megabyte disk drive, a 1920-character CRT, and a 150-cps printer. Up to four disk drives and up to thirty CRT's can be supported. The 150-, 300-, and 600-lpm printers can be used with the 6300.

The 6400 is an upright cabinet model with 64K bytes of memory, expandable to 256K bytes, a fixed/removable 26.5-megabyte rigid disk drive, a 1920-character CRT, and a 150-cps printer. The system will support up to eight disk drives of 79.4 megabytes each and up to thirty CRT's. The 150-, 300-, and 600-lpm printers can be used with the 6400.

The 6000 Series is built around the CPU-6; all other Centurion models use the CPU-5.

All of the Centurion systems have a remote data entry capability accessed through the video terminal keyboard, with output via the video terminal or printer.

The Centurion systems are hardware/software combinations that include the operating system, a Centurion Programming Language, and a Job Control Language. The Centurion library of applications includes routines for handling payroll, invoicing, general ledger, accounts receivable and payable, financial statements, professional billing, inventory control, depreciation, sales analysis, and text composition.

Through its dealers, Centurion offers software support, user training, equipment maintenance, and production ▷

▶ Hurst, Mt. Pleasant, Odessa, Richardson, San Angelo, San Antonio, Temple, and Victoria, Texas; Albuquerque, New Mexico; Baton Rouge and Metairie, Louisiana; Burlingame, Costa Mesa, and Woodland Hills, California; Charlotte, North Carolina; Cherry Hill, New Jersey; Cincinnati and Rocky River, Ohio; Denver and Colorado Springs, Colorado; Ellicott City and Potomac Village, Maryland; Hauppauge and New York City, New York; Honolulu, Hawaii; Knoxville and Memphis, Tennessee; Little Rock, Arkansas; Louisville, Kentucky; Milwaukee, Wisconsin; N. Miami, Florida; Oklahoma City and Tulsa, Oklahoma; Pendleton, Indiana; Smyrna, Georgia; and Wichita, Kansas. There is also a dealer in Mexico, two in Canada, and one in Bahrain. Centurion dealers provide full support, including sales, programming capabilities, and hardware maintenance. Each dealer owns his own Centurion computer and provides users with demonstrations, programming, and back-up support.

MODELS: Centurion 100, Centurion 200, Centurion III, and Centurion 6000 Series (consisting of 6100, 6200, 6300, 6400 systems).

DATE ANNOUNCED: Centurion III, 1975; Centurion 100 and 200, February 1979; Centurion 6000 Series, October 1979.

DATE OF FIRST DELIVERY: Centurion III, 1975; Centurion 100, April 1979; Centurion 200, May 1979; Centurion 6000 Series, October 1979.

NUMBER INSTALLED TO DATE: Over 1000 Centurion systems.

DATA FORMATS

BASIC UNIT: Sixteen-bit words and eight-bit bytes (CPU-5, used in the 100, 200, and III); eight-bit bytes, numeric operands of one to sixteen bytes, and character strings of one to 256 bytes (CPU-6, used in the 6000 Series).

FIXED-POINT OPERANDS: 32-bit and 48-bit, with 64-bit intermediate results (CPU-5); binary numbers of one to sixteen bytes (CPU-6).

FLOATING-POINT OPERANDS: None (CPU-5); eight-bit exponent and 32-bit mantissa (CPU-6).

INSTRUCTIONS: Seventy-one basic types, one to three bytes long, operating on eight-bit or sixteen-bit operands (CPU-5); 147 basic types, one to seven or more bytes long, operating on operands from one to 256 bytes (CPU-6).

INTERNAL CODE: ASCII and two's complement binary numbers.

MAIN STORAGE

TYPE: Random-access MOS.

CYCLE TIME: 800 nanoseconds per one-byte access.

CAPACITY: 32K bytes minimum expandable to 64K bytes maximum (CPU-5); 64K bytes minimum expandable to 256K bytes maximum (CPU-6).

CHECKING: None (CPU-5); one parity bit per memory byte (CPU-6).

STORAGE PROTECTION: None (CPU-5); each 2K-byte block of memory in a program's address space may independently be unprotected, write-protected, or read-and-write-protected (CPU-6).

RESERVED STORAGE: Upper 4K bytes of memory are used as I/O addresses, and operating system occupies lower 12K to 18K bytes (CPU-5); upper 6K bytes are reserved for ▶

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PERIPHERALS/TERMINALS

Model	Description and Speed	Manufacturer
PRINTERS		
TI-825	Serial; 132 positions; 9 x 7 dot matrix; 96 ASCII character set, upper/lower case; compressed print, 6 and 8 lines per inch, switch-selectable; 75 cps	Texas Instruments
TI-810	Serial; 132 positions; 9 x 7 dot matrix; 96 ASCII character set, upper/lower case; compressed print, 6 and 8 lines per inch, switch-selectable; 150 cps	Texas Instruments
CDC-9317	Serial; 132 positions; 7 x 7 dot matrix; 96 ASCII character set, upper/lower case; compressed print, 6 and 8 lines per inch, switch-selectable; 175 cps	Control Data Corp.
CLP-150	Chain; 132 positions; 64 ASCII character set, upper case only; 10 characters per inch; 150 lpm	Data 100
CLP-300	Chain; 132 positions; 64 ASCII character set, upper case only; 10 characters per inch; 300 lpm	Data 100
CDC-600	Chain; 132 positions; 64 ASCII character set, upper case only; 10 characters per inch; 600 lpm	Control Data Corp.
TERMINALS		
R100	CRT display/keyboard; 1920 characters, 96 ASCII character set, upper/lower case; 8 x 8 dot matrix	ADDS
CT-520	CRT display/keyboard; 1920 characters, 64 ASCII character set, upper case only; 5 x 7 dot matrix; interface for serial EIA printer.	ADDS

▷ facilities. Currently, there are over 40 Centurion dealers located in major cities of the U.S., Canada, Mexico, and Bahrain.

USER REACTION

Datapro conducted telephone interviews with seven users of Centurion systems selected at random from a list supplied by the vendor. The seven included a savings and loan, two CPA firms, an engineering/mechanical contractor, a wholesale/retail oil supply company, a supplier of machinist's tools and supplies, and a manufacturer.

Each of the users had one system (five III's and two 6300's). One III had 32K bytes of memory, and the other six systems had 64K. Six systems had been purchased, and the other system is being leased. Three years was the longest time that any of the systems had been in use; nine months was the shortest; and the average was slightly under two years.

There were twenty-two CRT's attached to the seven systems, with ten being the largest number attached to a single computer. All seven systems were configured with one printer.

Ready-made programs from Centurion dealers were the source of applications programs in six cases, and two users had in-house personnel writing programs. Accounting and payroll/personnel were the two principal applications reported, while other uses included word processing, retail, amortization, construction, service bureau, depreciation schedules, manufacturing, inventory, government allocation, transaction processing, distributed processing, banking/finance, and engineering/scientific. ▷

▶ I/O and protection purposes, and operating system occupies 20K to 32K bytes of remaining memory (CPU-6).

CENTRAL PROCESSOR

GENERAL: The CPU-5 processor (used in the 100, 200, and III) uses approximately 135 bipolar MSI and LSI components. It communicates with memories and I/O devices via an eight-bit data bus, a sixteen-bit address bus, and various control signals. It is microprogrammed and executes a single microinstruction in each 200-nanosecond CPU cycle. The execution of both microinstructions and machine-language instructions is overlapped with the fetching of the next instruction to speed up execution.

The CPU contains an eight-bit-wide arithmetic/logic unit (ALU) and data paths. Two sixteen-bit address counters make it possible to generate sequential instruction and operand addresses rapidly without tying up the ALU. The ALU contains seventeen eight-bit registers that are used for temporary results. Registers accessible to the programmer reside in a high-speed 256-byte RAM on the CPU card.

The CPU-6 processor (used in the 6000 Series) uses approximately 145 bipolar MSI and LSI components. It communicates with memories and I/O devices via a data bus with eight bits plus parity, an eighteen-bit address bus, and various control signals. It is microprogrammed and executes a single microinstruction in each 200-nanosecond CPU cycle. The execution of both microinstructions and machine-language instructions is overlapped with the fetching of the next instruction to speed up execution.

The CPU contains an eight-bit-wide arithmetic/logic unit (ALU) and data paths. Two sixteen-bit address counters make it possible to generate sequential instruction and operand addresses rapidly without tying up the ALU. The ALU contains seventeen eight-bit registers that are used for temporary results. Registers accessible to the programmer reside in a high-speed 256-byte RAM on the CPU card.

The CPU-6 incorporates a memory mapping and protection unit that allows 2K-byte blocks of the program's 64K-byte address space to be independently located anywhere in the ▶

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▷ Additional software from Centurion, expanded data communications facilities, and more CRT's were the only acquisitions the users plan to make in 1980. Six of the seven have no plans to replace their computers in the near future, but the seventh expects to replace his with equipment from a different manufacturer.

The table below summarizes the ratings of the seven Centurion users.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	4	3	0	0	3.6
Reliability of mainframe	4	3	0	0	3.6
Reliability of peripherals	5	1	1	0	3.6
Maintenance service:					
Responsiveness	4	1	1	1	3.1
Effectiveness	4	1	1	0	3.5
Technical support:					
Trouble-shooting	1	3	0	2	2.5
Education	1	5	0	1	2.9
Documentation	1	3	1	2	2.4
Manufacturer's software:					
Operating system	2	2	0	0	3.5
Compilers and assemblers	1	1	0	0	3.5
Applications programs	0	2	2	0	2.5
Ease of programming	2	0	0	0	4.0
Ease of conversion	0	1	0	0	3.0
Overall satisfaction	2	5	0	0	3.3

*Weighted Average on a scale of 4.0 for Excellent.

On the positive side of these users' experiences with their Centurion systems, five said that they were happy with the response time, and three felt that the system was easy to expand or reconfigure when the need arose. One expressed special praise for the "growth allowed," and another was "very well satisfied." Only one user would not recommend the system, but of the six who would, one said that he would do so "without hesitation." The one who would not also would not elaborate on his reason for this decision, but he nevertheless assigned no ratings less than "Good," including the rating for "Overall satisfaction."

The only complaint heard more than once came from two users who said that their proposed systems had been too small and had to be expanded. One user felt that the power and/or the cooling requirements were excessive; another said that the costs had exceeded his expectations; one expressed dissatisfaction with the "costs of maintenance and software"; and another said that "a disk drive was replaced."□

▶ actual 256K-byte memory space. Each block may also be assigned different protection attributes. Any instruction which violates protection restraints or fetches data with bad parity will be aborted immediately.

The CPU-6 has supervisor and user states that define which instructions may be legally executed. Instructions not permitted in the user state are called privileged and include I/O, mapping control, and interrupt control instructions. User programs which attempt to execute a privileged instruction are aborted immediately.

The CPU-6 also maintains an eight-bit counter which is decremented sixty times a second for use in time-of-day routines. Underflow through zero causes an interrupt.

CONTROL STORAGE: 512 56-bit words of ROM (CPU-5); 2,048 56-bit words of ROM (CPU-6).

REGISTERS: Sixteen independent sets of registers, one for each interrupt level. Each set can be addressed as sixteen bytes or eight words.

ADDRESSING MODES: Seventeen modes for load, store, jump, and JSR instructions. These include immediate, direct, indirect, relative, relative indirect, and many indexed modes with auto-increment and auto-decrement modes. Relative addressing for conditional branches. Other instructions operate on register operands (CPU-5).

Seventeen modes for load, store, jump, and JSR instructions. These include immediate, direct, indirect, relative, relative indirect, and many indexed modes. Relative addressing for conditional branches. Most one- and two-operand instructions have immediate, direct, and indexed addressing on one or both operands (CPU-6).

INSTRUCTION REPERTOIRE: 354 distinct instructions of seventy-one basic types, including twenty-three control instructions, fourteen conditional branches, sixteen one-operand instructions, fourteen two-operand instructions, and four memory reference instructions (CPU-5).
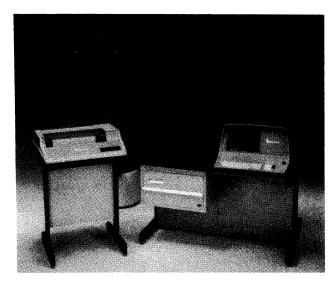
840 distinct instructions of 147 basic types. Elementary types include thirty-seven control, sixteen branch, four load/store, and thirty-one byte and word operations. Complex types include move, arithmetic, editing, and base conversion instructions which can have two memory operands of one to sixteen bytes and move, compare, logic, search, and translation instructions which can have two memory operands of one to 256 bytes. The complex arithmetic instructions can trigger an interrupt on overflow conditions (CPU-6).

INSTRUCTION TIMINGS: The timings are in microseconds.

1) CPU-5; 16-bit operands   (8-bit timings in parentheses)
   Load Immediate   3.8   (2.8)
   Load Direct   6.4   (5.4)
   Add Two Registers   3.6   (2.8)
   CPU-5; miscellaneous
   Conditional Branch   2.0-3.2
   Jump to Subroutine   10.4
2) CPU-6; 16-bit operands
   Load, Memory to Register   5.0
   Add Two Registers   3.0
   Add Memory to Register   6.2
   Multiply Register by Memory   25.6
   CPU-6; 32-bit operands, both in memory
   Add   32.0
   Move   28.8
   Multiply   150.0
   Convert ASCII to Binary   214.0
   Convert Binary to ASCII and Edit 140.0
   CPU-6; miscellaneous
   Move 100 Bytes   317.0
   Conditional Branch   2.0-3.6
   Supervisor Call   13.0

INTERRUPTS: Sixteen-level fully vectored interrupts. Each level has priority over all lower levels (CPU-5).

Sixteen-level fully vectored interrupts. In addition to interrupts by I/O devices, interrupts can be triggered by a number of conditions within the CPU. These include arithmetic overflow, execution of unimplemented or privileged instructions, illegal memory references, parity errors, and time-of-day clock underflow (CPU-6). ▶

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The above Centurion 200 includes the 32K CPU, a four-port multiplexer, a 10.4-megabyte cartridge disk drive, CRT, and a 150-cps matrix printer for $27,062 as pictured.

PHYSICAL SPECIFICATIONS: The Centurion extended cabinet systems (Centurion III, 6300, 6400) accommodate the basic CPU, memory modules, peripheral controllers, and, in the III and 6300, up to two disk drives in a single cabinet. Fourteen I/O slots are available. The unit is 44 inches high, 32 inches wide, 35 inches deep, weighs 400 pounds, and is mounted on casters. Centurion systems do not require special air conditioning or physical facilities. Operational temperature is 65° to 85° F., and relative humidity is 20 to 80 percent, noncondensing. Input voltage is 94.5 to 121 VAC, 59 to 60.5 Hz. The voltage tolerance allows for brownouts.

Centurion desk cabinet systems (Centurion 100, 200, 6100, 6200) accommodate the basic CPU, memory modules, peripheral controllers, up to three floppy disk drives or one cartridge disk unit, and one CRT terminal in the basic cabinet. Seven I/O slots are available. The unit is 28 inches high, 48 inches wide, 33 inches deep and weighs 300 pounds. Operational environment and electrical requirements are the same as for Centurion extended cabinet systems.

INPUT/OUTPUT CONTROL

I/O CHANNELS: All of the Centurion systems are equipped with a four-port multiplexer which provides four channels of asynchronous control for the keyboard, printer, CRT's, or remote units. Each I/O device is on its own independent channel and operates independently of all other devices. Low-speed devices transfer data under software control. High-speed devices transfer data under Direct Memory Access control at rates up to 1.2 megabytes/second.

CONFIGURATION RULES

The basic Centurion 100 can be expanded to 64K bytes of memory, up to three diskette drives (single-sided/double-density or dual-sided/double-density), and a second CRT. The system can be configured with multiple printers, which can be addressed simultaneously.

The basic Centurion 200 can be expanded to 64K bytes of memory, up to two cartridge disk drives (10.4 or 20.8 megabytes each), and up to four CRT's. The system can be configured with multiple printers, which can be addressed simultaneously.

The basic Centurion III can be expanded to 64K bytes of memory, up to four cartridge disk drives (10.4 or 20.8

megabytes each), and up to four CRT's. The system can be configured with multiple printers, which can be addressed simultaneously.

The basic Centurion 6100 can be expanded to 256K bytes of memory, up to three diskette drives (single-sided/double-density or dual-sided/double-density), and up to four CRT's. The system can be configured with multiple printers, which can be addressed simultaneously.

The basic Centurion 6200 can be expanded to 128K bytes of memory, up to two cartridge disk drives (10.4 or 20.8 megabytes each), and up to eight CRT's. If fewer CRT's are used, the system can be configured with multiple printers, which can be addressed simultaneously, and with up to 256K bytes of memory.

The basic Centurion 6300 can be expanded to 256K bytes of memory, up to four cartridge disk drives (10.4 or 20.8 megabytes each), and up to thirty CRT's. The system can be configured with multiple printers, which can be addressed simultaneously.

The basic Centurion 6400 can be expanded to 256K bytes of memory, up to eight cartridge disk drives (79.4 megabytes each), and up to thirty CRT's. The system can be configured with multiple printers, which can be addressed simultaneously.

The Centurion 100, 200, and III can be field-upgraded to the 6100, 6200, and 6300, respectively, without changing the basic cabinet. In all cases, additional disk capacity can be added without obsoleting the basic system; add-on cabinets are provided.

WORKSTATIONS: Varies for each system from up to four to up to thirty. See above configurations for each system.

DISK STORAGE: Varies for each system. See above configurations.

MAGNETIC TAPE UNITS: None.

PRINTERS: Varies for each system. See above configurations.

MASS STORAGE

10.4-MEGABYTE CARTRIDGE DISK DRIVE: Provides four recording surfaces on two disks, one fixed and one removable. The drive has a capacity of 10.4 megabytes with 5.2 megabytes fixed and 5.2 megabytes removable. Each 5.2-megabyte disk contains 812 16-sector tracks with 400 bytes per sector. Average access time is 35 milliseconds, and data transfer rate is 2.5 megabits per second. The disk controller will support up to four drives for a maximum storage capacity of 41.6 megabytes. The drive is Control Data Corporation's Hawk, and Centurion manufactures the controller.

20.8-MEGABYTE CARTRIDGE DISK DRIVE: Provides eight recording surfaces on four disks, three fixed and one removable. The drive has a capacity of 20.8 megabytes with 5.2 megabytes removable and 15.6 megabytes fixed. Each 5.2-megabyte disk contains 812 16-sector tracks with 400 bytes per sector. Average access time is 40 milliseconds, and data transfer rate is 2.5 megabits per second. The disk controller will support up to four drives for a maximum storage capacity of 83.2 megabytes. The drive is the Pertec D3000E, and the controller is manufactured by Centurion.

CMD CARTRIDGE DISK DRIVE: Available with 26.5-, 52.9-, and 79.4-megabyte capacities. The 26.5-megabyte version has two recording surfaces on two disks, one fixed and one removable. The 52.9-megabyte version has four record- ▶

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ing surfaces on three disks, two fixed and one removable. The 79.4-megabyte version has six recording surfaces on four disks, three fixed and one removable. Each recording surface (13.23 megabytes) contains 827 40-sector tracks with 400 bytes per sector. In order to be compatible with all other Centurion disk drives, the 827 physical tracks are handled by the operating system as 2,067.5 logical 16-sector tracks with 400 bytes per sector. I.e., there are two and a half logical tracks per physical track. Average access time is 20 milliseconds, and data transfer rate is 9.68 megabits per second. The disk controller will support up to eight drives for a maximum storage capacity of 635.2 megabytes. The CMD is manufactured by Control Data Corporation, and the controller is manufactured by Centurion.

SSDD FLOPPY DISK DRIVE: Single-sided double-density (SSDD) floppy disk drive stores up to 616K bytes on 96 16-sector tracks with 400 bytes per sector. Average access time is 263 milliseconds, and data transfer rate is 62.5K bytes per second. The floppy disk controller will support up to four drives, but the desk cabinet used on the 100 and 6100 systems provides for up to three drives, making the maximum capacity 1.8 megabytes. Control Data Corporation manufactures the drive, and Centurion manufactures the controller.

DSDD FLOPPY DISK DRIVE: Dual-sided double-density (DSDD) floppy disk drive stores up to 1.2 megabytes on 192 16-sector tracks with 400 bytes per sector. Average access time is 96 milliseconds, and data transfer rate is 62.5K bytes per second. The SSDD and DSDD use the same controller. The cabinet size restraint (up to three drives) also applies to both drives. The maximum capacity of the DSDD is therefore 3.6 megabytes. Control Data Corporation manufactures the drive, and Centurion manufactures the controller.

COMMUNICATIONS CONTROL

All Centurion systems are equipped with a communications controller that connects the Centurion system with the telephone system, enabling the Centurion to communicate with other data processing equipment or Centurion systems at other locations. A modem translates the language of the telephone lines to the language of the CRT or printer. Data transmission is performed concurrently with local processing. The remote CRT or printer can be used for inquiry and updating, remote job entry, and software updating. The operations can be performed under the control of an operator at the remote CRT without any manual intervention at the Centurion system site or they can be controlled locally.

SOFTWARE

Centurion offers a variety of software products including a basic operating system, programming languages, assembler, editor, standard utilities, and a library of business-oriented application software. Centurion provides complete documentation and programming instructions.

OPERATING SYSTEM: *OS* is the operating system used on Centurion systems with the CPU-5. OS provides some device-independent input/output programming and permits the concurrent operation of up to six programs, with each program residing in a different portion of main storage. A round-robin scheduling system determines the partition to which control is given. In a multi-user environment, the programmer using OS is provided with a set of resident routines for accessing data files at both the physical and logical I/O levels.

MAXIMUS is the operating system used on the Centurion 6000 Series (CPU-6). All program I/O is device-independent, using the system logical I/O capabilities. MAXIMUS allows up to sixty-four independent partitions for program execution. All partitions are dynamic in memory allocation and will grow or shrink so that they are always the size required at any particular time. MAXIMUS is completely protected against accidental modification and is virtually crashproof.

LANGUAGES: Three languages—Centurion Programming (CPL), Job Control Language (JCL), and Assembler Language—are available on Centurion CPU-5 systems with OS. Also available is a program/report generator called System Maintenance and Reporting Technique (SMART).

In addition to all of the above, BASIC and COBOL are also available on CPU-6 systems.

The *Centurion Programming Language (CPL)* is a symbolic language designed primarily to implement application software tailored to the in-house needs of users. CPL is oriented to the multiprogramming operating system, which is designed for disk-based random access. The operating system allows users to partition memory into segments which can execute a CPL program, and the CPL program is compiled, assembled, and then linked with external subroutines. The main I/O routines are located in the operating system and are shared by each partition.

The *Job Control Language (JCL)* is implemented to load programs, activate system routines, allocate system resources, manipulate data files to and from peripheral storage devices, and respond to any unusual conditions that may arise during job execution. JCL statements are processed by the Operating System Executive program when it is resident between program executions.

An important concept in the JCL is the use of symbolic parameters. This is a set of variables with assigned values which may be used to represent file names, device names, or any operand values in the JCL statement. Substitution of the real value for the symbolic reference is performed prior to processing the JCL statement.

A two-pass symbolic *assembler* translates source language into absolute binary programs for the Centurion computers. During the first pass, the source program is read and the assembler builds a name table and assigns a value to each symbol. On the second pass, the assembler reads the source program again and generates a binary object record and a program listing. The assembler on the CPU-6 includes over 300 instructions with 71 different memory addressing modes available. Its capabilities include 16-byte (256-bit) math and logical operations, character string manipulation, and numeric editing. Up to 64K bytes of memory can be moved with a single instruction.

System Maintenance and Reporting Technique (SMART), a sophisticated program and report and generator, simplifies software development and facilitates generation of customized management reporting by nonprogrammers.

Centurion BASIC is a Dartmouth standard syntax with enhanced string handling capabilities. All Centurion file structures, including variable spanned indexed (VSI), may be accessed in Centurion BASIC.

COBOL offered with the 6000 Series is IBM-compatible ANSI '74 or '68, Level I COBOL with over 85% of Level II implemented. There are also extensions to the language which facilitate the use of special 6000 Series features such as video screen controls.

UTILITIES: Centurion supplies many general-purpose utilities on both the CPU-5 and CPU-6, plus a library of diagnostic tests for the processor and all peripherals. Standard utilities include: Sort/Merge, File/Transmission, Print, File Copy, Disk Copy, File Display, Spool Maintenance,▶

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and a Scan utility to review file contents. An on-line Program Trace/Debug is also available with the CPU-6.

A *Text Editor* program permits creation, updating, or correction of disk files. Since information is located by content rather than by relative position within a file, the file is always searched for the specific character string supplied by the operator. During this search, file records can be copied, listed, or by-passed until the specific string is found. When it is found, the entire file record is displayed, and the operator, working through the video keyboard, can modify, delete, or rearrange the file in whole or in part. When all changes have been completed, the updated text is copied back to the original data file.

APPLICATION SOFTWARE: All Centurion programs are interactive.

Standard Business Applications are routines designed to perform the data processing functions of typical small to medium-sized businesses. Each package contains detailed operator instructions and the JCL procedures required to execute the programs. Standard application programs may be tailored to meet specialized user requirements. The following systems and programs are included in the Standard Business Series:

Random-Access General Ledger (RAGL) is a comprehensive general ledger and financial reporting system designed specifically to meet the client-accounting needs of accountants in public practice. The system allows for complete flexibility in designing the chart of accounts; branch accounting can be handled; and an unlimited number of accounts can be scheduled in either the balance sheet or income statement. Automatic interfacing with payroll accumulation is available, allowing checks to be entered simultaneously with normal transaction entry. Employee earnings records with 941a's, W-2's, and 1099's are available when required. Calculation routines allow for any computation involving basic arithmetic to be performed during financial report preparation for ratios, gross profit calculations, etc. Reports generated include transaction entry journal, general ledger, trial balance worksheet, financial statements with accountant's compilation report, statement of changes in financial position, comparative balance sheet and income statement, budgetary comparatives, and subaccount general ledger (for job costing, product sales analysis, etc.).

Centurion Distribution Management System (CDMS) is an interactive real-time accounting and management information reporting system for the manufacturer, wholesaler, and distributor. A single entry automatically updates all applicable files, and virtually any data contained in the system is instantly available. The system includes the following modules: order entry, invoicing, accounts receivable with aging, inventory management reports, sales analysis, sales tax reporting, and statement preparation.

Accounts Payable System provides cash disbursement control, general ledger data, and accounts payable checks. The same entry will post invoices to the vendor file and make distribution to the expense accounts in the General Accounting System. The user has complete flexibility in paying invoices and may elect to pay all vendors, pay any selected invoice for a vendor, pay by date, or indicate that an invoice has been paid manually. The system also provides a series of reports.

Accounts Receivable System is available in open-item and balance-forward versions. The system provides for entry of invoices, credit memos, and adjustments, printing of customer statements, and accounts receivable balances, with aging.

Random-Access Payroll System (RAP) features full-screen displays, prompting messages, and validity checking. Because RAP contains most of the capabilities needed by most small to medium-sized companies, the user has complete control in establishing his payroll procedures. RAP also provides a number of special features: up to fifteen optional deductions above the standard; classification of employees; accrual of vacation and sick leave hours; 3-digit department code; 6-digit employee code; and salary range up to $999,999.99 annually.

Professional Billing System is designed specifically for public accountants but can be used by other firms that bill their clients on the basis of time expended on the client's behalf. The system provides a record of each professional's time, with services performed and for whom; a record of nonbillable time by activity for each professional; expense records by category and client; a record of services performed by client and for the entire firm, showing total hours and dollars for both billable and nonbillable services; a record of work-in-process, what has actually been billed, and the balance of each client's account with aging; and preparation of statements for services rendered.

Depreciation System allows the user to create a file of all fixed assets. The system is completely flexible and allows depreciation schedules to be run as often as needed. The method of depreciation is controlled by the user, allowing him at any time to change his method from declining balance to straight line or any other method.

Amortization Program allows the user to calculate the monthly interest and principal portion of a loan payment. The setup includes total principal amount, monthly payment amount, interest rate, and beginning month and year. Year-end totals of principal and interest are printed.

The Centurion Text Composition System (KOMPOZ) produces perfectly typewritten copies of letters, manuals, etc. automatically from a file created and stored on a disk. Significant features of the system include automatic formatting and justification and ease in correcting mistakes before a document is printed. Special commands are provided that allow letters, words, or entire lines to be inserted, deleted, centered, or underlined.

Specialized Applications developed by Centurion dealers provide routines to perform the data processing function required by certain selected industries. These include:

• *Fuel Oil Distribution*—complete system, from printing of delivery schedule to printing of service contract renewals and generation of customer statements.

• *Country Club Accounting*—membership list, statements, aged accounts receivable, departmental revenue analysis, mailing labels.

• *Hospital Accounting*—patient and third-party billing, general accounting including inventory. For small to medium-size hospitals.

• *Medical Billing*—patient and third-party billing for doctors' offices and clinics.

• *Utility Billing*—water, sewage, and refuse billing for municipalities.

• *Oil and Gas Accounting*—lease P & L, inventory, rentals, accounts payable and receivable, general ledger and financial statements. For independent producers.

• *Insurance Agency Accounting*—claims handling, policy expirations/renewals, invoicing, statements, aged accounts receivable, accounts payable, and producer statements. For independent insurance agencies.

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> - *Publisher's System*—circulation handling, accounts receivable, and commercial printing estimating. For newspaper publishers and printers.

- *Bank Accounting*—DDA, CD's, savings, loans, general ledger and financial statements.

- *Contractor's System*—labor distribution, job costing, equipment inventory, accounts payable and receivable, general ledger and financial statements.

POLICY: Centurion systems are available on a purchase or lease-purchase basis. Individual models are offered as a package, including the processor, required peripherals, and operating system, with separately priced options.

Maintenance is also separately priced and is available through Centurion dealers.

SOFTWARE AND SUPPORT: Dealers are provided with a library of application software from Centurion. In addition, they can develop software for individual users and participate in a cooperative software exchange program coordinated by Centurion. Software pricing is set by the dealer, and software prices can be quoted separately or as part of a packaged system. Application software is supported by the dealers.

EQUIPMENT: The components and prices of numerous packaged configurations of the Centurion systems are listed in the Equipment Prices section that follows.■

EQUIPMENT PRICES

PACKAGED SYSTEMS		Purchase Price	Monthly Maint.
Series 100	Basic system: CPU-5 with 32K, 4-port MUX, R100 CRT, 2 SSDD floppy disks, and 150-cps printer.	$15,326	$153
	Basic system with 2 DSDD floppy disks instead of SSDD	17,384	174
	Basic system with 175-cps printer instead of 150-cps printer	15,904	159
	Basic system with 175-cps printer and DSDD disks	17,964	180
	Basic system with 150-lpm printer and SSDD disks	18,504	185
	Basic system with 150-lpm printer and DSDD disks	20,564	206
Series 6100	Basic system: CPU-6 with 64K, 4-port MUX, R100 CRT, 2 SSDD floppy disks, and 150-cps printer	18,439	184
	Basic system with 2 DSDD disks and 150-cps printer	20,401	204
	Basic system with 175-cps printer and SSDD disks	19,041	190
	Basic system with 175-cps printer and DSDD disks	21,002	210
	Basic system with 150-lpm printer and SSDD disks	21,641	216
	Basic system with 150-lpm printer and DSDD printer	23,602	236
Series 200	Basic system: CPU-5 with 32K, 4-port MUX, R100 CRT, 10.4-megabyte Hawk disk drive, 150-cps printer	26,786	298
	Basic system with 150-cps printer and 20.8-megabyte Pertec disk drive	29,672	327
	Basic system with 175-cps printer and Hawk disk drive	27,834	309
	Basic system with 175-cps printer and Pertec disk drive	30,721	338
	Basic system with 150-lpm printer and Hawk disk drive	30,434	335
	Basic system with 150-lpm printer and Pertec disk drive	33,322	364
	Basic system with 300-lpm printer and Hawk disk drive	31,749	348
	Basic system with 300-lpm printer and Pertec disk drive	34,637	377
	Basic system with 600-lpm printer and Hawk disk drive	40,219	432
	Basic system with 600-lpm printer and Pertec disk drive	43,107	461
Series 6200	Basic system: CPU-6 with 64K, 4-port MUX, R100 CRT, 10.4-megabyte Hawk disk drive, 150-cps printer	29,354	322
	Basic system with 150-cps printer and 20.8-megabyte Pertec disk drive	32,104	350
	Basic system with 175-cps printer and Hawk disk drive	30,402	333
	Basic system with 175-cps printer and Pertec disk drive	33,152	360
	Basic system with 150-lpm printer and Hawk disk drive	33,002	359
	Basic system with 150-lpm printer and Pertec disk drive	35,752	386
	Basic system with 300-lpm printer and Hawk disk drive	34,316	372
	Basic system with 300-lpm printer and Pertec disk drive	37,067	400
	Basic system with 600-lpm printer and Hawk disk drive	42,786	457
	Basic system with 600-lpm printer and Pertec disk drive	45,537	484
Series III	Basic system: CPU-5 with 32K, 4-port MUX, R100 CRT, 10.4-megabyte Hawk disk drive, 150-cps printer	29,817	298
	Basic system with 150-cps printer and 20.8-megabyte Pertec disk drive	32,704	327
	Basic system with 175-cps printer and Hawk disk drive	30,866	309
	Basic system with 175-cps printer and Pertec disk drive	33,752	338
	Basic system with 150-lpm printer and Hawk disk drive	33,466	335
	Basic system with 150-lpm printer and Pertec disk drive	36,352	364
	Basic system with 300-lpm printer and Hawk disk drive	34,779	348
	Basic system with 300-lpm printer and Pertec disk drive	37,667	377
	Basic system with 600-lpm printer and Hawk disk drive	43,249	432
	Basic system with 600-lpm printer and Pertec disk drive	46,137	461
Series 6300	Basic system: CPU-6 with 64K, 4-port MUX, R100 CRT, 10.4-megabyte Hawk disk drive, 150-cps printer	32,241	322
	Basic system with 150-cps printer and 20.8-megabyte Pertec disk drive	34,991	350
	Basic system with 175-cps printer and Hawk disk drive	33,289	333
	Basic system with 175-cps printer and Pertec disk drive	36,039	360
	Basic system with 150-lpm printer and Hawk disk drive	35,889	359
	Basic system with 150-lpm printer and Pertec disk drive	38,639	386
	Basic system with 300-lpm printer and Hawk disk drive	37,202	372
	Basic system with 300-lpm printer and Pertec disk drive	39,952	400
	Basic system with 600-lpm printer and Hawk disk drive	45,672	457
	Basic system with 600-lpm printer and Pertec disk drive	48,422	484
Series 6400	Basic system: CPU-6 with 64K, 4-port MUX, R100 CRT, 26.5-megabyte CMD disk drive, 150-cps printer	40,466	405
	Basic system with 150-cps printer and 52.9-megabyte CMD disk drive	43,466	435
	Basic system with 150-cps printer and 79.4-megabyte CMD disk drive	46,799	468
	Basic system with 175-cps printer and 26.5-megabyte drive	41,514	415
	Basic system with 175-cps printer and 52.9-megabyte drive	44,514	445
	Basic system with 175-cps printer and 79.4-megabyte drive	47,847	478
	Basic system with 150-lpm printer and 26.5-megabyte drive	44,114	441
	Basic system with 150-lpm printer and 52.9-megabyte drive	47,114	471
	Basic system with 150-lpm printer and 79.4-megabyte drive	50,447	504

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EQUIPMENT PRICES

► **PACKAGED SYSTEMS (Continued)**

		Purchase Price	Monthly Maint.
	Basic system with 300-lpm printer and 26.5-megabyte drive	45,427	454
	Basic system with 300-lpm printer and 52.9-megabyte drive	48,427	484
	Basic system with 300-lpm printer and 79.4-megabyte drive	51,761	518
	Basic system with 600-lpm printer and 26.5-megabyte drive	53,897	539
	Basic system with 600-lpm printer and 52.9-megabyte drive	56,897	569
	Basic system with 600-lpm printer and 79.4-megabyte drive	60,231	602

MEMORY

11-0107400	32K-byte memory board	2,400	24
11-0107500	64K-byte memory board	4,167	42
11-0106200	128K-byte memory board	7,550	76

MASS STORAGE

23-9404000	SSDD floppy disk drive	950	10
23-9406000	DSDD floppy disk drive	1,567	16
23-9427H00	10.4-megabyte Hawk disk drive with cabinet and controller	11,499	99
	Same with cabinet only	9,832	82
	Same without cabinet or controller	8,165	82
23-D340000	20.8-megabyte Pertec disk drive with cabinet and controller	13,862	122
	Same with cabinet only	12,195	106
	Same without cabinet or controller	10,529	106
CMD-32	26.5-megabyte CMD add-on disk drive	15,200	152
CMD-64	52.9-megabyte CMD add-on disk drive	18,800	188
CMD-96	19.4-megabyte CMD add-on disk drive	23,000	230

PRINTERS

TI-825	75-cps, 9 x 7 serial matrix	3,074	31
TI-810	150-cps, 9 x 7 serial matrix	3,544	36
CDC-9317	175-cps, 7 x 7 parallel matrix printer	4,592	46
CLP-150	150-lpm, chain printer, parallel	7,192	72
CLP-300	300-lpm, chain printer, parallel	8,505	86
CDC-600	600-lpm, chain printer, parallel	16,975	170

TERMINALS

R100	CRT terminal; 1920 characters, upper/lower case	2,492	25
CT-520	CRT terminal; 1920 characters, upper case, for use at a remote location with a printer	2,492	25