

THE CONTROL DATA

CYBER 205

COMPUTER SYSTEM

THE PRACTICAL SUPERCOMPUTER



Introducing the Control Data CYBER 205: The Supercomputer for the 80s



The scientific and engineering challenges of the 1980s range from the development of new energy sources to turning today's technological breakthroughs into safe, efficient products that meet society's needs.

Meeting these challenges requires an extremely fast, high-performance computing system, not only for use in specialized research, but throughout government and industry, so that the results of that research can be put to practical use.

Now, Control Data makes such a computer system available—a supercomputer that can meet the large-scale challenges of the future.

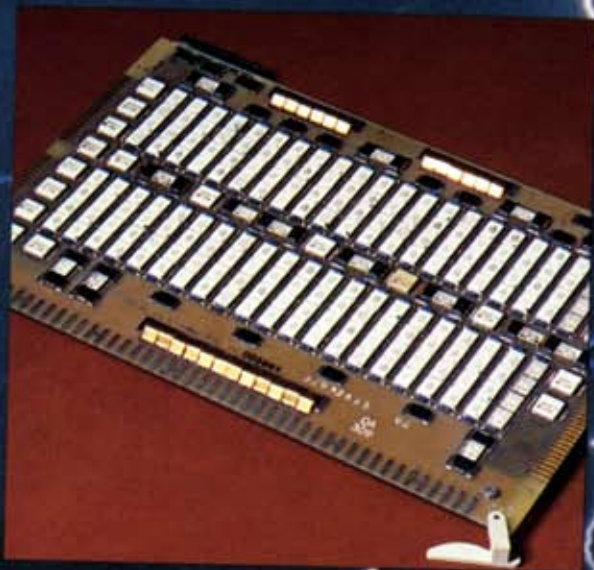
The CYBER 205, the newest member of Control Data's family of advanced, large-scale computer systems, provides computing power and capability beyond that available with any conventional computer system, for scientists and engineers working in:

- Petroleum exploration and production
- Structural engineering
- Electronic design
- Hydrodynamics
- Aerodynamics
- Numerical analysis
- Nuclear physics
- Biomedicine
- Meteorology
- Astrophysics
- Any discipline requiring three-dimensional modeling or solutions to large systems of linear equations

The CYBER 205 applies some of the most advanced technology available today, including large-scale integrated (LSI) bi-polar circuitry, vector processing, hardware macro instructions, superfast semiconductor memory, virtual memory and a distributed peripheral network to meet challenges that require maximum computing performance.

Control Data combines this technology with expertise in peripheral systems, computer communications and software—for a *total computing facility* that makes even your largest problems more manageable.

The CYBER 205 provides unprecedented power for solving problems in structural analysis, meteorology, electronic design, nuclear power, and petroleum exploration and production.



The Result of More Than 20 Years of Large-Scale Computing Development



The supercomputer is a tradition at Control Data, and the CYBER 205 represents more than 20 years of evolution in supercomputing.

The tradition began with our first computer in 1960: the CDC® 1604, the world's first solid-state computer.

The CDC 6600 was the first significant architectural change in computers since the automatic math machines. A true supercomputer when first delivered in 1964, the 6600 introduced distributed processing. Ten functionally independent, programmable peripheral processors provided system control and input/output processing. The central processing unit was freed to execute users' jobs.

The 7600, introduced in 1968, was oriented toward large production FORTRAN applications. It used a front-end computer, like a 6000 series machine, for communications, operator control, unit record functions and other software languages.

In 1974, the STAR-100 computer system introduced integrated scalar and vector processing, for even more effective distribution of computing functions to specific units. Independent processors performed peripheral functions, such as disk input/output and communications to front-end processors. Vector processing produced up to 100 million results per second.

The CYBER 203, based on the architecture of the STAR-100 and using the same software, was introduced in early 1979. It provided improvements through the use of semiconductor memory and concurrent scalar processing, at up to 50 million instructions per second.

The CYBER 205 has evolved from these major milestones in super-scale computer technology. It incorporates these latest developments in concurrent supercomputing:

- Up to 800 million floating point results per second through linked vector stream processing
- Up to 50 million instructions per second through scalar processing
- Up to 4 million 64-bit words of real memory
- A two-trillion (2×10^{12}) word virtual memory
- Up to 16 input/output ports with a total I/O rate of 3.2 billion (3.2×10^9) bits per second.

Furthermore, Control Data is committed to advancing the state-of-the-art in large-scale computing hardware and software. We continue to produce faster processors, larger memory and bandwidth, and software that can effectively use the advanced hardware... all to help you solve tomorrow's problems.

In its maximum configuration, the CYBER 205 is up to eight times faster than any previous Control Data system and more than three times faster than any other computer currently available.



Advanced Technology Means Advanced Performance



Because different organizations need different amounts of computing power, the CYBER 205 is available in six models. The base model has one million words of semiconductor memory, one vector pipeline and eight input/output ports.

Because computing needs grow, the CYBER 205 can be field upgraded to the top-of-the-line model, which offers four million words of memory, four vector pipelines and 16 input/output ports.

All six models offer the advanced technology that makes the CYBER 205 the *working* supercomputer for scientists and engineers.

LSI Circuitry Provides Speed and Reliability

The CYBER 205 uses LSI bi-polar gate array emitter coupled logic (ECL) circuitry throughout the central processor. High-density packaging (168 gates per chip) results in sub-nanosecond switching, not only because of fast circuit switch time, but also because of reduced distance between switches.

A direct-contact heat transfer technique places a cold surface beneath each chip to assure low, stable junction temperature. The result is long circuit life when compared with air or edge cooling.

Only 29 different LSI chip types are used in the 205 and each chip is a plug-in module that can be replaced by a field engineer in seconds; no soldering or board replacement is needed in the central processor. Because there are only 29 LSI chip types, a field engineer can carry a complete set of spare parts. There is no need to maintain a large inventory of parts on site.

Vector Processing Produces up to 800 Million Results Per Second

The circuit speed achieved by LSI technology increases processing speed. Through vector stream processing, the CYBER 205 can produce up to 800 million results per second. This processing speed means efficiency in solving complex physical and mathematical problems, such as those using finite element and finite difference techniques, and problems involving large systems of linear equations.

The CYBER 205 is unique in the vector processing community because it provides computation and storage on 32-bit half-words as well as 64-bit words. The instruction repertoire includes a subset of instructions that operate on half-precision operands.

During execution, each 64-bit vector pipeline is treated as two independent 32-bit pipelines operating in parallel. Thus, for applications that don't require 64-bit precision, 32-bit computation can produce twice as many vector results per clock period.

Scalar Processing Performs up to 50 Million Instructions Per Second

Because all problems are not entirely oriented to vector processing, the CYBER 205 offers scalar processing at up to 50 million instructions per second for recursive operations, selected library functions and input/output conversion, and for preparing and generating data to be used by the vector processor.

Hardware Macro Instructions Improve Performance

Common subroutines that would be performed by scalar sequences have been identified as individual macro instructions to be performed by the logic of the computer. The result is improved performance.

Large Memory for Complex Problems

The central memory of up to four million 64-bit words complements the powerful central processing unit by providing the facilities for solving large, complex problems. The access method transfers data between central memory and the central processor at up to 25.6 billion bits per second for each one million word increment, more than sufficient to sustain the maximum processing and input/output capabilities of the CYBER 205 simultaneously.

Single error correction/double error detection (SECEDED) provides data integrity. Seven SECEDED bits accompany each 32-bit half word in central memory and on the data paths to and from central memory.

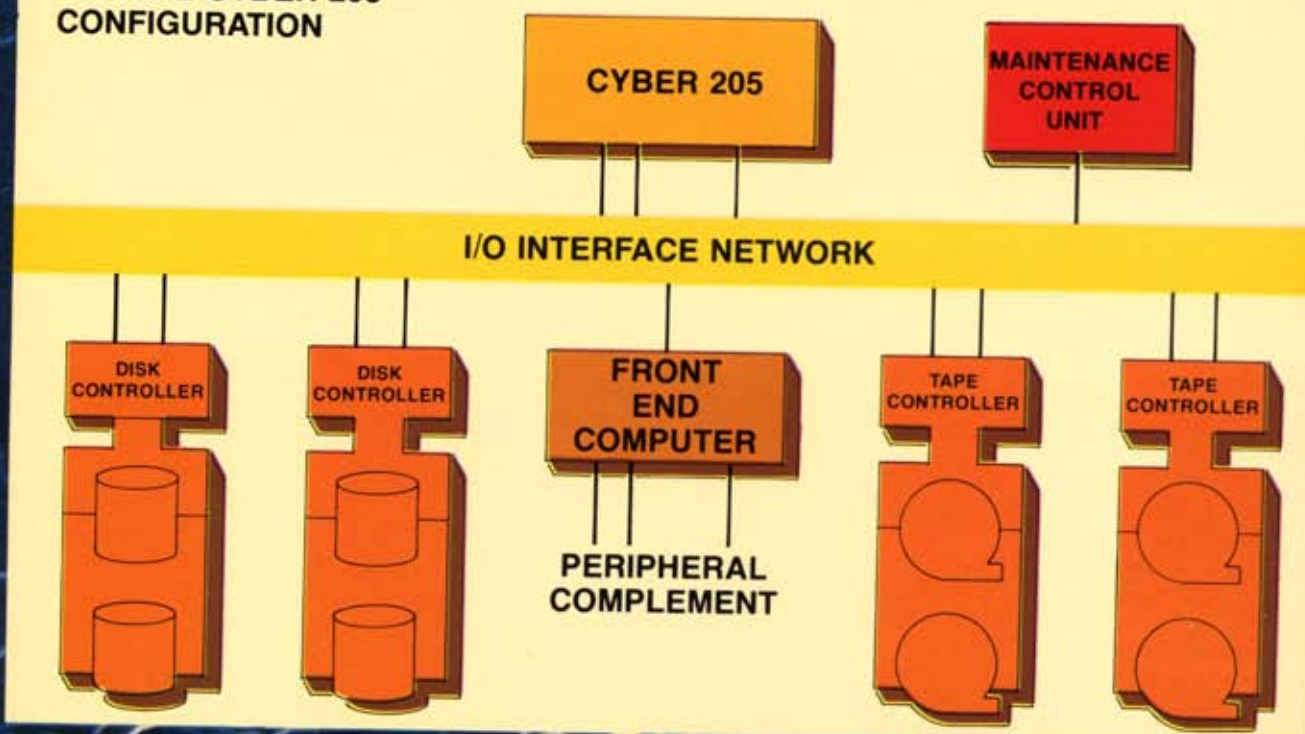
Virtual Memory for Almost Unlimited Storage

The virtual memory addressing technique implemented in the CYBER 205 uses hardware to map from the essentially unlimited address space of the user to the finite address space of central memory. This large virtual address space (2×10^{12} words per user) eliminates the need for programmers to concern themselves with the amount of physical memory available and how to allocate that physical memory when program size exceeds available space.

FEATURE COMPARISON OF CYBER 205 MODELS

MODEL	MEMORY (64-BIT WORDS)	VECTOR PIPELINES
205-411	1 MILLION	1
205-412	1 MILLION	2
205-422	2 MILLION	2
205-424	2 MILLION	4
205-442	4 MILLION	2
205-444	4 MILLION	4

TYPICAL CYBER 205 CONFIGURATION



Field-Proven Software Gives You Interactive and Batch Access to CYBER 205 Power



Software is the user's interface with the computer system, and CYBER 200 software exploits the advanced technology of the CYBER 205 so you can use this powerful system to solve problems.

CYBER 200 software has passed the test of useability and reliability where it counts—at STAR and CYBER 203 customer sites since 1974.

The CYBER 200 Operating System Provides Both Batch and Interactive Access

The many features of the CYBER 205 operating system—CYBER 200-OS—allow you to access the full power of the CYBER 205 from a remote batch or interactive terminal or from local devices via a front-end processor such as a CYBER 170/Series 700 computer system.

CYBER 200-OS can accommodate both a large multi-programming base and large production codes. Its efficient virtual memory hardware features allow each user to directly address more than 2×10^{12} 64-bit words. And, CYBER 200-OS manages the allocation of storage between main memory and mass storage, moving data as necessary to ensure fast user program execution.

CYBER 200 FORTRAN

CYBER 200 FORTRAN allows the average user to take advantage of the CYBER 205's power via normal coding conventions.

The source language for the CYBER 200 FORTRAN is compatible with the ANSI X3.9 1966 FORTRAN Standard. Extensions have been added to permit your programmers to make more efficient use of the architecture of the CYBER 205, especially vector and string processing capabilities, as well as taking advantage of the 32-bit data type. In addition, some features have been added that adhere to the ANSI X3.9 1978 Standard, with full compliance being developed. Also, CYBER 200 FORTRAN contains extensions traditional to Control Data compilers such as NAMELIST I/O, ENCODE/DECODE, and BUFFER IN and BUFFER OUT statements.

CYBER 200 FORTRAN provides code optimization, automatic vectorization, and effective use of the 256-word CYBER 205 register file, thus eliminating many unnecessary memory references. CYBER 200 FORTRAN also furnishes accessibility to all of the instructions of the CYBER 205 through FORTRAN calls. Your programmers can write in traditional FORTRAN, allowing the compiler to optimize and collapse loops where possible; or they can use the extensions that permit direct access to the hardware capabilities of vector and string manipulation.

The CYBER 200 FORTRAN library provides the standard and extended mathematical and input/output functions. Although defined primarily for the FORTRAN user, those who are coding in another language can take advantage of the functions in the library.

CYBER 200 Assembler

The CYBER 200 Assembler, META, allows your systems programmers to further take advantage of the register and memory architecture of the CYBER 205 by declarative assignments of data locations and content.

All hardware functions of the CYBER 205 can be expressed mnemonically, producing machine-language programs. META also provides for conditional assembly and macro capabilities.

CYBER 200 Utility Programs

The CYBER 200 software system contains a wide variety of easy-to-use utility programs. These programs provide you with the advantages of faster software implementation, increased programmer productivity and less debugging. Included are:

- A loader, which collects and links relocatable programs and sub-programs to produce an executable job stream.
- UPDATE, which provides source text editing and program library maintenance.
- Programs for creating and maintaining files that are permanently resident on mass storage.
- A variety of programs for copying and comparing all or parts of a file.

CYBER 200 Applications

CYBER 200 Series computers have been used in advanced research labs to solve problems that couldn't be attempted with conventional computers. But engineers and scientists in many areas of government and industry also have used CYBER 200 Series systems.

The CYBER 200 has solved problems in three-dimensional reservoir simulation for petroleum exploration, three-dimensional structural analysis and circuit analysis of LSI chips, and completed the 10 billion calculations for a 24-hour weather forecast in *one-fifth the time* required on the largest scalar computers.

Application packages, such as ADINA and ANSYS for structural analysis, and TRAC and DOT-IV for nuclear reactor safety analysis, have been run on CYBER 200 Series systems.

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01 UP CRT RECV ACT
02 UP CRT XMIT
03 UP CRT RECV ACT
04 UP CRT XMIT
05 UP TTY RECV ACT 1550 0660 0666 0697 0086 0761 0666 0712 50-27
07 DW TTY RECV 0000 0000 0000 0000 0000 0000 0000 0000 50-00
08 UP TTY XMIT IDL 0359 0181 0159 0201 0417 0377 0459 0213 50-01
40 (0000) 41 (0000)
09 DW TTY RECV 0000 0000 0000 0000 0000 0000 0000 0000 50-00
10 UP TTY XMIT IDL 0012 0003 0004 0004 0004 0005 0001 0004 50-29
42 (0000) 43 (0000)
11 UP TTY RECV IDL 0000 0000 0000 0000 0000 0000 0000 0000 50-00
12 UP TTY XMIT IDL 0002 0014 0000 0000 0000 0000 0000 0000 50-00
44 (0000) 45 (0000) 30 (0000)
13 UP TTY RECV ACT 0144 0101 0071 0067 0140 0185 0170 0071 50-00
TO= 0013
15 UP TTY RECV ACT 0144 0000 0055 0066 0145 0141 0131 0070 50-00
TO= 0016
17 UP TTY RECV ACT 0159 0084 0050 0070 0182 0187 0185 0070 50-00
TO= 0012
19 UP TTY RECV ACT 0163 0113 0000 0095 0177 0000 0170 0070 50-00
TO= 0022
21 UP TTY RECV ACT 0177 0002 0000 0067 0117 0120 0102 0070 50-00

CDC CONTROL DATA

CLEAR BREAK CO

NO ODD PAR FULL DUP
EVEN PAR HALF DUP
LOCAL
10 20 30 40 50 60 70 80 90
0 1 2 3 4 5 6 7 8 9
+ * / %
=

Control Data: Your Full-Service Source for Supercomputing

The CYBER 205 offers you a new level of computing power. Control Data puts this power to work for you by providing the entire computing facility, including a front-end computing system, state-of-the-art peripheral equipment, communications systems to distribute the computing power to your users, and people to help you make more effective use of the CYBER 205.

The CYBER 170/Series 700 is an efficient front-end system for handling peripheral processing and communications, leaving the CYBER 205 free to perform the complex computing needed to solve problems. The CYBER 170 system also can be used for jobs that don't require the power of a CYBER 205.

New Control Data local networking advances allow the CYBER 205 to be interconnected into an existing computing environment, including communications with a selection of equipment manufactured by other vendors.

As the world's largest independent supplier of peripheral equipment, we also supply a full line of peripherals to support the CYBER 205, including disk drives, mass storage systems, tape drives, printers, terminals, card readers and card punches.

And, Control Data offers the support of *people*... people with expertise and experience in using large and super-scale computers to solve problems. Our people can provide you with these and other services:

- Facilities planning and construction
- Training
- Hardware and software maintenance
- Systems and applications programming
- Industry-oriented consulting in manufacturing, structural engineering, environment, energy, mining, petroleum, education, data management and data communications

Put the CYBER 205 to Work for Your Organization

The CYBER 205 harnesses the latest technology in large-scale computing, to help you solve today's—and tomorrow's—toughest problems.

Ask your Control Data sales representative how the CYBER 205 can benefit your organization, or write:

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