

Control Data Cyber 18 Family

MANAGEMENT SUMMARY

The Cyber 18 family of computers, introduced in March 1976, were developed for the distributed data processing and small computer markets. They feature micro-programming techniques that result in increased data protection, more flexibility, and faster processing than Control Data's earlier System 17 series, which has been incorporated into the Cyber 18 family.

Control Data was one of the earliest and strongest proponents of distributed processing. In addition to the locally distributed architecture of the innovative 6000 Series computers introduced in the 1960's, the predecessors of the System 17 were widely used by Control Data as the basis for specialized "intelligent terminals" to fit the needs of individual situations. The System 17 has not been highly visible on the minicomputer scene, but it is quietly at work in many process control tasks in the petrochemical, petroleum, and drug industries. Curiously, the company has had much more visibility in the field of minicomputer peripherals, and has achieved a solid position in the market for small disk drives and tape drives along with printers, punched card units, and magnetic media.

The Control Data System 17 series was announced in July 1973 as an extension and replacement for the earlier real-time-oriented CDC 1700 systems, originally introduced in 1965. With more than 600 of the earlier systems installed at the time of the System 17's announcement, and three levels of CDC 1700 operating systems available, as well as dozens of major applications programs representing more than \$10 million worth of software development, it made very good sense for the System 17 to have the same instruction repertoire >

The Cyber 18 family from Control Data spans a wide range of configurations and applications for both business and industrial users while retaining software compatibility with CDC's earlier System 17 Series. The top-of-the-line Cyber 18-25 time-sharing system features dual processors, up to 512K bytes of memory, up to 400 million bytes of disk storage, and support for up to 56 interactive terminals.

CHARACTERISTICS

MANUFACTURER: Control Data Corporation, P.O. Box 0, Minneapolis, Minnesota 55440. Telephone (612) 853-8100.

Control Data is a worldwide business organization with over \$3 billion in annual revenues and 50,000 employees. Its areas of specialty are primarily in the design, manufacture, sale, and maintenance of a wide range of data processing equipment and the design and sale of professional services to business and industry. A major financial service subsidiary is Commercial Credit Company. Magnetic Peripherals (with Honeywell) and Computer Peripherals (with NCR) represent significant joint venture companies.

MODELS: Cyber 18-5M, 18-10M, 18-20, and 18-25.

DATE ANNOUNCED: March 30, 1976.

DATE OF FIRST DELIVERY: Late 1976.

NUMBER INSTALLED: Over 2,000 (including Cyber 18-17 systems). >



The Cyber 18-20 features a memory size of from 32K to 256K bytes, 9 I/O slots that accept magnetic tape, floppy and hard disks, a card reader/line printer, and micro memory controllers. A typical 18-20 system with 192K bytes of memory, ten terminals, 300 lpm printer, and 100 megabytes of disk storage costs about \$115,000.

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CHARACTERISTICS OF THE CYBER 18 FAMILY

MODEL	18-5M	18-10M	18-20	18-25
Processor	Microprogrammed	Microprogrammed	User Microprogrammable	User Microprogrammable (2)
Memory (K=1024):				
Type	MOS	MOS	MOS	MOS
Minimum (bytes)	32K	32K	32K	64K*
Maximum (bytes)	64K	128K	256K	512K*
Cycle time (nanoseconds)	750	750	750	750
Maximum flexible disk (bytes)	0	512K	512K	512K
Maximum hard disk (bytes)	0	35 million	400 million	400 million

*Includes both CPU's.

➤ and fundamental architecture as the older 1700's. A hallmark of the System 17 was its program, peripheral, and operator panel compatibility with the 1700's.

In August 1975, Control Data announced several enhancements for the System 17 that strengthened its competitive position in the scientific and process control fields. The new features included floating-point hardware, improved communications capabilities, remote A/D interfaces, additional D/A conversion units, a seven-frequency real-time clock, and such mini-peripherals as magnetic tape units, punched tape units, and a card punch.

In March 1976, Control Data enhanced and upgraded its small computer product line by introducing the Cyber 18 family.

In distributed applications, the Cyber 18-5M can function as an intelligent terminal, processing routine data on-site while sending larger jobs to a central computer. The 18-5M can emulate IBM 2780 and 3780 terminals, which makes it compatible with IBM host computers. In addition, it can emulate a CDC 200 User Terminal for use in Control Data system environments. The 18-5M features a memory size of 32K bytes and up to six I/O slots that accept magnetic tape, communications, floppy disk, and card reader/printer controllers. An 18-5M system with 32K bytes of memory, a 300-cpm card reader, a 300-lpm printer, a single CRT console, and synchronous communications capability can be purchased for about \$30,000.

The 18-10M offers from 32K to 128K bytes of memory, while the 18-20 features a memory size of from 32K to 256K bytes. Both systems offer 9 I/O slots that accept magnetic tape, floppy and hard disks, a card reader/line printer, and micro memory controllers. A basic 18-10M with 32K bytes of memory sells for \$16,700. An 18-20 system with 64K bytes of memory, 8K bytes of micro-program memory, magnetic tape drive, card reader, line printer, and mass storage capability sells for about \$70,000.

➤ DATA FORMATS

BASIC UNIT: 16-bit word.

FIXED-POINT OPERANDS: 16 or 32 bits.

FLOATING-POINT OPERANDS: For single-precision arithmetic, operands are 32 bits. For double-precision arithmetic, operands are 48 bits. The operands consist of a sign bit, an 8-bit exponent, and either a 23-bit (single precision) or a 39-bit (double precision) fraction. The exponent is biased by 128.

INSTRUCTIONS: All instructions are either one or two 16-bit words in length.

Storage-reference instructions have a 4-bit operation code, a 4-bit address mode (for indexing/addressing), and an 8-bit operand address (or a 16-bit operand address where 2-word addressing is required). Register-reference instructions have an 8-bit operations code and an 8-bit field called the modifier for replacement or modification of register contents. Shift instructions have an 8-bit operation code, a 1-bit direction flag, two 1-bit A/Q indicators, and a 5-bit shift count.

Inter-register instructions have an 8-bit operation code and a 2-bit indicator for the type of operation possible; the possible operations are exclusive OR, logical product, complement logical product, or arithmetic sum. The inter-register format is completed by a 1-bit first operand and a 5-bit second operand. The one-bit first operand can be combined with the first two bits of the second operand to indicate origin registers, while the last three bits of the second operand indicate destination registers. Shift and inter-register instructions are both subgroups of the register reference instructions. Skip instructions have a 12-bit operation code and a 4-bit skip count.

INTERNAL CODE: ASCII.

MAIN STORAGE

STORAGE TYPE: MOS (metal oxide semiconductor).

CYCLE TIME: 750 nanoseconds.

CAPACITY: 32K to 64K bytes on the 18-5M, 32K to 128K bytes on the 18-10, 32K to 256K bytes on the 18-20, and 32K to 256K bytes for each of the processors on an 18-25 system.

➤ **CHECKING:** One parity bit per word is standard. ➤

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PERIPHERALS/TERMINALS

DEVICE	DESCRIPTION AND SPEED	MANUFACTURER
MAGNETIC TAPE EQUIPMENT		
1860-72	7-track; 25 ips, 800 bpi NRZI; 20K 6-bit char./sec.	C. P. I.
1860-92	9-track; 25 ips, 800 bpi NRZI; 20K 8-bit bytes/sec.	C. P. I.
LINE PRINTERS		
1827-32	136 columns, full-line buffer, 12 vertical format channels, 63-character band, 6/8 lines/inch; 300 lpm	C. P. I.
1827-60	136 columns, full-line buffer, 63-character print band, 6/8 lines/inch; 600 lpm	C. P. I.
1827-90	136 columns, full-line buffer, 63-character print band, 6/8 lines/inch; 900 lpm	C. P. I.
CARD EQUIPMENT		
1829-30	Reader, 1000-card input hopper, photoelectric read checking, 300 cpm	Control Data
1829-60	Reader, 1000-card input hopper, photoelectric read checking, 600 cpm	Control Data
TERMINALS/OPERATOR CONSOLES		
752-30	Single-station, TTY-compatible display terminal, 1920-character display, 24 lines by 80 characters, 128-character set, typewriter layout, detachable keyboard, highlighting, cursor addressing, characters-at-a-time transmission	Control Data
1811-1	CRT/keyboard display console, 1920-character display, 24 lines by 80 characters, 128-character set, 9-by-7 dot matrix; character, line, or page transmission	Control Data

➤ The Cyber 18-25 is designed for time-sharing applications and can support up to 56 interactive terminals simultaneously. This computer system features dual processors, one dedicated to data communications and the other to time-sharing functions. There are dual memory interfaces, and each processor incorporates a flexible disk drive for diagnostics. The data communications processor interfaces to a communications multiplexer that supports up to 56 terminals in increments of 2. The 18-25 supports from 64K to 512K bytes of shared-error correcting memory and 9 I/O slots that accept magnetic tape, card reader/line printer, disk storage, and CRT console controllers. A dual-processor 18-25 that supports 32 terminals and has 384K bytes of main memory, 16K bytes of microprogram memory, communications links, a magnetic tape drive, a card reader, a line printer, and mass storage capability costs about \$129,000.

Software compatibility has been a hallmark of CDC product history, and the Cyber 18 Series bears this out. The Cyber 18-10, 18-20, and 18-25 all share the same basic instruction set as the CDC 1700 and System 17.

Control Data currently offers two operating systems for the Cyber 18 Series. The Mass Storage Operating System (MSOS) is a multiprogramming system designed to support a variety of applications that require dedicated system utilization, batch processing, and program checkout features in a real-time environment. MSOS ➤

➤ **STORAGE PROTECTION:** One memory protect bit per word is standard, and permits the implementation of a Program Protect System. This system sets (resets) the protection bit associated with each operand and instruction contained in a given program, and causes an interrupt when unauthorized access is attempted. (This system must be employed for time-sharing/multiprogramming operations.)

RESERVED STORAGE: The interrupt system reserves 64 words (128 bytes). The operating systems require from 3K to 16K bytes plus a job area.

CENTRAL PROCESSORS

GENERAL: All Cyber 18 models use a microprogrammable 16-bit processor. Execution of macro programs stored in MOS main memory is controlled by micro-level programs stored in micro memory. ROM micro memory is provided for execution of the basic CDC 1700 instruction set and the additional enhancements which include character and field manipulation, indexing, micro memory referencing, autodata transfer, and main memory paging control. Read/write micro memory is available for microprogramming requirements. Arithmetic is one's-complement, signed, fixed-point, with hardware add/subtract/multiply/divide. The Cyber 18-25 uses two of these processors which share main memory; one processor functions as the time-sharing processor and the other as a communications processor. Automatic program loading (dead start) is provided through ROM. One internal flexible disk drive is included with each processor for loading diagnostics. The memory access time is 750 nanoseconds.

REGISTERS: The Cyber 18 processors each provide 14 registers. Seven traditional registers are used in the execution of normal CDC 1700 instructions, and four general-

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▷ divides memory into a protected area (foreground) and an unprotected area (background).

The Interactive Terminal-Oriented System (ITOS) provides a multi-user interactive environment and features file manager utilities which are accessible from terminals, an on-line file oriented data base, resource management, and data entry procedures.

FORTRAN, AUTRAN, RPG II, COBOL, and a macro assembler language are the currently available programming languages for the Cyber 18 Series. FORTRAN is a superset of ANSI basic FORTRAN, while AUTRAN provides procedural arithmetic and process specification capabilities for industrial control applications. The Cyber 18 RPG II is source-code-compatible with IBM's System/3 RPG II, and the assembler language provides the full set of CDC 1700 operation codes.

The CYBER 18 COBOL addresses the 1974 ANSI standard. It implements 10 of the 12 modules defined in the standard. The communications module is not included and the inter-program communications module is low-level. The runtime interpreter may be used concurrently by multiple users/terminals.

The Cyber 18 family competes against a wide variety of equipment from vendors such as Data General, DEC, Hewlett-Packard, IBM, and Interdata. Against these well-entrenched competitors, the Control Data line shows its greatest strength when the company's broad line of services is taken into account. CDC provides field service from approximately 160 locations worldwide (including nearly 90 in the U.S.) and also offers custom systems engineering support. (CDC, in fact, provides field support for a number of competitive minicomputer vendors.) Furthermore, CDC manufactures its own peripherals (as well as those of many of its competitors) and is able to provide factory-trained maintenance service as necessary. Both on-call and non-contract maintenance is offered, and service is obtainable for periods ranging from prime shift only to full 24-hour, 7-days-a-week coverage.

USER REACTION

Control Data would not supply a list of Cyber 18 users, and Datapro was unable to locate enough to prepare a meaningful analysis of user reaction.□

▶ purpose registers have been added to support the enhanced instruction set. Three special-purpose registers are used exclusively for machine control.

The 16-bit A register is the principal arithmetic register (accumulator), and also serves as the data interface during I/O operations. The 16-bit Q register serves as an auxiliary accumulator or index register, and holds the address of the peripheral device during I/O operations. The P register serves as the program address counter. If main memory is 32K words or less, P is 15 bits. If main memory is greater than 32K words, P is 16 bits. The 16-bit X register is called

the exchange register. Its prime function is to hold data going from or to storage; a secondary function is to hold one of the operands in most arithmetic operations. The 16-bit Y register serves primarily for address computation; a secondary function is its use as a counter during multiply, divide, and shift instructions. The 16-bit M register is the system mask register. Its function is to enable and disable interrupt lines. The 16-bit B register is used for storing the breakpoint address, while the 16-bit I register is used for indexing.

The four general-purpose registers, R1, R2, R3, and R4, are all 16-bit registers, and can be used for indexing, as accumulators, and for loop control. Lastly, two 16-bit registers, LB and UB, are lower and upper bound registers for unprotected memory areas.

The two general-purpose registers are the 16-bit A register and the 16-bit Q register. The A register is the principal accumulator and also serves as the data interface during I/O operations. The Q register serves as an auxiliary accumulator or index register and holds the address of the peripheral device during I/O operations.

In addition, there are seven special-purpose registers. The P register serves as the program address counter. If main memory is 64K bytes, P is 15 bits. If main memory is greater than 64K bytes, P is 16 bits. The 16-bit X register is called the Exchange register. Its prime function is to hold data going from or to storage; a secondary function is to hold one of the operands in most arithmetic operations. The 16-bit Y register serves primarily for memory address computation; a secondary function is its use as a counter during multiply, divide, and shift instructions. The 16-bit M register is the system Mask register. Its function is to enable and disable interrupt lines. The 8-bit F register holds the instruction identification and/or addressing mode bits during the execution of an instruction. The Breakpoint register, called the B register, is 16 bits long and holds the address of data for the breakpoint mode of operation. Lastly, there is one memory location used as an index register. It is symbolically called register I.

The real-time clock contains two 16-bit registers. The Holding register is loaded by an OUTPUT command from the A register and used in comparison with the 16-bit binary counter. The Output Buffer register holds the last count for a READ STATUS command.

▶ **DIRECT ADDRESSING:** Yes, to multiple levels, in 32K mode only. To one level in 64K mode.

ADDRESSING: There are eight addressing modes on the Cyber 18-10, -20, and -25. The modes are Absolute, Indirect, Relative, Relative Indirect, Constant, Storage, Storage Indirect, and Field.

Control Data's names for these modes are: Absolute (one-word direct), Constant (two-word direct), Indirect (one-word indirect), Storage (two-word indirect), Relative (one-word relative), 16-bit Relative (two-word relative, and Relative Indirect.

Indexing can be specified with any of these modes. Indexing is performed through either the auxiliary accumulator (Q register) or the memory index register (I register).

INSTRUCTION REPERTOIRE: 72 basic instructions. There are 15 storage reference instructions; in this category are 4 transfers, 6 arithmetic, 2 logical, and 2 jump/stop instructions. The register reference instructions number a total of 41, including 5 transfer, 7 arithmetic, 14 logical, 2 jump/stop, 6 shift, 2 I/O, 3 interrupt, and 2 program protect instructions. The last category contains 16 skips. ▶

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

Load/Store:	1.76
Add/Subtract:	1.76
Multiply/Divide:	6.6/10.5
Compare and Branch:	NA

INTERRUPTS: The microprogrammable processors used in Cyber 18-10, -20, and -25 systems provide 16 levels of vectored interrupts.

PHYSICAL SPECIFICATIONS:

	18-10M	
	18-20	18-25
Height (inches)	29	29
Width (inches)	61	61
Depth (inches)	31	31
Weight (pounds)	475	950
Heat (BTU/hr)	4508	9016

All systems require from 104 to 127 volts AC and a temperature range of from 50 to 95 degrees F.

INPUT/OUTPUT CONTROL

I/O CHANNELS: A non-buffered programmed data channel (AQ channel or Bus) is standard with all Cyber 18 CPU's. The "A" register is used to transfer data in and out of the computer, transmit function codes, and receive status bits. The "Q" register transmits the addresses of peripheral devices and the control signals. The AQ channel can handle data rates of 110K words/second. A Direct Memory Access Channel (DMA channel) is also a standard component that provides direct access by external devices to main storage at rates of 1.6 million words/second.

CONFIGURATION RULES: The Cyber 18-10M, -20, -25 processor has 10 I/O slots, with 1 reserved for a Model 1811-1 CRT console. The other nine slots are available for controllers that accept magnetic tape drives, a card reader and line printer, a communications line adapter, flexible and hard disk drives, a breakpoint controller, micro memory (two slots), and an ECC MOS array.

The Cyber 18-5M is sold only as a batch terminal controller for CDC 200 UT or IBM 2780/3780 emulation. The 18-5M has 6 I/O slots for controllers for a card reader, line printer, communications line, and magnetic tape.

MASS STORAGE

1866 CARTRIDGE DISK SUBSYSTEMS: These single- and double-density controller and drive subsystems are used with Cyber 18-10 and 18-20 systems. The single-density 1866-12 drive stores 4.4 million data bytes using one fixed disk and one removable cartridge, while the double-density 1866-14 stores 8.8 million bytes. Up to four intermixed drives can be attached to the 1833-4 controller. Data is stored on two surfaces of each fixed and removable, single- or double-density cartridge, using 200 or 400 tracks per surface and 29 sectors per track. Average head-positioning time is 35 milliseconds, and rotational delay averages 12.5 milliseconds. Data is transferred at a rate of 312,000 bytes per second. These units are manufactured by Magnetic Peripherals, Inc.

1867 FREE-STANDING DISK PACK SUBSYSTEM: The 1867 drives are available only on Cyber 18-20 and 18-25 systems. The single-density 1867-10 drive provides storage for 25 million 8-bit bytes on a 5-surface disk pack.

The double-density 1867-20 drive provides storage for 50 million bytes. Up to eight drives of either density can be attached to the 1833-3 controller. Each pack has 3 platters, 5 recording surfaces, 1 servo surface, 5 tracks per surface, 64 sectors per track, and 192 bytes per sector. Average head-positioning time is 30 milliseconds. Average rotational delay is 8.33 milliseconds. The data transfer rate is 1.2 million bytes per second. The drives are manufactured by Magnetic Peripherals, Inc., a Control Data subsidiary.

INPUT/OUTPUT UNITS

See Peripherals/Terminals table.

COMMUNICATIONS CONTROL

1843-1 COMMUNICATIONS LINE ADAPTER (Models 18-10M, -20, -25 only): Provides multiplexed dual channel interfaces for the connection of two synchronous or asynchronous modems which conform to CCITT V.24 or EIA RS-232C standards. Selectable transmission rates include 110, 150, 300, 600, 1200, 2400, 4800, 9600 and 19,200 bits per second in asynchronous mode, or 1200, 2400, 4800, and 9600 bps in synchronous mode. Provides for selection of half-duplex or full-duplex operation, 5-, 6-, 7-, or 8-bit character code lengths, even or no parity generation and checking, I/O speeds, and stop-bit length. Requires one I/O slot.

SOFTWARE

OPERATING SYSTEMS: The Cyber 18 family is supported by two operating systems: the Mass Storage Operating System Version 5 (MSOS 5), and the Interactive Terminal Oriented System Version 2 (ITOS 2).

MSOS 5 is a multiprogramming system designed to support a variety of applications requiring dedicated system utilization, batch processing, and program checkout features in a real-time environment. Multiprogramming is on a priority basis, and there is no restriction on the number of I/O requests or programs that can be scheduled on the queue.

MSOS 5 segregates main memory into two functional areas: protected memory and unprotected memory. Protected memory is reserved for executing the operating monitor and the user's application programs. Unprotected memory is used for the execution of batch job processing and program checkout. The size of protected and unprotected memory is variable.

The MSOS 5 Monitor is the real-time executive which serves as the interface to other programs and system resources on a priority basis. The bare-bones Monitor requires 3K bytes of memory and contains request processors for I/O, program scheduling, time delays, memory allocation, enable/disable scheduling, and background requests.

The MSOS 5 Job Processor is responsible for monitoring background programs and provides the interface for the batch stream, unattended jobs, operator-controlled jobs, compilation, assembling, and various utility functions.

The MSOS 5 File Manager creates and maintains both sequential and indexed files. It can be used by both background and foreground programs.

The minimum hardware required for MSOS 5 includes 32K bytes of main memory, a console device, an input device (cards or magnetic tape), an output device (cards or magnetic tape), and at least 1 million bytes of disk storage. ►

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► ITOS 2 will support up to 17 concurrent users at interactive terminals. It includes an executive, text editor, file manager, user utilities, print spooling and on-line configure utility. The ITOS executive and file manager interface though system files and the interactive source language text editor. ITOS requires a minimum configuration that includes 128K bytes of memory, two disk drives, (or one disk and one tape) and one CRT operator console.

LANGUAGES: Control Data currently offers an assembler, a macro assembler, FORTRAN, AUTRAN, RPG II, and COBOL.

Assembler 1 runs under RTOS 3 and includes the capability to assemble CDC 1700 operation codes. It provides pseudo operators, but does not include a macro capability.

FORTRAN 3 A/B runs under MSOS 5, ITOS 2, and has a syntax that is a superset of ANSI Basic FORTRAN. The extensions to the ANSI standard include ASSEM, BYTE, DATA, RELATIVE, and SIGNED BYTE. A subset of ANSI FORTRAN extensions is also implemented, including byte manipulation, an in-line assembly code, three execution-time packages, and a FORTRAN multiprogramming interface. The "A" compiler has a larger number of overlays than the "B" compiler and requires more compilation time but less main memory (16K bytes versus 32K bytes). If double precision is used, an additional 5K bytes are required.

AUTRAN 3 runs under MSOS 5 and provides procedural arithmetic and process specification capabilities for industrial control applications. AUTRAN provides FORTRAN as a subset, includes scaling, alarming, and analog/digital control facilities, and is sold with an operator's console.

RPG II runs under MSOS 5 and is functionally compatible and source-code-compatible with IBM's System/3 RPG II. The package includes a compiler, interpreter, run-time support routines, and a data base manager. RPG II requires the SORT/MERGE utility.

COBOL runs under ITOS 2 and addresses the 1974 ANSI standard. The package includes a compiler and run-time interpreter.

UTILITIES: Each of the Cyber 18 operating systems includes a basic set of utilities.

PRICING

POLICY: Control Data makes the Cyber 18 systems available on either a purchase or lease basis. Lease terms are for one year with CDC or three to seven years with Commercial Credit Leasing, Inc., a subsidiary of CDC's Commercial Credit Company subsidiary. Discounts are available under certain circumstances. For each year's lease with Commercial Credit Leasing over the basic three years, discount one percent. Discount two percent for each 12-month increase in the basic two-year, noncancellable leasing period. Discount four percent for each year's rental paid in advance. Discounts are cumulative. Lease cancellation notice required after the noncancellable period is 90 days.

MAINTENANCE: The minimum maintenance contract is for one year unless a special arrangement is requested. The Principal maintenance plan provides for nine consecutive hours between 7:00 a.m. and 6:00 p.m., Monday through Friday, excluding holidays. The Modified maintenance plan provides for any nine consecutive hours between 5:00 a.m. and 8:00 p.m., Monday through Friday, excluding local holidays. Principal plan rates are quoted in the accompanying price list. Charges for the Modified plan and extended-period coverage are as follows:

	Monday through Friday*	Saturday or Sunday
Principal period	—	3-8
Modified principal	1-4	5-12
16-hour period	5-30	7-16
24-hour period	9-45	4-9

*Percentage above Principal plan charges. Charges are cumulative. Percentages vary depending on the CDC group responsible for the product.

The non-contract maintenance rate is \$60/hour during normal working hours, Monday through Friday. The minimum charge is for two hours, including travel time. Transportation, lodging, and other expenses are at additional cost. Parts are at CDC's standard published rates.

All Control Data software is unbundled from the hardware. Each software product has a specified initial fee and a monthly license charge. A paid-up license can be obtained for certain products. All licenses are on an as-is basis where CEM (Central Enhancement and Maintenance) services are not available or not separately contracted for. For a monthly charge, CEM services provide corrective code, updates, enhancements, and rights to Successor Products generally offered by Control Data. Analyst service and support is available on a time and material basis. Installation is not included with Control Data software, nor is customer training or education, although courses can be arranged for separately.

EQUIPMENT: Typical configurations of the Cyber 18-10 and 18-20 systems are as follows:

TYPICAL 18-10M SYSTEM: Consists of an 18-10M central processor with 128K bytes of main memory, six 1920-character display terminals, a 300-lpm printer, a card reader/line printer controller, an 8-channel communications line adapter, a cartridge disk drive controller that supports up to four drives, a double-density (8.8 million bytes) cartridge disk drive, a flexible disk drive. Purchase price is \$61,000.

TYPICAL 18-20 SYSTEM: Consists of an 18-20 central processor with 192K bytes of main memory, ten 1920-character display terminals, a 300-lpm printer, a card reader/line printer controller, two 8-channel communications line adapters, a storage module drive controller, two 50-million-byte storage module drives, a flexible disk drive, and one nine-track magnetic tape drive. Purchase price is \$115,000. ■

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EQUIPMENT PRICES

		Purchase Price	Monthly Maint.	Rental (1-Year Lease)*	Rental (3-Year Lease)*
CENTRAL PROCESSORS					
18-5M	Batch terminal controller which includes 32K bytes of main memory, display console, card reader/line printer controller, one communications channel, one emulation option, desk and power supplies	\$16,705	146	327	302
18-10M	Microprogrammable processor with no main memory (can accommodate from 32K to 128K bytes of 750-nanosecond MOS), parity, memory protection, hardware multiply/divide, 16 micro interrupts, 16 macro interrupts, real-time clock, ADT (Automatic Data Transfer), cabinet, operator's panel, power supplies, one floppy disk controller and one 262K-byte drive, and one console controller	13,700	83	494	457
18-20	Microprogrammable processor with no main memory (can accommodate from 32K to 256K bytes of 750-nanosecond MOS), parity, memory protection, hardware multiply/divide, 16 micro interrupts, 16 macro interrupts, real-time clock, ADT (Automatic Data Transfer), cabinet, operator's panel, power supplies, console controller, no micro memory	15,300	113	551	510
18-25	Dual processor (one for I/O and one for communications) with dual memory interface (no main memory is included), paging registers, 4K bytes of RAM micro memory, multiplexer for communication line adapters, one flexible disk w/controller in each processor for diagnostic support, console display controller (switchable between processors), desks and power supplies	41,060	272	1,472	—
MEMORY AND PROCESSOR OPTIONS					
1870-2	2048, 32-bit, micro control instructions (user programmable)	4,266	45	157	145
1874-1	Error-correcting memory array, provides storage for the 5-bit correction codes for up to 192K bytes of MOS main memory	5,000	45	184	170
1882-16	32K bytes of MOS memory, one protect bit and one parity bit for each 2 bytes, 750 nanosecond cycle time	3,000	24	108	101
1882-32	64K bytes of MOS memory, one protect bit and one parity bit for each 2 bytes, 750 nanosecond cycle time	6,000	48	216	200
1888-3	Voltage transformer for 95, 105, 220, 230, 240, or 250 volts	550	—	20	18
1890-1	200 UT emulation package	760	—	25	24
1890-1	2780 emulation package	760	—	25	24
1890-3	3780 emulation package	760	—	25	24
MASS STORAGE					
The following are available on the 18-20 and 18-25 models:					
1833-1	Storage module drive interface	3,000	19	108	100
1833-2	Storage module drive interface (dual processors)	3,000	19	108	100
1833-3	Storage module control (up to 8 drives)	10,000	34	367	340
1867-1	Module drive subsystem; includes interface, controller and one 25-million-byte storage module drive	18,000	135	648	600
1867-2	Module driven subsystem; includes interface, controller and one 50-million-byte storage module drive	21,300	150	767	710
1867-10	25-million-byte disk pack drive	14,000	115	515	475
1867-20	50-million-byte disk pack drive	18,100	145	664	615
The following are available on the 18-10M, and 18-20 and 18-25 models:					
1833-4	Cartridge disk controller (up to 4 drives)	2,500	32	74	68
1865-2	Floppy disk drive, 256K bytes (IBM format) or 280K bytes (CDC format)	1,620	19	59	55
1866-12	Cartridge disk drive, single-density, 4.4 million bytes	7,887	64	284	263
1866-14	Cartridge disk drive, double-density, 8.8 million bytes	10,000	91	338	329
MAGNETIC TAPE EQUIPMENT					
1860-1	Magnetic tape subsystem, single 7-track	10,200	74	373	345
1860-2	Magnetic tape subsystem, dual 7-track	17,900	129	654	606
1860-3	Magnetic tape subsystem, single 9-track	10,200	74	373	493
1860-4	Magnetic tape subsystem, dual 9-track	17,900	129	654	750
1860-5	Magnetic tape subsystem, single phase encode	14,800	111	533	493
1860-6	Magnetic tape subsystem, dual phase encode	22,500	188	810	750
1860-72	7 track magnetic tape drive; 25 ips, 800 bpi	71,000	55	260	241
1860-92	9 track magnetic tape drive; 25 ips, 800 bpi	71,000	55	260	241
1860-95	9 track magnetic tape drive; 50 ips, 800/1600 bpi	77,000	77	274	253
LINE PRINTERS					
1828-1	Card reader/line printer controller (1 printer)	1,000	8	36	33
1828-2	Card reader/line printer controller/communications adaptor (1 printer)	1,500	24	54	50
1827-32	300 lpm line printer, band, 63 characters, 132 columns (136 columns optional)	—	90	370	343
1827-60	600 lpm line printer, band, 63 characters, 132 columns (136 columns optional)	17,000	120	565	523
1827-90	900 lpm line printer, band, 63 characters, 136 columns	23,700	190	855	790

*Rental prices do not include equipment maintenance.

Control Data Cyber 18 Family

EQUIPMENT PRICES (Continued)

		<u>Purchase Price</u>	<u>Monthly Maint.</u>	<u>Rental (1-Year Lease)*</u>	<u>Rental (3-Year Lease)*</u>
CARD EQUIPMENT					
1828-1	Card reader/line printer controller (not required if a line printer is already configured), 1 card reader	1,000	8	36	33
1828-2	Card reader/line printer controller/communications adaptor/not required if a line printer is already configured), 1 card reader	1,500	24	54	50
1829-30	300 cpm card reader, photo-electric	2,940	45	106	98
1829-60	600 cpm card reader, photo-electric	4,410	60	161	149

COMMUNICATIONS EQUIPMENT

1843-1	Communications Line Adapter, full/half duplex, 2 channels	1,700	11	62	57
1843-2	Communications Line Adapter, 8-channel	2,200	19	68	63

TERMINALS/OPERATOR CONSOLES

1811-1	1920-character CRT/keyboard operator console	2,200	18	79	73
1811-2	1920-character CRT/keyboard operator console	1,650	17	55	52
752-30	Single station, TTY-compatible, 1920-character display station	1,360	14	45	42
752-202	International keyboard	290	3	10	10

*Rental prices do not include equipment maintenance.

SOFTWARE PRICING

		<u>Initial Fee</u>	<u>Monthly Royalty</u>	<u>Paid-up License</u>	<u>CEM Service</u>
A325-01	Mass Storage Operating System (MSOS) 5; includes monitor and job processor, maintenance routines, debug/checkout utilities, installation file maintenance, and system initializer; requires peripheral drives A325-10	900	70	2,500	55
A325-02	FORTTRAN 3A under MSOS 5; syntax is a superset of ANSI basic FORTRAN and a subset of ANSI FORTRAN extensions; includes byte manipulation, an in-line assembly code, three execution-time packages and a FORTRAN multiprogramming interface to MSOS 5	30	N/C	30	15
A325-03	Same as A325-02; FORTRAN 3B	30	N/C	30	15
A325-04	File Manager 1 under MSOS 5; includes a general-purpose file manager that operates and maintains both indexed and sequential files; provides sequential indexed and direct methods of record retrieval as well as variations of both	30	N/C	30	15
A325-05	AUTRAN 3 under MSOS 5; oriented toward industrial control applications providing procedural arithmetic and process specification capabilities; provides FORTRAN as a subset; includes scaling, alarming, analog/digital control, and an operator's console	3,890	260	14,290	175
A325-06	Macro Assembler 3 under MSOS 5; includes a full set of symbolic CDC 1700 machine instructions, macro instructions, assembler error diagnostics, free-field source format listing and binary output to appropriate units	30	N/C	30	15
A325-10	Peripheral drivers 1C under MSOS 5; required by A325-01	110	N/C	110	15
A325-11	Magnetic tape utilities 2 under MSOS 5; includes the capability to block/deblock, tape labelling, copy utilities, EBCDIC/ASCII/BCD conversion	30	N/C	30	15
A325-12	RPG II 1 under MSOS 5; functionally and source code-compatible with IBM's System/3 RPG II; includes compiler, interpreter, run-time support routines, and data base manager	160	35	1,560	25
A325-13	SORT/MERGE 1 under MSOS 5; for tape or sequential disk files; requires A325-04	30	N/C	30	15
A325-101	CYBERDATA 5 under MSOS 5; features key to disk application package; operates on CYBER 18 processors and supports up to 32 key entry stations; cartridge disk storage, magnetic tapes, printers, card readers and line printers; requires A325-01, -06, -10, -11	500	30	1,100	20
A325-102	CYBERDATA 5 under MSOS 5; same as A325-100, except supports the SMD mass storage device	500	30	1,100	20
A622-01	Interactive Terminal-Oriented System (ITOS) 2; supports up to 17 concurrent users at interactive terminals; includes executive, text editor, file manager 2, user utilities, print spooling and on-line configure utilities; for use with systems which do not have 9-track magnetic tape as part of configuration; delivery media is 50-million byte storage module disk pack; requires A622-20	1,500	125	2,650	135
A622-02	Same as A622-01 but for use with systems that have 9-track magnetic tape	1,500	125	2,650	70
A622-03	Same as A622-01, except delivery media is 25-million byte storage module disk pack	1,500	125	2,650	135
A622-04	Same as A622-02, except for use with systems that have 9-track magnetic tape and 25-million byte disk pack	1,500	125	2,650	70
A622-05	Same as A622-01, except delivery media is cartridge disk pack	1,500	125	2,650	100
A622-06	Same as A622-02, except for use with systems that have 9-track magnetic tape and cartridge disk	1,500	125	2,650	70
A622-11	Communications 18 and ITOS 2; features ITOS 2 plus supports RJE terminal operation acting as a HASP multileaving workstation, or simulation of a CDC 200 UT remote batch station, or both; communications support is one two-lines at a max. of 4800 bps, reader/printer code is 64 ASCII only; communication code set is external BCD (200 UT) and EBCDIC (HASP); delivery media is 50-million byte storage disk pack; not for use with 9-track magnetic tape; requires A622-20	2,500	255	6,250	175