Control Data Cyber 180 Models 810A/830A

MANAGEMENT SUMMARY

Designed for interactive, remote batch, and transaction processing and for data base management, commercial, and scientific applications, the Cyber 180 line is built around the concept of one or two powerful central processors with a fast central memory serviced by multiple independent Peripheral Processor Units (PPUs). This architecture permits computation to be performed by the central processor and main memory, while slower, low-level functions like input/output and system control are performed by the PPUs. This modular design allows for faster throughput.

The Cyber 180 family includes six single-processor systems (810A, 830A, 840A, 850A, 860A, and 990E) and three dual-processor systems (830A Dual-CP, 870A, and 995E). Only the 810A, 830A, and 830A Dual-CP systems are considered superminis, so they are the only family members covered in this report; the rest of the product line falls into the mainframe category. For an in-depth discussion of the entire Cyber 180 product line, please refer to DATAPRO 70.

The Cyber 180 Series uses a dual-state architecture that enables the processor to run both the Network Operating System (NOS) and Network Operating System/Virtual Environment (NOS/VE). The NOS system operates with a 60-bit word and supports real memory addressing, and the NOS/VE system operates with a 64-bit word and supports virtual memory addressing.

The entry-level Model 810A is equipped with 8 megabytes of main memory, expandable to 64 megabytes. Models 830A and 830A Dual-CP have from 16 to 64 megabytes of memory, compared with the previous range of 2 to 32

The Cyber 180 Models 810A/830A superminis are designed for use in computationally intensive applications in markets such as the petroleum industry, electric utilities, computer-aided design/computer-aided manufacturing (CAD/CAM), government, and higher education. Through the Independent Software Vendor Program, Control Data has encouraged the development of Cyber-compatible software for general-purpose computing applications as well. Control Data has also protected its users' software investment by employing a dual-state architecture that allows users to simultaneously run the NOS and NOS/VE operating systems in the same central processing unit.

MODELS: Cyber 180 Models 810A, 830A, and 830A Dual-CP.
MAIN MEMORY: 8MB to 64MB.
DISK CAPACITY: Up to 1.6GB per drive.
WORKSTATIONS: Depends on configuration.
PRICE: Purchase prices range from $121,000 to $175,000 for basic systems.

CHARACTERISTICS

MANUFACTURER: Control Data Corporation, 8100 34th Avenue South, Minneapolis, Minnesota 55440. Telephone (612) 853-8100.

CANADIAN ADDRESS: Control Data Canada, Limited, 50 Hallcrown Place, Willowdale, Ontario MZJ 1P7. Telephone (416) 495-2800.

Entry to Control Data's Cyber 180 line is through the single-processor Model 810A. It is equipped with 8MB of main storage, expandable to 64MB, and can have 8, 12, or 16 I/O channels. The Model 810A supports the dual-state architecture, running both NOS and NOS/VE operating systems.

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CHART A. SYSTEM COMPARISON

MODEL	Model 810A	Model 830A	Model 830A Dual-CP
SYSTEM CHARACTERISTICS			
Date of introduction	July 1986	July 1986	July 1986
Date of first delivery	August 1986	August 1986	August 1986
Operating system	NOS, NOS/VE	NOS, NOS/VE	NOS, NOS/VE
Upgradable from	Not applicable	810A	830A
Upgradable to	830A	830A Dual-CP	Not applicable
MIPS	0.8 to 1.2*	0.8 to 1.2*	—
Relative performance	1.0	1.6	2.9
MEMORY			
Minimum capacity, bytes	8M	16M	16M
Maximum capacity, bytes	64M	64M	64M
Type	256K-bit CMOS	256K-bit CMOS	256K-bit CMOS
Cache memory	None	None	None
Cycle time, nanoseconds	400	400	400
Bytes fetched per cycle	—	—	—
INPUT/OUTPUT CONTROL			
Number of channels	8, 12, or 16	8, 12, or 16	8, 12, or 16
High-speed buses	—	—	—
Low-speed buses	—	—	—
MINIMUM DISK STORAGE	402MB	402MB	402MB
MAXIMUM DISK STORAGE	1.6GB per drive	1.6GB per drive	1.6GB per drive
NUMBER OF WORKSTATIONS	Configuration dependent	Configuration dependent	Configuration dependent
COMMUNICATIONS PROTOCOLS	CDCNet, HDLC, X.25, SNA, DECnet	CDCNet, HDLC, X.25, SNA, DECnet	CDCNet, HDLC, X.25, SNA, DECnet

**Computerworld estimates.*

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A dash (—) in a column indicates that the information is unavailable from the vendor.

megabytes. Standard on all Cyber 180 models is the Unified Extended Memory (UEM) feature, which allows main memory to be partitioned into areas reserved for execution and areas reserved for data storage. To increase system throughput, users can add a CyberPlus Parallel Processor.

Control Data markets bundled hardware packages incorporating its Cyber 180 Models 810A and 830A with the peripheral equipment required to make up a functioning system. Packages available at this time include four based on a Model 810A processor and two based on a Model 830A processor. All packages come with 8 or 16 megabytes of main memory, 10 peripheral processors, an operator console, a disk subsystem, a tape subsystem, a line printer, and a network processor. All hardware packages are fully upgradable within the series, and are object and source code compatible with larger Cyber 180 systems.

The Network Operating System/Virtual Environment (NOS/VE) is designed to enhance user productivity through English-like commands and user support aids. The use of an 8-bit architecture (full ASCII), with full support in all the compilers and utilities, ensures that no constraints are placed on the user's data.

NOS/VE supports the Unix System V (VX/VE and C) as a NOS/VE subsystem, the Information Management/Virtual Environment (IM/VE), and the Control Data Distributed Communications Network (CDCNet). NOS/VE supports the Fortran, Cobol, C, APL, Sort/Merge, Lisp, Prolog, Pascal, Basic, and Cybil programming languages.

The older Network Operating System (NOS 2.5.1) is designed for ease of use and features simple commands to

DATA FORMATS

BASIC UNIT: In Cyber 170 state, there are ten 6-bit characters in main storage and central processors, and a 12-bit word in peripheral processors and I/O channels. In Cyber 180 state, there are eight 8-bit characters (full ASCII) in main storage and central processors, and a 12-bit word in peripheral processors and I/O channels.

FIXED-POINT OPERANDS: For the 170 state, 60 or 18 bits in central processors; 6, 12, or 18 bits in peripheral processors. For the 180 state, 64 or 32 bits in central processors; 16 bits in peripheral processors.

FLOATING-POINT OPERANDS: In Cyber 170 state, there are ten 6-bit characters, consisting of a 48-bit coefficient and a 12-bit exponent. (Unrounding floating-point operations generate double-precision results, and the upper and lower halves, each consisting of a 48-bit coefficient and a 12-bit exponent, can be separately recovered.) In Cyber 180 state, there are eight 8-bit characters, consisting of a 48-bit coefficient and a 16-bit exponent. (Unrounding floating-point operations generate double-precision results, and the upper and lower halves, each consisting of a 48-bit coefficient and a 16-bit exponent, can be separately recovered.)

In 180 state, the Cyber 180 systems can perform integer and floating-point arithmetic; move, edit, and translate character strings; perform packed and unpacked decimal arithmetic; load or store fields on 64-bit word, byte, and bit boundaries; extract or insert bit strings of 1 through 64 bits; load or store multiple A and X registers; normalize floating-point numbers; perform logical and shift operations; perform branch tests and exchange jump operations; and perform call and return operations.

In 170 state, the Cyber 180 processors can perform floating-point add, multiply, and divide operations with double and single precision and with rounded and unrounded results. In addition, the instructions perform integer arithmetic; pack, unpack, and normalize floating-point numbers; set the X, A,

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initiate processing. Programming languages supported by NOS 2.5.1 include Cobol, Fortran, Basic, Algol, APL, and Pascal.

COMPETITIVE POSITION

Control Data has built a reputation as a manufacturer of engineering/scientific computers. However, with its Independent Software Vendor (ISV) Program, CDC has been marketing the Cyber line to those users who need to process both scientific/engineering and general business applications on the same machine. Through the ISV program, CDC provides support and technical assistance to third-party software vendors that convert their applications programs to run under NOS/VE.

The Cyber 180 systems compete against the higher end of the Digital Equipment Corporation VAX family (8550 and up) and the Sperry 2200 for scientific applications. For commercial applications, the Cyber 180 systems compete with the IBM 4300 Series.

The Cyber Models 810A and 830A compete with the IBM 4361 and 4381 systems. According to *Computerworld* estimates, the 810A and 830A are rated at 0.8 to 1.2 MIPS, while the 4361 is rated at 0.38 to 1.14 MIPS and the 4381 at 1.5 to 6.0 MIPS. The Cyber Model 810A offers from 8 to 64 megabytes of main memory, and the Model 830A has from 16 to 64 megabytes. The IBM 4361 has a main memory capacity of only 2 to 16 megabytes, while the 4381 offers a range of 4 to 32 megabytes. On the other hand, the IBM models include cache memory, and the CDC models do not. The Control Data models are lower in price than comparable IBM models. A basic Model 810A with 8 megabytes of memory sells for $121,000, compared to a basic 4361 Model M4 with 8 megabytes of memory, which sells for $176,900. A basic Model 830A with 16 megabytes of main memory has a purchase price of $175,000. A basic 4381 Model P11 with 16 megabytes of main memory carries a price tag of $275,000.

The Cyber 810A and 830A will also compete with Sperry's new 2200/200 "Midframe." The 2200/200 has up to 4 central processors, from 4 to 48 megabytes of main memory, and 32K bytes of cache memory. Sperry states that the systems have performed at 1.2 to 5.4 MIPS. The purchase price of a basic uniprocessor system is $133,100.

ADVANTAGES AND RESTRICTIONS

The CDC Cyber 180 provides users with full software and applications compatibility throughout the Cyber line. Users who had older Cyber 170 models enjoy the same software compatibility protection through CDC's dual-state architecture in use on all Cyber 180 machines. The dual-state mode enables Cyber 170 systems using the Network Operating System (NOS) to be upgraded to Cyber 180s using CDC's virtual operating system (NOS/VE) without the need for converting any applications programs. The advantage of using a dual-state architecture is realized when accessing real memory. The inherent degradation of

and B registers; perform logical, transmission, and shift operations; perform conditional, unconditional, return, and exchange jumps (context switching); read/write single words to and from central or extended memory; and transfer blocks of data between central and extended memory.

INSTRUCTIONS: All Cyber 180 models use a multistate architecture that permits two different instruction sets to operate simultaneously in the same central processor and memory unit. One instruction set, the 180 state, is required by the NOS/VE operating system. The 180 state supports virtual memory addressing. The second instruction set, the 170 state, is used with the NOS or NOS/VE operating systems and supports real memory addressing

All Cyber 180 models use instruction look-ahead registers that hold prefetched instructions for subsequent execution. Depending upon the processor model, the instruction look-ahead registers hold from 8 to 48 instructions ahead of the current instruction in the regular program sequence.

Central processor instructions in the 180 state use 64 bits for data. This allows two 16-bit instructions and one 32-bit instruction to be stored as one central processor word. Instructions vary in length by byte multiples. Instructions less than a full 64-bit word can be packed together; that is, two 16-bit and one 32-bit instruction, or four 16-bit instructions, can be stored in the central processor as one word.

All operands in the 180 state are in the two's-complement form, and are 64 bits long with 32-bit integer operands. Both words and bytes may be addressed, and word-oriented instructions or 64-bit operand arithmetic always uses a word boundary. The 64 bits are not split among bytes of two different words.

Central processor instructions in the 170 state are 15 or 30 bits in length; every ten 6-bit characters hold two to four instructions. Most 15-bit instructions consist of a 6-bit operation code and three 3-bit register designators. Most 30-bit instructions consist of a 6-bit operation code, two 3-bit register designators, and an 18-bit operand address.

In the 170 state, the central processor uses the least significant 60 bits of the 64-bit word and leaves the other 4 bits unused. Central processor instructions are 15 bits, 30 bits, or 60 bits long, and as many as four 15-bit instructions can be stored in one central processor word. The instruction set consists of 85 basic instructions; 55 are 15-bit, 27 are 30-bit, and 3 require the full 60 bits. Many instructions require only the operation code (a 2- or 3-digit number) and the registers containing the operands and the results. All operands are represented in one's-complement form and are 18 or 60 bits long.

Peripheral processor instructions are 12 or 24 bits (one or two words) in length. The Cyber 170-state 12-bit format consists of a 6-bit operation code and a 6-bit operand address or literal operand. The Cyber 180-state 16-bit format consists of an 8-bit operation code and an 8-bit operand address or literal operand. The 24-bit format consists of a 6-bit operation code and an 18-bit operand address or literal operand.

INTERNAL CODE: In the 170 state, 6-bit BCD is standard "display code." In the 180 state, 8-bit ASCII is standard.

MAIN STORAGE

TYPE: 256K-bit CMOS (complementary metal-oxide semiconductor) chips. Two central memory interface ports connect the central processor and the peripheral processor units with central memory. Data is distributed between each of the ports and central memory on a priority basis by a data

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CHART B. MASS STORAGE

MODEL	836-110	836-221	836-441
Type	Fixed	Fixed	Fixed
Controller model	Integrated	Integrated	Integrated
Drives per subsystem/controller	—	—	—
Formatted capacity per drive, megabytes	402	804 total	1.6G total
Number of usable surfaces	—	—	—
Number of sectors or tracks per surface	16,800 tracks	33,600 tracks	67,200 tracks
Bytes per sector or track	—	—	—
Average seek time	30 ms	30 ms	30 ms
Average rotational/relay time	8.33 ms	8.33 ms	8.33 ms
Average access time	38.33 ms	38.33 ms	38.33 ms
Data transfer rate	1.8MB/sec.	1.8MB/sec.	1.8MB/sec.
Supported by system models	810A, 830A, 830A-Dual CP	810A, 830A, 830A-Dual CP	810A, 830A, 830A-Dual CP
Comments			

A dash (—) in a column indicates that the information is unavailable from the vendor.

performance response time associated with the introduction of a virtual environment is minimized. CDC's dual state takes advantage of the virtual environment, while allowing users easy access to main memory, thereby maintaining critical performance response time. The entire Cyber 180 Series is binary code compatible.

As an aid to diagnostics, CDC has reserved a communications line interface that allows CDC's technical specialists to perform remote technical assistance by simply dialing into the line. A data distributor containing an Error-Correction Code (ECC) generator and a Single-Error-Correction/Double-Error-Detection (SECDED) logic is also included. This facility corrects single-bit errors and reports multiple-bit errors via the maintenance access channel and the maintenance control unit each time a word is read.

All models within the Cyber 180 family are supported by the Cyber 180 Network Operating System (NOS) and the Network Operating System/Virtual Environment (NOS/VE). Languages used in scientific/engineering applications, such as APL, Fortran, and Pascal, are supported. For scientific work, the Cyber 180 is a very efficient number-crunching machine and, with the addition of a single CyberPlus Multi-Parallel Processor, the user can increase the processing power to 620 MIPS.

Field upgradability is available either by upgrading to the next-level processor (810A to 830A) or with the addition of a second identical processor (830A to 830A Dual-CP).

One disadvantage of the Cyber systems is the relatively limited capacity of the disk drives that are available. The highest capacity disk drive, Model 895, has a storage capacity of only 2.44 gigabytes, while an IBM 3380 has a capacity of 5.04 gigabytes. That puts the Cyber systems at a disadvantage relative to IBM for large data base applications.

Even though CDC has markedly increased the number of commercial/business applications that can run on the Cyber 180 Series, competing vendors can support considerably more general-purpose applications. However, Control Data is attempting to shed its restrictive image as a manufacturer of machines that are strictly number crunchers for scientific applications. The number of general-purpose

distributor that also contains the Error Correction Code generators and the Single-Error Correction/Double-Error Detection (SECDED) logic.

CYCLE TIME: See Chart A for cycle times of specific models.

CAPACITY: Memory for the Control Data 180 Models 810A/830A ranges from 8MB to 64MB in 8MB or 16MB increments. See Chart A for memory sizes of particular models.

CHECKING: In all models, a single-bit error-correction, double-bit error-detection Hamming code, eight bits in length, is appended to each of ten 6-bit main memory characters. Upon reading from memory, a single-bit error is automatically corrected and transferred, while multiple-bit errors are detected and flagged for appropriate action.

A parity bit is generated with each 12-bit word stored in the Peripheral Processor Subsystem. A program-controlled Status and Control Register in each Peripheral Processor Subsystem monitors address and data parity errors and indicates error conditions on a visual status display.

STORAGE PROTECTION: Information not available from the vendor.

RESERVED STORAGE: Information not available from the vendor.

CENTRAL PROCESSOR

GENERAL: The Cyber 180 central processors are high-speed arithmetic units that communicate only with main memory. The central processors operate independently of, and in parallel with, input/output operations.

The Model 810A and 830A central processors use subnanosecond ECL circuits and are air-cooled. Memory can be partitioned into central memory, extended memory, and Cyber 180-state memory. The 810A can be field upgraded to an 830A, which in turn can be field upgraded by the addition of a second, identical central processor.

The Cyber 180 systems use *Peripheral Processor Units (PPUs)* to manage data transfers over the I/O channels and to off-load certain minor operating system functions from the CPU. A single Cyber 180 supports up to 30 PPUs, which operate independently and simultaneously as stored program computers. Access to main memory is via the central memory interface ports.

The PPU instruction repertoire consists of 66 instructions oriented toward system control, I/O control, and logic func-

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business applications written for the Cyber 180 Series is steadily growing and is being encouraged through CDC's Independent Software Vendor program. CDC also has made conversion utilities available to assist Digital Equipment and IBM users in converting to a Cyber 180. In addition, a File Migration Utility (FMU) is available to assist users in the migration of files from one system to another.

USER REACTION

The current Cyber 180 models were just announced in July 1986, so they were not available at the time we conducted our annual survey of general-purpose computer users. However, our 1986 survey yielded responses from nine users with earlier Cyber 180 and 170 models. Three of the respondents were using Cyber 180 systems: one Model 830, one Model 840, and one Model 855. The remaining six respondents were operating Cyber 170 Series 800 systems, of which two were Model 815s, three were Model 825s, and one was a Model 855. The Cyber systems had been in use for an average of 42.8 months.

Four users represented educational institutions, two represented government agencies, two were in manufacturing, and one was with a chemical company. Primary application areas reported were education and engineering/scientific. The majority of the Cyber systems included between 8 and 16 megabytes of main memory and from 4.8 to 10 gigabytes of disk storage.

In addition to asking the users about their present configurations, we asked about their plans for future acquisitions. Of the nine Control Data users, eight said they would add more hardware, and seven said they planned to add software and to expand their data communications facilities. Seven of the nine survey respondents had implemented a disaster recovery plan, and three had established an information center.

The users were asked to rate their systems as Excellent, Good, Fair, or Poor in 14 separate categories. The ratings earned by the Cyber systems are summarized in the table below.

	Excellent	Good	Fair	Poor	WA*
Ease of operation	3	5	1	0	3.22
Reliability of system	6	3	0	0	3.67
Reliability of peripherals	5	3	1	0	3.44
Maintenance service:					
Responsiveness	8	1	0	0	3.89
Effectiveness	6	3	0	0	3.67
Technical support:					
Troubleshooting	4	4	0	0	3.50
Education	4	2	2	0	3.25
Documentation	5	2	1	0	3.50
Manufacturers software:					
Operating system	3	5	1	0	3.22
Compiler & assemblers	5	4	0	0	3.56
Application programs	3	4	1	0	3.25
Ease of programming	2	6	1	0	3.11
Ease of conversion	2	5	1	0	3.13
Overall satisfaction	3	6	0	0	3.33

*Weighted Average on a scale of 4.0 for Excellent.

tions. Arithmetic capabilities are limited to fixed-point addition and subtraction.

The status of I/O channels, peripheral equipment, and other processors is indicated by hardware flags that can be examined by the peripheral processors.

The *CyberPlus Multi-Parallel Processor* is a high-performance parallel processor that can be integrated with any Cyber 180 model. It increases the scalar computational speeds and throughput of the Cyber machine to as much as 620 million instructions per second. With the floating-point option, each parallel processor provides up to 98 million floating-point operations per second.

The CyberPlus architecture is a non-Von Neumann-based processor using a high-speed ring interconnection. The ring architecture connects to the Cyber 180 host via Cyber Channel Ring Ports (CCRPs), each of which supports up to 16 CyberPlus processors. A total of four CCRPs may be added to the Cyber host, allowing a maximum of 64 CyberPlus processors to be attached. Each CyberPlus unit shares central memory with the host machine and has three memory units of its own. It communicates to the host by using one of the high-speed, 12-bit-wide Cyber I/O channels, and a Direct Memory Access (DMA) unit is available for additional performance. The channel interface provides a 24-megabit transfer rate; the DMA interface, an 800-megabit transfer rate. CyberPlus uses a ring packet protocol.

The CyberPlus processor has three memory structures: a program instruction memory, a 16-bit data memory, and a 64-bit data memory. The program instruction memory has a capacity of 4K 200-bit words. This memory contains instructions only and supplies an instruction word to the program instruction control unit every machine cycle. There are four independent 16-bit data memories, each with 4K 16-bit words. Each 16-bit data memory has a single machine cycle read/write time. The 64-bit data memory includes 256K 64-bit words. This system contains four banks with a four-cycle memory access. It is expandable to 512K.

The CyberPlus base processor has 14 functional units, including two add/subtract units, one multiply unit, and two shift/Boolean units. Each of these units provides 8-, 16-, or 32-bit execution modes. Also available are three optional floating-point functional units that have both 32- and 64-bit data formats and are composed of add/subtract, multiply, and divide/square root units.

Also available as options are the Processor Memory Interface, which provides 64-bit data transfer from one CyberPlus processor memory to another CyberPlus processor memory every 20 nanoseconds, and the Central Memory Interface, which uses the central memory ring to transfer data to the host Cyber.

The CyberPlus requires separate power and cooling units, as well as a System Power Monitor (SPM). A single SPM can support up to 10 CyberPlus systems, two water cooling units, and two motor generators.

CONTROL STORAGE: Information not available from the vendor.

REGISTERS: Processor registers vary according to the state in which the systems are operating. In the Cyber 170 state, every Cyber 180 central processor has a total of 24 operating registers: eight 6-bit operand (X) registers, eight 18-bit address (A) registers, and eight 18-bit index (B) registers. In the Cyber 180 state, every Cyber 180 central processor has a total of 32 operating registers: sixteen 64-bit operand (X) registers and sixteen 48-bit address (A) regis-

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CHART C. WORKSTATIONS

MODEL	Viking 721-21/31	Viking 722-30
DISPLAY PARAMETERS		
Max. chars./screen	3,960	3,960
Buffer capacity	—	—
Screen size (lines x chars.)	30 x 132	30 x 132
Tilt/swivel screen	Standard	Standard
Symbol formation	8 x 16 dot matrix	8 x 16 dot matrix
Character phosphor	Green	Green
Total colors/no. simult. displayed	Monochrome	Monochrome
KEYBOARD PARAMETERS		
Style	Typewriter	Typewriter
Character/code set	ASCII	ASCII
Detachable	Yes	Yes
Program function keys	12	12
TERMINAL INTERFACE	RS-232-C	RS-232-C

A dash (—) in a column indicates that the information is unavailable from the vendor.

The ratings indicate a high degree of satisfaction with the Cyber systems. We also asked the users if they would recommend their systems to other users with similar applications. Eight of the nine respondents said that they would recommend their Cyber system. □

ters. The X registers hold operands and results. Five of these registers, X1 through X5, hold operands read from storage and two, X6 and X7, hold results to be sent to main storage. Data is automatically transmitted between main storage and an X register whenever an address is placed into the corresponding A register. The A0 and X0 registers have no connection with main storage and can be used to hold intermediate results. Seven B registers, B1 through B7, serve as index registers, while the eighth (B0) provides a constant zero value.

In the Cyber 180 state, there are 16 registers that can hold operands and can also be used for indexing. These registers replace the eight X registers and eight B registers present in the 170 state. Each X register is 64 bits long. (A central memory word in the 180 state is 64 bits long.) The 16 X registers are numbered X0 through XF using hexadecimal notation (where X0 is the first register).

Sixteen 48-bit A registers hold the central memory addresses of the operands. They are given in the form of process virtual addresses. The 16 A registers are likewise numbered A0 through AF (where A0 is the first register). Unlike the 170 state, operations on the A registers have no effect on the X registers; operands can be loaded into or stored from any X register.

ADDRESSING: NOS (the 170 state) uses real memory addressing on word boundaries only; individual programs are limited to 131,072 words of central memory. NOS/VE (the 180 state) uses virtual memory addressing on both word and byte boundaries. Individual programs can have a virtual address space of 8.8×10^{12} bytes or 268 million 64-bit words.

INTERRUPTS: Three types of error conditions and one external condition cause central processor interrupts: address out of range (i.e., storage protection violation), operand out of range (i.e., exponent overflow), indefinite results, and execution of an Exchange Jump instruction by a peripheral processor or central processor.

OPERATING ENVIRONMENT: The Cyber 180 systems can operate at 50, 60, or 400 hertz. Maximum power consumption is 5.74 to 7.91 kVA for Models 810A and 830A and 7.94 to 10.11 kVA for Model 830A Dual-CP. Models 810A and 830A are air-cooled. Heat dissipation, in Btus per hour, is from 18,195 to 25,600 for Models 810A and 830A and from 25,178 to 32,583 for Model 830A Dual-CP. Models 810A and 830A require an operating environment with a relative humidity of 20 to 80 percent and a temperature of 50 to 104 degrees Fahrenheit. The recommended operating temperature is 74 degrees Fahrenheit.

INPUT/OUTPUT CONTROL

Cyber 180 Models 810A and 830A can have either 8, 12, or 16 I/O channels. All of the channels can be used by any of the peripheral processors. The maximum data rate on the standard I/O channels is 3 megabytes per second.

One input or output operation on each I/O channel can be overlapped with computing in the central processor and peripheral processors. Every I/O operation is executed under the direct control of a peripheral processor. All channels can be active at the same time.

CONFIGURATION RULES

GENERAL: Models 810A and 830A are single-processor configurations, while the Model 830A Dual-CP is a dual-processor configuration. The basic Cyber 180 systems include a central processor with 8MB to 64MB of main memory, 10 to 30 Peripheral Processor Units, and 8 to 16 I/O channels.

A minimum system includes a Cyber 180 processor, line printer, one tape unit, and one 844 or 885 Disk Storage Unit, or an 834/836 Disk Storage Unit for the 810A/830A. The system uses two Peripheral Processor Units on a dedicated basis. The remaining eight PPUs are dynamically allocated to system and subsystem tasks. The Independent Shared Device Mode provides the capability of sharing 844 or 885 mass storage devices among up to 16 Cyber 180 or older Cyber mainframes.

WORKSTATIONS: The Cyber 180 Communications Subsystem will support the CDC 714, 721, and 722 terminals; 200UT; TTY Models 33, 35, 37, 38, and 40; IBM 2780/3780 and IBM 3270 BSC; Tektronix 4010/4014/4015; Memorex 1240; Hasp Multileaving Terminals; CCITT X.25 interface; and various PCs such as IBM and Apple.

DISK STORAGE: The Integrated Controller Interface (ICI) supports the 7255-1 disk adapter; a combined total of six disk or tape adapters is permitted through upgrade options. The Cyber 180 810A/830A systems support up to 1.6GB of disk storage per drive.

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CHART D. PRINTERS

MODEL	533-1	536-1	580-120	580-160	580-200	5870-1
Type	Line	Line	Line	Line	Line	Page
Speed	300 lpm	600 lpm	1200 lpm	1600 lpm	2000 lpm	70 ppm
Bidirectional printing	No	No	No	No	No	—
Paper size	4″ to 15″ wide, 3″ to 18″ long	4″ to 15″ wide, 3″ to 18″ long	4″ to 20″ wide, 4″ to 15″ long	4″ to 20″ wide, 4″ to 15″ long	4″ to 20″ wide, 4″ to 15″ long	8½″ x 11″
Character formation	—	—	—	—	—	—
Horizontal character spacing (char./inch)	10	10	10	10	10	4 to 30
Vertical line spacing (char./inch)	6/8	6/8	6/8	6/8	6/8	3 to 18
Character set	—	—	48	48	48	—
Controller/Interface	—	—	Integral	Integral	Integral	—
No. of printers per controller/ interface	—	—	—	—	—	—
Printer dimensions, in. (h x w x d)	—	—	52 x 62 x 46	52 x 62 x 46	52 x 62 x 46	—
Graphics capability	—	—	No	No	No	—
Comments						

A dash (—) in a column indicates that the information is unavailable from the vendor.

MAGNETIC TAPE: The ICI supports the 7221-1 tape adapter. The Cyber 180 Models 810A/830A support the 7221/639 streaming tape subsystem and the 677/679 magnetic tape transports.

PRINTERS: A variety of printers, ranging from 300 lines per minute to 70 pages per minute, are supported by the Cyber 180 systems.

MASS STORAGE

For information on the available mass storage devices, please refer to Chart B.

INPUT/OUTPUT UNITS

For information on available input/output units, please refer to Terminals (Chart C), Printers (Chart D), and Magnetic Tape Equipment (Chart E).

COMMUNICATIONS CONTROL

Control Data's *Loosely Coupled Network (LCN)* is designed primarily for sites using a number of large-scale computers from various vendors. It permits the interconnection of a variety of computers, and through the use of one to four Network Access Devices (NADs) provides communications capability between a local host and satellites. Up to four trunk connections per NAD, operating at a data transmission rate of 50 megabits per second, can be configured to provide redundant paths and higher performance. The maximum number of workstations is 112, and the LCN supports IBM, CDC Cyber, and Digital Equipment VAX and UNIBUS (PDP-11) interfaces.

The *Control Data Distributed Communications Network (CDCNet)* is an Ethernet-based system that permits users to link Control Data Cyber computers, user terminals, user workstations, and non-CDCNet networks into an overall network. CDCNet is based on the Open System Interconnect (OSI), and the software modularity adheres to the OSI model.

CDCNet distributes the power and manages the network through microprocessors called Device Interfaces (DIs). The DIs can be used in different configurations depending on network needs. They can route transmissions via least-cost algorithms, so that if one of the DIs goes down, the system will automatically reroute the transmission via another path and choose the least expensive one.

Four DIs are available: the Mainframe Device Interface (MDI), the Terminal Device Interface (TDI), the Network Device Interface (NDI), and the Mainframe/Terminal Device Interface (MTI). The MDI enables a Cyber 180 host to be connected to Ethernet and is responsible for the host interface protocols. The TDI permits the connection of user terminals and workstations to the host system and performs all terminal handling functions. It supports up to 32 communications lines, either asynchronous at up to 38.4K bps or synchronous at up to 128K bps. The NDI can connect a remote CDCNet to a local CDCNet by medium-speed links such as HDLC or X.25 virtual circuits. It can also act as a gateway to connect CDCNet to outside networks, such as SNA networks, X.25 public data networks, and DECnet. MTI is an entry-level unit designed for users with fewer than 32 terminals or workstations. As the number of terminals grows, the MTI can be reconfigured into an MDI and a TDI connected by Ethernet. Additional DIs can be added as needed.

Each DI includes at least one System Main Memory (SMM) board containing one megabyte of random access memory (RAM) with a cycle time of 312 nanoseconds. Up to five SMM boards can be installed in a DI. If additional performance is required, a Private Memory Module (PMM) can be added. The PMM contains 128K bytes of memory with a 140-nanosecond read cycle. Only one PMM can be installed in a DI.

Two channel interface units are available. The Mainframe Channel Interface (MCI) enables a DI to interface with the Cyber host's 12-bit channel. Two MCIs can be added to a DI, but only one MCI can be linked per channel. The Ethernet Serial Channel Interface (ESCI) permits a DI to interface with an Ethernet multiplexer or transceiver via transceiver cables. The ESCI includes one Ethernet controller chip, one Ethernet serial interface chip, one Motorola 68000 microprocessor, 16K bytes of RAM, and 16K bytes of ROM (read-only memory). The Ethernet transceiver is compatible with the IEEE 802.3 specifications.

Line Interface Modules (LIMs) provide an interface between a DI and user terminals, workstations, modems, and printers. The LIMs connect to a Communications Interface Module (CIM), which controls transmission between the DI and the LIM. Up to eight LIMs are supported on a DI.

SOFTWARE

OPERATING SYSTEM: The Control Data Cyber 180 Models 810A/830A support the Network Operating System/Virtual Environment (NOS/VE) and Network Operating System (NOS) operating systems.

Network Operating System/Virtual Environment (NOS/VE) provides an extremely large address space with

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CHART E. MAGNETIC TAPE EQUIPMENT

MODEL	639-1	679-5	679-6	679-7
TYPE	Streaming	Cartridge	Cartridge	Cartridge
FORMAT				
Number of tracks	9	9	9	9
Recording density, bits per inch	1600/6250	1600/6250	1600/6250	1600/6250
Recording mode	PE, GCR	PE, GCR	PE, GCR	PE, GCR
CHARACTERISTICS				
Controller model	Integral	7021-31/-32	7021-31/-32	7021-31/-32
Drives per controller	—	—	—	—
Storage capacity, bytes	—	—	—	—
Tape speed, inches per second	25/75	100	150	200
Data transfer rate, units per second	40KB-468KB	160KB/625KB	240KB/937KB	320KB/1.2MB
Streaming technology	Yes	No	No	No
Start/stop mode; speed	—	—	—	—
Switch selectable	Yes	Yes	Yes	Yes

A dash (—) in a column indicates that the information is unavailable from the vendor.

a virtual memory byte address of 31 bits per segment and 4,096 segments per task, allowing each task to have up to 8.8 $\times 10^{12}$ bytes. Unlike the NOS 2.5.1, NOS/VE uses 64-bit words (eight 8-bit bytes), 31-bit addressing for real memory, and variable page size from 2K bytes to 64K bytes, which is incremented in powers of two.

NOS/VE extends the concept of virtual memory to the I/O subsystem. Both program and I/O data can be retained in real memory, thus reducing the number of system requests to disk storage. Virtual I/O also relieves programmers from managing their own I/O memory.

NOS/VE multitasking allows users to break a program into a series of tasks that may be run synchronously or asynchronously. Program and data structures are automatically separated into segments to maintain security and maximize data sharing in multiuser environments. The use of segments and links between data and programs allows all programs, data, utilities, and procedures to be fully reentrant. Users share the same copy of compilers and editors for more efficient use of real memory.

Character handling instructions include ASCII native mode (8-bit bytes), decimal arithmetic (packed and unpacked), move character string, translation of character set (EBCDIC to ASCII and vice versa), and the scan and/or edit of character strings.

The entire operating system is written in Cyber Interactive Language (Cybil), rather than assembler, and uses a combination command language/job control language called SCL, or system control language. Because the SCL is a high-level language, it allows both keyword and positional parameters with range and type constraints. All file names under NOS/VE can consist of up to 31 characters and include a 256-byte label that the user can write or display. Under NOS, only a 7-character file name was possible.

NOS/VE supports full message and brief message modes, a help facility, and on-line manuals that can be site modified. NOS/VE also features symbolic debugging, on-line manual generation, full-screen editing, source code and object code utilities, and job performance monitors.

All Cyber 180 models can perform dual-state operation. The central processor will run on two different instruction sets: the 170 state executes the NOS and/or NOS/VE operating systems, supports real memory addressing, and uses 60-bit words; the 180 state executes the NOS/VE operating system, supports virtual memory addressing, and uses 64-bit words.

NOS/VE security is provided through a ring concept, which uses a hardware isolation technique that subdivides the segments into a hierarchy of privileged access. There are 16 rings (0-15), of which 15 are valid. Ring 0 is used to indicate an unlinked process and causes an interrupt to a handler that then dynamically links the module to the current process. The rings allow codes that have different levels of privilege to occupy the same address space. The second property of the rings is the call inward/return outward mechanism. Any module may call a module in a lower ring; however, the called module can only respond if the ring bracket includes both the caller and the callee. The reverse process is not allowed; this stops a privileged application from "spying" on a less privileged application and data. A lower ring cannot initiate the link; it services less privileged requests only and can never issue requests. All files require a password.

NOS/VE also features *Unix System V (VX/VE)* as an NOS/VE subsystem. VX/VE supports Unix System V kernel calls, utilities, runtime libraries, documentation, and support files. The VX/VE C compiler has been optimized for Cyber 180 hardware. A full-featured standard C runtime library is provided to link VX/VE users with NOS/VE. Programs written in C for other processors can be transported to NOS/VE through the C compiler.

The *Network Operating System (NOS) 2.5.1* supports Cyber 170 and 180 processors in standalone, multiprocessor, or network configurations. The basic NOS 2.5.1 package includes the Compass assembly language, the Cyber Record Manager for performing basic I/O tasks, the Cyber Loader for loading object modules, the Form conversion aid for converting from one file organization to another, the Update facility for maintaining source decks, and the 8-bit Subroutine Package for managing sequential files using 8-bit character sets.

The Transaction Facility is a separate package that provides general-purpose transaction processing capabilities, including centralized control for transaction terminals; a specialized data management system; support for multiple task libraries, journaling, and debugging; and testing aids. The Remote Batch Facility supports remote job entry from various batch terminals. Both the Transaction Facility and the Remote Batch Facility operate in conjunction with the Network Access Method and the Communications Control Program.

The Multi-Mainframe Module provides a shared-processor capability that permits up to four processors to access permanent files stored on mass storage devices. The Remote Host Facility supports communications between multiple mainframes via Control Data's Loosely Coupled Network.

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NOS 2.5.1 uses the Peripheral Processor Units (PPUs) to handle system and I/O functions. Various components of the NOS 2.5.1 software reside in main memory, Extended Semiconductor Memory, PPU storage, and the system disk unit. One PPU contains the Monitor routine and permanently controls the system's overall operations. A second PPU is permanently assigned to control the console keyboard and displays. In the event of a malfunction, the monitor and operator display functions can be reassigned to alternate PPUs. The remaining PPUs are used to perform I/O and system tasks on a dynamic pool basis. If the Remote Batch Subsystem is active, a PPU is dedicated to the subsystem.

NOS 2.5.1 includes a number of ease-of-use features that enable users to create their own data processing procedures. These features include the use of simple English language commands to initiate processing, the use of a global library that enables a number of authorized users to access a common program procedure, and the use of user prompts and explanations. Specific instructions can be added to the system to assist a particular user group, and interfaces can be created for the use of languages other than English. In addition, NOS 2.5.1 supports Control Data's computer-based education package, Plato, as a standard software application without any special hardware requirements.

Under NOS 2.5.1, users can hold and review job output before printing, send output to an interactive wait queue, call for detailed information on job status, change certain characteristics of a job, obtain job output from the queue, and drop a job from execution or from any queue.

System productivity aids include the System Resource Unit, an accounting system that measures the system resources required to perform a function, and Remote Technical Assistance, a facility that allows maintenance engineers to diagnose and solve many problems via a remote terminal.

NOS provides system security in two modes: normal mode and through the Multi-Level Security option. The normal security level employs passwords at the system level and the file level and uses password encryption. The Multi-Level Security option builds on the normal security mode by providing mandatory access controls with eight hierarchical access levels with individual validation for each specific level.

DATA BASE MANAGEMENT SYSTEM: Data management software available for the Cyber 180 Models 810A and 830A include the Data Management System-170, Information Management/Virtual Environment, Information Management Facility, and Data Catalogue 2.

The *Data Management System-170 (DMS-170)* combines existing Control Data software modules with data base management capabilities to form a data base management system that incorporates the CODASYL Data Base Task Group functions, plus some unique CDC extensions for data base management. DMS-170 includes the following modules: Data Description Language (DDL), Cyber Data Base Control System (CDCS), Query/Update, Fortran Data Base Facility, TAF Transaction Executive, Report Generator, and Administrative Utilities.

The DDL, a separate self-contained language, produces a description of an entire data base (schema) and descriptions of that data which are known to specific programs or users (subschema). The DDL compiler accepts schema and subschema source statements and converts them to schema and subschema object directories, which are saved for use by the data base management system.

Based on CODASYL DDLC and DBLTG specifications, DDL allows the data base administrator to describe data attributes and data base procedure invocation. It also allows specifications of validity checks to be performed on data at the time it is stored and a constraint clause to enforce data integrity. Data compression/decompression routines, integrity checks, and encryption/decryption may be invoked as procedures.

The Cyber Data Base Control System controls traffic between user programs and the data base, providing data independence for the programs, concurrent access to integrated data bases by multiple programs, and consistent recovery capability for all DMS-170 data bases. CDCS uses criteria specified by the data administrator in the data base schema to perform data validation. Data base transactions are logged and the log file can be used later for auditing data base activity.

The CDCS interfaces to the Cyber Record Manager with its standard access methods. CDCS operates on CRM files accessible to Cobol or Fortran without requiring conversion of the file. Using the Multiple Index Processor, CDCS can maintain complex interrecord and interfile relationships. For record selection and retrieval, linkage paths declared in the DDL are used to traverse the logical relationships between records and files.

Query/Update is a high-level, English-like language for use in querying and manipulating data files. It is especially powerful for multiple files using alternate keys and multiple relationships. Because Query/Update is designed for use in a terminal-oriented environment, communications with a data base are in a conversational mode.

The Boolean List Processor Query/Update interacts directly with the indexes of the Multiple Index Processor. The Boolean Processor evaluates selection criteria for data without accessing the data by applying Boolean functions to the indexes. The resulting list of keys then can be processed directly or used to access the qualified data.

The Fortran Data Base Facility is composed of a Fortran subschema definition language and a Data Manipulation Language. The TAF Transaction Executive schedules and controls on-line application tasks that require high priority and fast response time. Report Generator produces ad hoc reports as a subset of Query Update, and Administrative Utilities aids the data base administrator.

Information Management/Virtual Environment (IM/VE) is a modular system composed of Information Management/Data Base Management (IM/DM), Information Management/Quick (IM/Quick), Information Management/Personal (IM/Personal), and Information Management/Access (IM/Access). IM/DM is a relational data base management system that integrates structured data and unstructured data. IM/DM features integrated screen management, an integrated fourth-generation-level command system, full concurrency and recovery systems, and security and privacy mechanisms.

IM/Quick is a decision support system with query, manipulation, and report generation capabilities. It is targeted for use by administrative and managerial personnel.

IM/Personal provides for the distribution of applications between a personal computer and a Cyber 180 mainframe. The program can also run as a self-contained data base management system on the personal computer.

IM/Access provides a bridge between IM/Personal on the personal computer and IM/DM on the mainframe. It couples the data in the two computers so that updates performed off-line to data in the personal computer can be subsequently transmitted in batch mode to the mainframe. IM/Access also generates on the mainframe data models, screens,

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queries, and reports that reflect those already defined on the personal computer.

The *Information Management Facility (IMF)* is an information base modeling tool that can be used as a production information base management system. IMF supports hierarchical and/or network structures and interfaces to the Fortran and Cobol compilers. Query/Update also interfaces to IMF, and provides interactive or batch mode query, update, and report generation. IMF runs under NOS in batch and remote batch modes. It uses a three-schema architecture (conceptual, internal, and external schemas) that maintains a description of the information bases within the computer and within various applications, and contains the definitions of all the relationships between these varied bases. IMF also includes a Data Manipulation Language and a Data Description Language.

Data Catalogue 2 is a data dictionary/directory that defines the array of relationships between data and users for the data base. Once these relationships are defined, the dictionary can manage the data resource environment. Any change in data structure, data elements, or user relationships is traced and fully documented where the alteration impacts the system. Data Catalogue 2 provides organized, detailed reports about the data on file, summaries of relationships, analysis of names, and top-down or bottom-up explosions of data with full indexing.

The interactive language used in Data Catalogue 2 has three English-like commands that provide a display of the system hierarchy, file contents, and relationships. Entries are readily accessed by the use of keywords. Data Catalogue 2 is an independent data dictionary system developed by Synergetics, Inc. It is not dependent on any single data base management system, but can describe most data base and file management systems.

LANGUAGES: Both NOS 2.5.1 and NOS/VE support the Cobol, Fortran, Basic, Algol, APL, and Pascal languages. NOS/VE also supports C, Lisp, Prolog, and Cybil. In addition, the Cyber 180 systems use Compass, a standard symbolic assembly language.

COMMUNICATIONS: Data communications software is incorporated into CDCNet, which is described in the COMMUNICATIONS CONTROL section.

UTILITIES: The following utilities are available for the Cyber 180 systems: On-Line Debug, On-Line Manual Generation, Full Screen Editor, Source Code Utility, Object Code Utility, and File Management Utility.

The *NOS/VE Programming Environments*, which supports Fortran, Cobol, C, and Pascal, combines compilers, debuggers, and reference aids. The Programming Environments package allows programmers to develop, debug, and install NOS/VE applications without any knowledge of NOS/VE or the system command language.

Programming Environments includes a full-screen editor for creating and editing source code and a full-screen debugger for locating and correcting errors. Compilation errors are identified automatically and error messages are displayed. The system also automatically generates graphs and charts that show program performance. NOS/VE Programming Environments also features a full-screen interface to permanent files, on-line software manuals, a help facility, compiler templates, and programming language skeletons that provide a properly formatted, syntactically correct model from which to build a program.

OFFICE AUTOMATION: The Cyber 180 Models 810A/830A are not targeted to the general office environment. However, Control Data does provide *Cyber On-line Text (Context)*, a software package that produces fully integrated, complete technical documentation that can be accessed sequentially or randomly.

APPLICATIONS: Control Data provides a number of applications software for the Cyber 180 systems.

IPF is an interactive application that includes data definition, data entry and updating, ad hoc query, report generation, data transformation, and utilities. IPF modules are Define, Update, Query, Report, and Transform.

Transaction Facility (TAF) provides multitasking and recovery and also allows for batch transactions. TAF applications include energy management systems, on-line banking, and billing.

A number of scientific/engineering applications packages are available for the Cyber 180, including APAS (electric utilities), Apex IV (mathematical language), APT-IV Enhanced (numerical control), CD-2000 (computer-aided design), CDC-SynthaVision (geometric modeling), Cyberspice (electronic/electrical design), GPSS V (general-purpose simulation system), GTICES Strudl II (structural design), ICEM (computer-aided engineering and manufacturing), IMSL (mathematical library), McIDAS (environmental control), MSSI (Cyber data base central system), PDS/MaGen (modeling and report generator), Pert/Time, Plato (computer-aided instruction), Seismic Processing/Interpretation System, Simscript 2 (discrete event simulation), Tigs (graphics system), Uniplot (plotting system), and Unistruc (structural analysis).

CDC also has a wide range of general computing packages available. These packages include applications covering Business Management, Finance, Word Processing, Education, and General/Multi-Industry.

PRICING

POLICY: Cyber 180 systems are available on a purchase or lease basis. Lease terms offered are one year and three years, noncancellable for 24 months (3 years/24 months). The 3-year/24-month lease contract can be written for periods of up to 7 years/24 months. Lease contracts with a term of 3 years/24 months or greater are financed on a third-party basis through Commercial Credit Company, CDC's wholly owned financial services subsidiary. Customers who lease their system can take advantage of purchase conversion plans and apply from 30 to 90 percent of the amount paid into leases against the purchase price. However, a minimum price must be paid for each system, usually between 20 and 30 percent.

Trade-in credits for customer-owned equipment are also offered. A quotation will be provided upon request.

SUPPORT:The basic monthly maintenance charge provides full on-call maintenance service for any nine consecutive hours per day between 7 a.m. and 6 p.m., or 5 a.m. and 8 p.m., Monday through Friday, excluding local holidays. Options are available for extended maintenance at additional cost. Option 1 extends maintenance to 16 consecutive hours per day, Monday through Friday, on an on-site or on-call basis. Option 2 extends maintenance to 24 hours per day, Monday through Friday, on an on-site or on-call basis. Maintenance can also be extended to Saturday and Sunday, excluding local holidays, for additional cost.

Software is licensed and is offered on an "as is" basis. Software support is priced separately. Each product is designated as a Class 1, Class 2, Class 3, or Class 4 product in terms of support. Class 1 support is equivalent to the Central Enhancement and Maintenance (CEM) support previously

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offered. Class 1 support includes corrective codes, updates, enhancements, and rights to successor products. Class 2 support is reserved for future use. Class 3 support is the same as Class 1 except that corrections, improvements, and enhancements may not be verified using current configuration environments and the latest released levels of the software products. No support is available for Class 4 products. Unless otherwise specified, all software products listed in the accompanying price list are Class 1 products.

Software is designated as Use Group A, Use Group B, or Use Group C. Use Group A products may be used on a specific mainframe at a specific site for the customer's own use or to provide services to others. If the designated mainframe becomes inoperative, the software may be used on another one of the same model. Use Group B products are restricted to internal use by the customer. Use Group C products are available only to nonprofit educational institutions. Unless otherwise specified, software products listed in the accompanying price list are Use Group A products.

Software licenses can be obtained either by paying a one-time paid-up license fee or by paying a recurring monthly fee. Customers with multiple systems are eligible for the Distributed System Software License (charged for each copy of a given software product) with support furnished to a designated support location (single charge for multiple copies). Under the DSSL, the designated support location is granted the right to copy and distribute software products and support service elements for use on specific eligible processors. There is a separate charge for support services, except for the full software license, which includes support services in the monthly charges.

TRAINING: Contact Control Data for information pertaining to customer training.

TYPICAL CONFIGURATIONS: The systems described below illustrate two typical Cyber 180 configurations. The quoted prices include the necessary hardware, but do not include software.

MODEL 810A:

Central Processor (includes 8MB of main memory, 10 PPUs, and 8 I/O channels)	$121,000
One 18002-2 Operator Console	2,450
One 836-221 Disk Subsystem (804MB)	39,000
Two 679-5 Tape Transports (1600/6250 bpi, 100 ips)	55,850
One 7021-31 Tape Controller	42,300
One 536-1 Line Printer (600 lpm)	11,700
TOTAL PURCHASE PRICE:	$272,300

MODEL 830A:

Central Processor (includes 16MB of main memory, 2K words of cache, 10 PPUs, and 8 I/O channels)	$175,000
One 18002-2 Operator Console	2,450
One 10513-740 Power Supply (40 kVA)	21,370
One 895-1 Disk Subsystem (2.4GB)	58,000
One 895-2 Disk Unit (2.4GB)	43,000
One 7165-21 Disk Controller	56,000
Two 679-5 Tape Transports (1600/6250 bpi, 100 ips)	55,850
One 536-1 Line Printer (600 lpm)	11,700
TOTAL PURCHASE PRICE:	$423,370

EQUIPMENT PRICES

		Purchase Price ($)	Monthly Maint. ($)	Monthly Charges, 1-Year Lease ($)
PROCESSORS				
Model 810A	Central Processor; includes 1,048,576 words (8MB) of main memory, 10 Peripheral Processors, 6 external data channels, and 2 Integrated Controller Interface (ICI) channels; requires system console and power supply	121,000	560	9,325
Model 830A	Central Processor; includes 2,097,152 words (16MB) of main memory, 10 Peripheral Processors, 6 external data channels, and 2 Integrated Controller Interface (ICI) channels; requires system console and power supply	175,000	790	14,615
PACKAGED SYSTEMS				
810-43	Hardware Package; includes Cyber 810A processor, 8MB of main memory, 10 Peripheral Processors, 4 external data channels, 4 Integrated Controller Interfaces, operator console, disk subsystem, tape subsystem, 600-lpm printer w/96-character band, and Network Processor Unit	202,851	1,334	13,679
810-44	Hardware Package; includes Cyber 810A processor, 16MB of main memory expandable to 64MB, 10 Peripheral Processors, 4 external data channels, 4 Integrated Controller Interfaces, operator console, disk subsystem, tape subsystem, 600-lpm printer w/96-character band, and Network Processor Unit	271,258	1,856	18,733
810-63	Hardware Package; includes Cyber 810A processor, 8MB of main memory expandable to 64MB, 10 Peripheral Processors, 4 external data channels, 4 Integrated Controller Interfaces, operator console, disk subsystem, tape subsystem, 600-lpm printer w/96-character band, and mainframe terminal device interface	202,809	1,270	13,679

T&M—Time and materials.
NA—Not available.

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Charges, 1-Year Lease ($)
810-64	Hardware Package; includes Cyber 810A processor, 16MB of main memory expandable to 64MB, 10 Peripheral Processors, 4 external data channels, 4 Integrated Controller Interfaces, operator console, disk subsystem, tape subsystem, 600-lpm printer w/96-character band, and mainframe terminal device interface	266,140	1,555	18,422
830-44	Hardware Package; includes Cyber 830A processor, 16MB of main memory, 10 Peripheral Processors, 4 external data channels, 4 Integrated Controller Interfaces, operator console, disk subsystem, tape subsystem, 600-lpm printer w/96-character band, and Network Processor Unit	294,882	1,991	21,247
830-64	Hardware Package; includes Cyber 830A processor, 16MB of main memory expandable to 64MB, 10 Peripheral Processors, 4 external data channels, 4 Integrated Controller Interfaces, operator console, disk subsystem, tape subsystem, 600-lpm printer w/96-character band, and mainframe terminal device interface	289,514	1,675	20,944
65830-2	Hardware Package; includes Cyber 830A processor, 16MB of main memory, 20 Peripheral Processors, 18 external data channels, and 6 Integrated Controller Interfaces; requires 18002-1 operator console and 18105-X power option	243,500	1,080	18,972
PROCESSOR UPGRADES & OPTIONS				
18107-2	Model 810A Processor Upgrade; upgrades a Model 810A with 8MB of memory to a Model 830A with 16MB of memory	54,000	230	5,290
18107-3	Model 810A Processor Upgrade; upgrades a Model 810A with 16MB of memory to a Model 830A with 16MB of memory	26,000	70	2,330
18109-1	Model 830A Upgrade; adds a second central processor to a Model 830A system	77,000	345	5,365
18102-1	Channel Increment for Models 810A and 830A; adds three C170 and one ICI channel; a maximum of two 18102-1 options can be installed. A one-time charge of $5,000 is assessed for the Channel Conversion (18102-2) if the extra channels are field installed.	8,500	20	315
18103-1	Peripheral Processor Unit (PPU) Upgrade for Models 810A and 830A; adds 10 PPUs; requires prior installation of two 18102-1 channel increments	17,500	50	1,105
18104-1	Battery Backup for Models 810A and 830A	5,500	20	205
10513-725	25 kVA Motor Generator; 60 hertz power supply for Models 810A, 830A, and 840A	18,595	32	600
10514-725	25 kVA Motor Generator; 50 hertz power supply for Models 810A and 830A	18,595	32	600
18002-1	Operator Console; includes alphanumeric keyboard and 21-inch display; required for NOS/VE	19,900	75	735
18002-2	Operator Console; includes detachable alphanumeric keyboard and 15-inch display; required for NOS/VE	2,450	31	132
18670-1	CyberPlus Base Processor; includes Program Instruction Memory, four 16-bit Data Memories, and a 64-bit Data Memory; requires 18674-1 or 18675-1 water cooler and 18676-1 power supply	735,000	3,292	27,225
18671-1	CyberPlus Ring Port Interface; permits connection to a Cyber 180 host	30,000	225	1,115
18672-1	CyberPlus Memory Expansion; expands 256KB 64-bit memory to 512KB and expands memory banks from 4 to 8	250,000	500	9,255
18673-1	CyberPlus Floating-Point Option; adds 3 floating-point functional units that operate in either 32- or 64-bit data formats; also increases program memory from 200 bits to 240 bits	350,000	1,225	12,975
18676-1	CyberPlus System Power Control Panel; provides power control interface for up to 10 base CyberPlus units and all options	20,000	0	740
MEMORY				
18101-8	Memory Increment for Model 810A; increases main memory from 1,048,576 words (8MB) to 2,097,152 words (16MB)	28,000	160	2,960
18101-16	Memory Increment for Models 810A and 830A; increases main memory from 2,097,152 words (16MB) to 4,194,304 words (32MB)	56,000	320	5,920
18101-48	Memory Increment for Models 810A and 830A; increases main memory from 4,194,304 words (32MB) to 6,291,456 words (48MB)	56,000	320	5,920
18101-64	Memory Increment for Models 810A and 830A; increases main memory from 6,291,456 words (48MB) to 8,388,608 words (64MB)	56,000	320	5,920
MASS STORAGE				
836-110	Disk Storage Subsystem; includes one disk storage unit and one control module; formatted capacity is 508M 6-bit characters or 402M 8-bit characters; for Models 810A and 830A only	19,000	110	1,045
836-221	Disk Storage Subsystem; includes 2 disk storage units and 2 control modules; for Models 810A and 830A only	39,000	220	2,145
836-441	Disk Storage Subsystem; includes 4 disk storage units and 4 control modules; for Models 810A and 830A only	73,000	440	4,015

T&M—Time and materials.
NA—Not available.

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Charges, 1-Year Lease ($)
MASS STORAGE				
885-11	Disk Storage Unit; 2 independent spindles; 692M 6-bit characters per spindle; provides access for one controller per spindle	40,732	198	1,605
885-42	Disk Storage Unit; 2 independent spindles; 692M 6-bit characters per spindle; provides access for two controllers per spindle	75,900	226	2,050
895-1	Disk Storage Unit; 4 independent spindles; 611M 8-bit characters per spindle; handles control logic for up to three 895-2 units	58,000	325	2,915
895-2	Disk Storage Unit; 4 independent spindles; 611M 8-bit characters per spindle	43,000	240	2,110
7155-11	Mass Storage Controller; controls up to four 885-11 disk units; single channel	32,000	151	1,170
7155-12	Mass Storage Controller; two channels	38,500	165	1,364
7155-13	Mass Storage Controller; three channels	45,000	179	1,558
7155-14	Mass Storage Controller; four channels	51,500	193	1,752
7155-401	Mass Storage Controller (DEMA); provides access to up to four 885-42 Disk Units via Direct Extended Memory Access (DEMA) to a low-speed ESM port or four 885-11 disk units via the Cyber 180 I/O channel	49,990	150	1,340
7165-21	Mass Storage Controller; for 895-1 and 895-2 disk units; two single-channel units	56,000	395	2,910
7165-22	Mass Storage Controller; two dual-channel units	62,000	406	3,150
10397-1	Additional Channel Option; up to three per 7155-1X or up to two per 7155-401	6,500	14	194
10399-1	885 Four-Drive Expansion Option; allows 7155 Controller to access up to four additional 885 Disk Units	15,550	39	458
MAGNETIC TAPE UNITS				
639-1	Magnetic Tape Transport; 1600/6250 bpi, 25 ips and 75 ips; uses integrated Tape Adapter	16,900	130	610
679-5	Magnetic Tape Transport; 1600/6250 bpi, 100 ips	27,925	179	620
679-6	Magnetic Tape Transport; 1600/6250 bpi, 150 ips	31,540	188	701
679-7	Magnetic Tape Transport; 1600/6250 bpi, 200 ips	33,510	241	745
7021-31	Magnetic Tape Controller; 1 x 8 to one control; for all 679 tape drives in any mix	42,300	186	1,103
7021-32	Magnetic Tape Controller, 1 x 8 to two controls; for all 679 tape drives in any mix	90,000	382	2,346
PRINTERS				
533-1	Line Printer; 300 lpm	7,700	125	280
536-1	Line Printer; 600 lpm	11,700	165	425
580-120	Train Printer Subsystem; 1200 lpm printer and controller	45,000	488	1,445
580-160	Train Printer Subsystem; 1600 lpm printer and controller	50,000	721	1,960
580-200	Train Printer Subsystem; 2000 lpm printer and controller	54,000	1,055	2,240
596	580 Train Cartridge; 48, 64, or 96 characters	3,122	75	95
5870-1	Nonimpact Printing Subsystem; includes 20-ppm printer and Cyber channel coupler (There is a monthly impression charge of $0.0041 per impression.)	236,500	2,255	N/A
COMMUNICATIONS EQUIPMENT				
2601	CDCNet Basic Device Interface (DI) Cabinet; includes power supply, cooling fan, and master processor board	3,625	65	202
2604	System Main Memory Board; one megabyte	4,595	0	256
2605	128KB Private Memory Module; increases local memory in master processor board from 16KB to 144KB	2,225	0	124
2607	Mainframe Channel Interface; allows a DI to be coupled to a Cyber channel	3,195	0	178
2608	Ethernet Serial Channel Interface; allows a DI to be coupled to, and service, an IEEE 802.3 Ethernet that complies with CDCNet	1,855	0	104
2609	Communications Interface Module; provides processing power and a connecting mechanism to support up to 8 Line Interface Modules	1,355	0	76
2610	RS-449 Line Interface Module; provides 2 independent ports for terminals or modems	600	0	34
2612	RS-232 Line Interface Module; provides 4 ports; 50 bps to 38.4K bps asynchronous and up to 56K bps synchronous	600	0	34
2617	V.35 Line Interface Module; provides 2 ports; 50 bps to 38.4K bps asynchronous and up to 256K bps synchronous	600	0	34
2620	Mainframe Terminal Device Interface; includes basic DI cabinet with master processor board, one-megabyte System Memory Module, Private Memory Module, Mainframe Channel Interface, and Communications Interface Module	14,995	65	834

T&M—Time and materials.
NA—Not available.

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		Purchase Price ($)	Monthly Maint. ($)	Monthly Charges, 1-Year Lease ($)
2621	Mainframe Device Interface NOS/VE; includes basic DI cabinet with master processor board, one-megabyte System Memory Module, Mainframe Channel Interface, and Communications Interface Module	13,270	65	738
2622	Terminal Device Interface; includes basic DI cabinet with master processor board, one-megabyte System Memory Module, Mainframe Channel Interface, and Communications Interface Module	11,430	65	635
2623	Network Device Interface; includes basic DI cabinet with master processor board, one-megabyte System Memory Module, Ethernet Serial Channel Interface, and Communications Interface Module	11,430	65	635
2630	Ethernet Transceiver; allows a nonintrusive tap to be made to an Ethernet coax cable; complies with IEEE 802.3	375	1	—
2631	Ethernet Multiplexer; allows connection of up to 8 Ethernet Serial Channel Interfaces	2,795	36	150
2632	Ethernet Repeater; provides connection between 2 Ethernet trunk cables to extend an Ethernet LAN	1,795	25	83
2650	Three-DI Cabinet Assembly; provides mounting for 3 Device Interfaces	2,095	T&M	117
TERMINALS				
721-21	Display Terminal	2,295	31	125
721-31	Graphics/Plato Display Terminal	2,895	43	159
722-30	Display Terminal	850	16	50
755-21	Impact Printer; 70 lpm	2,300	83	144
725-10	Impact Printer; 150 cps	2,150	49	90

T&M—Time and materials.
NA—Not available.

SOFTWARE PRICES

		Onetime Charges		Monthly Charges		
		Basic License ($)	DSSL License ($)	Full License ($)	DSSL License ($)	Support Charge ($)
W810-01	Network Operating System/Virtual Environment (NOS Dual State); CPU 810A	13,201	11,221	594	367	227
W830-01	CPU 830A	23,901	20,316	1,075	664	411
W810-02	Network Operating System/Virtual Environment (NOS/VE Dual State); CPU 810A	11,580	9,843	625	386	239
W830-02	CPU 830A	23,160	19,686	1,250	772	478
W810-05	VX/VE under NOS/VE; CPU 810A	12,420	10,557	452	345	107
W830-05	CPU 830A	17,712	15,055	645	492	153
W810-20	Fortran/VE; requires W8XX-01/W990-01; CPU 810A	9,234	7,925	360	222	138
W830-20	CPU 830A	15,624	13,280	603	372	231
W810-22	C/VE; requires W8XX-01/W990-01; CPU 810A	5,292	4,498	193	147	46
W830-22	CPU 830A	10,584	8,996	386	294	92
W810-23	Cobol/VE; requires W8XX-01/W990-01; CPU 810A	8,568	7,283	330	204	126
W830-23	CPU 830A	14,364	12,209	554	342	212
W810-24	Basic/VE; requires W8XX-01/W990-01; CPU 810A	7,098	6,033	274	169	105
W830-24	CPU 830A	9,608	8,167	370	229	141
W810-25	APL/VE; requires W8XX-01/W990-01; CPU 810A	6,804	5,783	262	162	100
W830-25	CPU 830A	11,424	9,710	441	272	169
W810-26	Prolog/VE; requires W8XX-01/W990-01; CPU 810A	4,620	3,927	178	110	68
W830-26	CPU 830A	7,946	6,754	306	189	117
W810-27	Cybil/VE; requires W8XX-01/W990-01; CPU 810A	5,502	4,677	212	131	81
W830-27	CPU 830A	9,198	7,818	355	219	136
W810-28	Lisp/VE Interpreter; requires W8XX-01/X990-01; CPU 810A	5,166	4,391	199	123	76
W830-28	CPU 830A	10,332	8,782	398	246	152
D810-30	NOS/VE Programming Environments; CPU 810A	1,848	1,571	71	44	27
D830-30	CPU 830A	3,696	3,142	143	88	55

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		Onetime Charges		Monthly Charges		
		Basic License ($)	DSSL License ($)	Full License ($)	DSSL License ($)	Support Charge ($)
W810-34	Pascal/VE; requires W8XX-01/W990-01; CPU 810A	4,494	3,820	173	107	66
W830-34	CPU 830A	6,068	5,158	234	144	89
D810-40	IM/DM; CPU 810A	23,520	19,992	907	560	347
D830-40	CPU 830A	47,040	39,984	1,814	1,120	694
W810-50	IM/Quick; requires W8XX-01/W990-01; CPU 810A	5,880	4,998	227	140	87
W830-50	CPU 830A	11,760	9,996	454	280	174
D810-90	IM/IFP; CPU 810A	19,950	14,963	1,077	665	412
D830-90	CPU 830A	29,130	21,848	1,773	971	602
D810-01	Network Operating System 2; requires D8XX-02/D990-02 for maintenance; CPU 810A	6,770	5,755	396	226	170
D830-01	CPU 830A	13,540	11,509	755	452	303
D810-02	Maintenance Package; requires D8XX-01/D990-01; CPU 810A	0	0	0	0	0
D830-02	CPU 830A	0	0	0	0	0
D810-03	Multi-Mainframe Module 1; requires D8XX-01/D990-01; CPU 810A	3,528	2,999	140	84	56
D830-03	CPU 830A	5,880	4,998	234	140	94
D810-04	Mass Storage System; requires D8XX-01/D990-01; CPU 810A	16,388	13,929	650	389	261
D830-04	CPU 830A	27,384	23,276	1,089	652	437
D810-05	Tracer 1; requires D8XX-20/D990-20; CPU 810A	1,470	1,250	58	35	23
D830-05	CPU 830A	2,520	2,142	100	60	40
D810-10	Network Access Method (NAM) 1; requires D8XX-01/D990-01; CPU 810A	660	561	39	22	17
D830-10	CPU 830A	1,320	1,122	73	44	29
D810-11	Interactive Facility (IAF) 1; requires D8XX-10/D990-10; CPU 810A	3,720	3,162	217	124	93
D830-11	CPU 830A	7,440	6,324	414	248	166
D810-12	Remote Batch Facility (RBF) 1; requires D8XX-10/D990-10; CPU 810A	930	790	54	31	23
D830-12	CPU 830A	1,860	1,581	104	62	42
D810-13	Transaction Facility (TAF) 1; requires D8XX-10/D990-10; CPU 810A	9,912	8,425	394	236	158
D830-13	CPU 830A	16,548	14,066	658	394	264
D810-15	Cyber Cross System 1; requires D8XX-10/D990-10; CPU 810A	0	0	0	0	0
D830-15	CPU 830A	0	0	0	0	0
D810-18	Message Control System; requires D8XX-01/D990-01; CPU 810A	5,586	4,748	222	133	89
D830-18	CPU 830A	9,282	7,890	369	221	148
D810-20	Fortran 5; requires D8XX-01/D990-01; CPU 810A	6,972	5,926	277	166	111
D830-20	CPU 830A	11,634	9,889	463	277	186
D810-23	Cobol 5; requires D8XX-33/D990-33; CPU 810A	6,384	5,426	254	152	102
D830-23	CPU 830A	10,668	9,068	424	254	170
D810-24	Interactive Basic 3; requires D8XX-01/D990-01; CPU 810A	5,124	4,355	204	122	82
D830-24	CPU 830A	8,568	7,283	341	204	137
D810-25	APL 2; requires D8XX-11/D990-11; CPU 810A	5,334	4,534	212	127	85
D830-25	CPU 830A	8,946	7,604	356	213	143
D810-26	PL/1; requires D8XX-01/D990-01; CPU 810A	9,660	8,211	384	230	154
D830-26	CPU 830A	16,212	16,212	645	386	259
D810-28	Xedit 3; requires D8XX-01/D990-01; CPU 810A	2,982	2,535	119	71	48
D830-28	CPU 830A	4,998	4,248	199	119	80
D810-29	Cyber Interactive Debug 1; requires D8XX-01/D990-01; CPU 810A	1,974	1,678	78	47	31
D830-29	CPU 830A	3,318	2,820	132	79	53
D810-33	Sort/Merge 5; requires D8XX-01/D990-01; CPU 810A	3,360	2,856	134	80	54
D830-33	CPU 830A	5,670	4,819	225	135	90
D810-34	Pascal 170; requires D8XX-01/D990-01; CPU 810A	3,024	2,570	120	72	48
D830-34	CPU 830A	5,082	4,320	203	121	81
D810-36	IMSL V9; requires D8XX-01/D990-01; CPU 810A	16,000	16,000	230	155	75
D830-36	CPU 830A	18,100	18,100	260	175	85

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		Onetime Charges		Monthly Charges		
		Basic License ($)	DSSL License ($)	Full License ($)	DSSL License ($)	Support Charge ($)
D810-37	Full Screen Editor; requires D8XX-01/D990-01; CPU 810A	900	765	53	30	23
D830-37	CPU 830A	1,800	1,530	100	60	40
D810-39	Printer Support Utility; CPU 810A	2,300	1,955	92	74	18
D830-39	CPU 830A	2,300	1,955	92	74	18
D810-40	Cyber Data Base Control System 2; requires D8XX-33/D990-33; CPU 810A	12,768	10,853	508	304	204
D830-40	CPU 830A	21,336	18,136	848	508	340
D810-41	Data Description Language 3; requires D8XX-33/D990-33; CPU 810A	2,184	1,856	87	52	35
D830-41	CPU 830A	3,612	3,070	144	86	58
D810-42	Query/Update 3; requires D8XX-41/D990-41; CPU 810A	6,468	5,496	257	154	103
D830-42	CPU 830A	10,836	9,211	431	258	173
D810-43	Fortran Data Base Facility 1; requires D8XX-20/D990-20; CPU 810A	2,184	1,856	87	52	35
D830-43	CPU 830A	3,612	3,070	144	86	58
D810-44	Total Universal 2; requires D8XX-33/D990-33; CPU 810A	30,786	30,786	962	733	229
D830-44	CPU 830A	37,464	37,464	1,171	892	279
D810-45	Total Extended 2; requires D8XX-13/D990-13; CPU 810A	33,222	33,222	1,038	791	247
D830-45	CPU 830A	40,466	40,466	1,263	963	300
D810-49	Information Management Facility (IMF2); requires D8XX-01/D990-01; CPU 810A	19,236	16,351	765	458	307
D830-49	CPU 830A	32,130	27,310	1,278	765	513
D810-50	Information Analysis Support Tool (IAST 1); requires D8XX-01/D990-01; CPU 810A	9,870	8,389	392	235	157
D830-50	CPU 830A	16,506	14,030	656	393	263
D810-52	IPF/CDCS Link; CPU 810A	8,800	7,480	470	295	175
D830-52	CPU 830A	8,880	7,480	470	295	175
D810-53	Data Catalogue 2; requires D8XX-23/D990-23; CPU 810A	10,629	9,035	437	253	174
D830-53	CPU 830A	17,765	15,100	690	423	267 ■