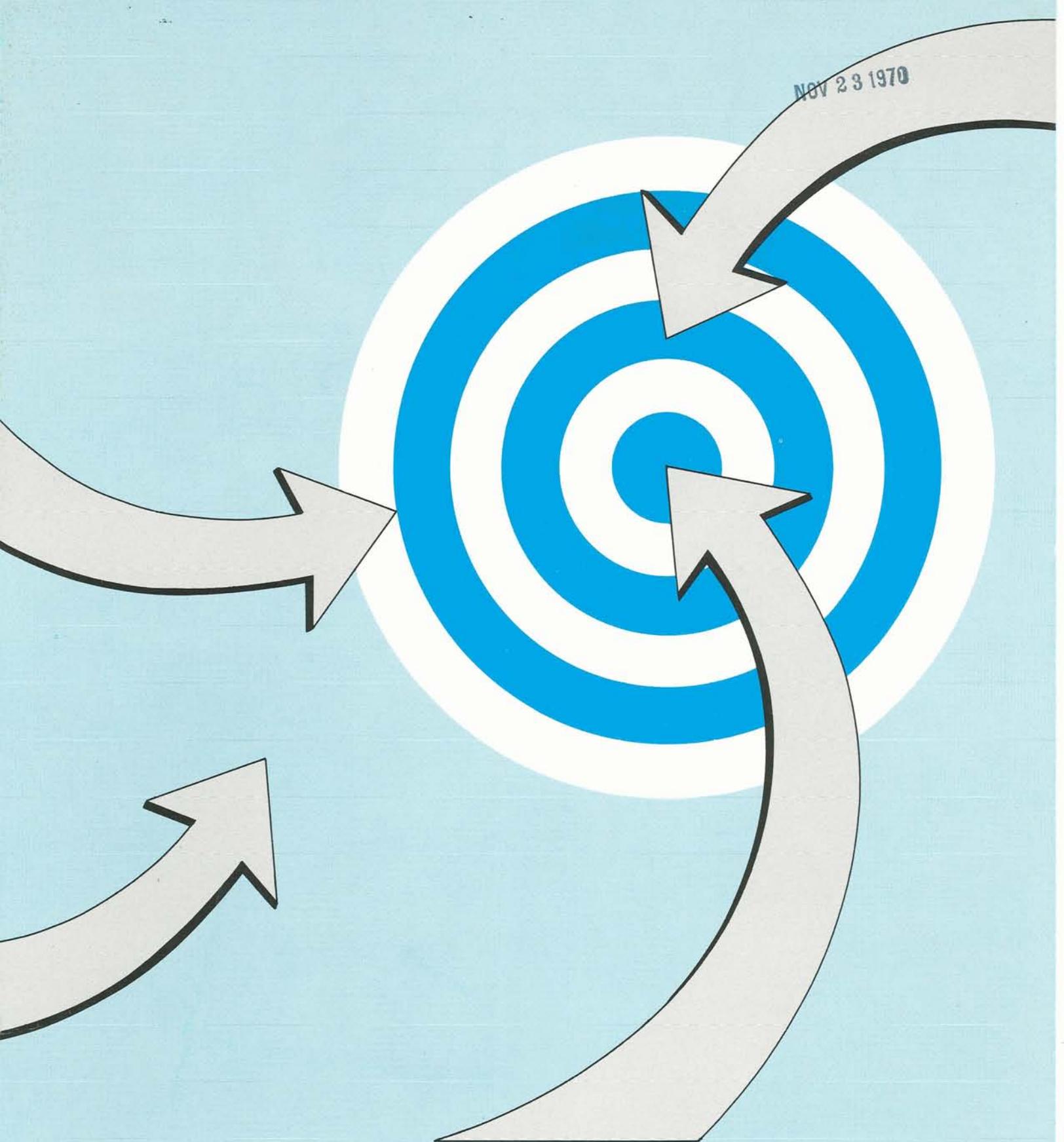
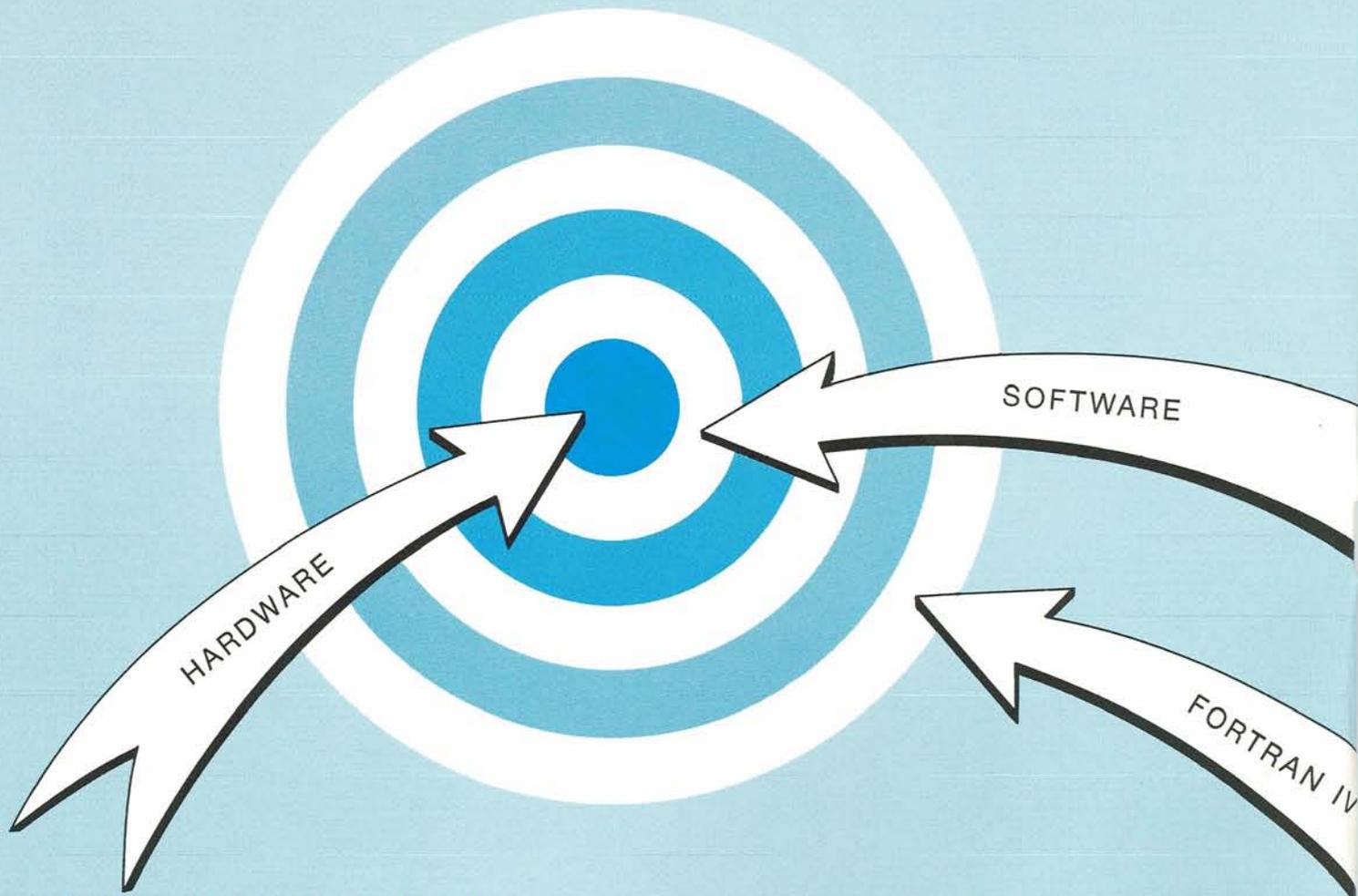


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NEW... MODULAR... AND POWERFUL

The newest product of Cincinnati Milacron, the CIP/4000, is a powerful general-purpose computer unusually adaptable to process control applications. This adaptability is the direct result of an integrated modular design approach to both hardware and software. Each level of the CIP/4000—the TTL integrated circuitry, the assembler language instructions, the carefully constructed diagnostic, maintenance and development programs, the sophisticated Fortran IV compiler—was planned in a modular scheme. As a result, the user benefits from a real-time processor with software reliability as well as Cincinnati's noted hardware reliability.

This modular structure permits flexible application of a standard repertory of more than one hundred instructions, while an efficient addressing scheme allows any location in memory to be addressed by a single 18-bit word. Full hardware support for 9-bit character, 18-bit word, and 36-bit longword operations is standard. The

18-bit word was chosen because (1) it offers more precision, and (2) using 9 bits for an 8-bit character set allows one bit for a flag.

A unique feature of the CIP/4000 is its *self-relative* addressing structure. Any address which is not base relative is self-relative. Self-relative addresses are expressed as a displacement from their present location. Therefore, since there are no absolute addresses in an object program, all programs are inherently relocatable without software intervention.

Memory modules are provided in 4k x 18-bit increments ranging from 4k to 64k. Memory is protected in 256-word blocks. Memory modules are fully independent and operate at a speed of 1.2 microseconds for a full read-write cycle. Data can be transferred between CPU and Memory in either 9-bit characters or 18-bit words.

I/O Operation is based on a priority interrupt structure. As many as 256 distinct levels of priority interrupts can be provided on this processor. Priority

is not dependent on the device address but on the order in which the I/O boards are placed in the card sockets. For this reason, the priority of interrupts can be reassigned to suit the user's changing needs without changing the program.

All I/O devices respond to a common set of I/O instructions and commands. The number of I/O devices can be expanded to 237. (The remaining interrupts are reserved for computer system use.) Addition of an I/O device requires only the addition of the circuitry necessary to its operation. Options and a flexible I/O bus provide for a full line of peripherals which may be expanded whenever required. There are three types of I/O transfers available: (1) Direct Memory Access (DMA) with a maximum of 830 kHz, (2) Direct Memory Channel (DMC) with a maximum of 50 kHz, and (3) Word transfer.

Program state switching is accomplished automatically by use of control stacks maintained by the interrupt hardware. Each control stack entry contains register contents,

CIP/4000

A Midi Designed For Process Control



program counter value, and machine status. This information is used to save and restore the machine state. Multilevel state switching can be accomplished without completing any program in the chain because current status is stacked in a nested manner. This automatic feature not only speeds the process, but prevents errors by relieving the programmer of the task of saving this information.

Modular software designed in conjunction *with* the hardware makes a "building block" approach possible. The Basic Executive System (BES/4000) is a control program including system management routines and a sophisticated scheduling system which greatly simplifies programming. BES/4000 is itself part of a larger scheme called Program Development System (PDS/4000) which provides the

user with an easily used, flexible tool to develop programs to fit *his* applications. PDS/4000 includes a very powerful assembler, a flexible linkage editor for combining separate programs, and a Fortran IV package allowing in-line assembly code. PDS/4000 supports and extends the hardware capabilities, enabling the user to obtain maximum system performance in his application.

The instruction set also takes advantage of the coordinated interaction between software and hardware by reducing the number of instructions required. Arithmetic and logical instructions are bidirectional; that is, one instruction such as Add serves for both register-to-memory and memory-to-register usage.

The assembler reduces programming effort and increases program reliability by saving data definitions and performing many helpful crosschecks. The assembler also uses the saved definitions to select the appropriate hardware instruction for the most commonly used operations—Replace (RPL), Add (A), Subtract (S), Compare (C), And (N), Or (O), and Exclusive Or (X).

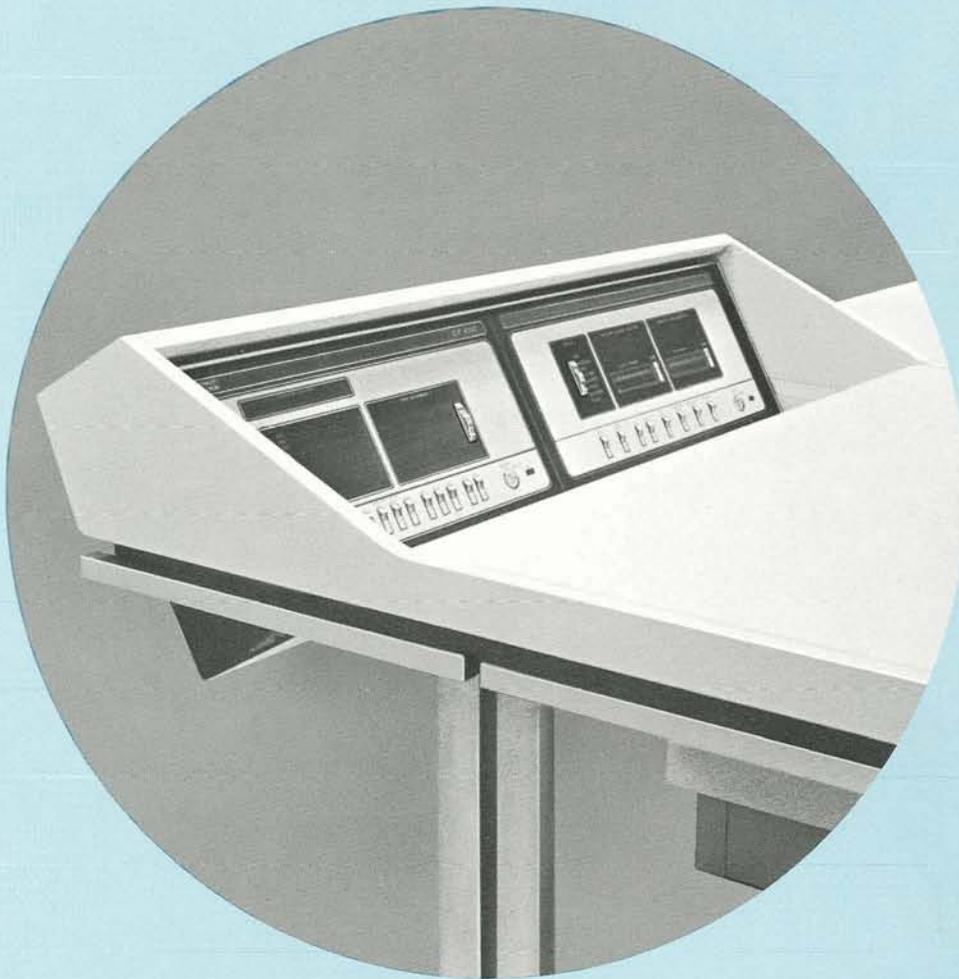
Since hardware support of common software operations increases reliability and lowers programming cost, it is offered for such diverse features as Initial Program Load, subroutine control stacks, and various arithmetic and addressing functions. For instance, hardware support for arithmetic includes add, subtract, multiply, divide, and square root for both 18- and 36-bit quantities. Hardware stacks and queues are provided to support real-time tasks efficiently.

Modular construction, storage protection, and instructions reserved for privileged programs provide foreground-background processing capabilities, making the CIP/4000 supremely well-suited to process controls applications. For instance, the CIP/4000 can maintain program integrity when scanning hundreds of instruments, pulse trains, and process alarms in the foreground mode, while programs are being compiled, assembled, and tested in the background mode.

Complete courses on every aspect of the CIP/4000 are offered in our modern training center. And our trained field service organization is equipped to deal with your problems immediately.

CIP/4000

Specifications



Core Memory 1.2 microsec full read-write cycle. Modules of 4,096 18-bit words to max. of 65,536.

Arithmetic 18 and 36 bit, parallel, binary, fixed-point, two's complement.

Addressing 8, including direct, indirect to 16 levels, self- and base relative, indexed.

Input/Output 18-bit parallel I/O bus for 9 or 18-bit. Programmed I/O, hardware-supported DMC up to 50 kHz, DMA transfers up to 830 kHz. Word transfer available on all devices.

Interrupts Priority structure allows 256 levels, 237 for external interrupts.

Logic TTL logic elements including MSI.

Registers 4 accumulators (2 36-bit), 1 index, 1 base, 1 stack pointer (privileged), 1 program counter, 1 program base.

Instructions Over 100, including control, shift, skip, fixed-point arithmetic, I/O, stacks, and queues.

Cabinet Desk height, 30" high. Memory, motor-generator modules 19 x 10½ x 26". Processor, I/O modules 19 x 12¼ x 26". Max. length 120".

Power 3 phase, 230/460V, 9/4,5 amp motor generator for power-line isolation, safe power-fail detection.

Environment 0°-55°C (32°-131° F).

Panels Operator's panel displays all registers, provides manual command execution, control switches. Memory Access displays memory contents, allows modification of memory contents, tests memory. Both panels can be locked out.

Software PDS/4000 (Program Development System) includes Basic Executive System, Linkage Editor, Two-Pass Assembler, Dynamic Debug Program. CPU and peripheral diagnostics. USA FORTRAN IV compiler package can also be provided.

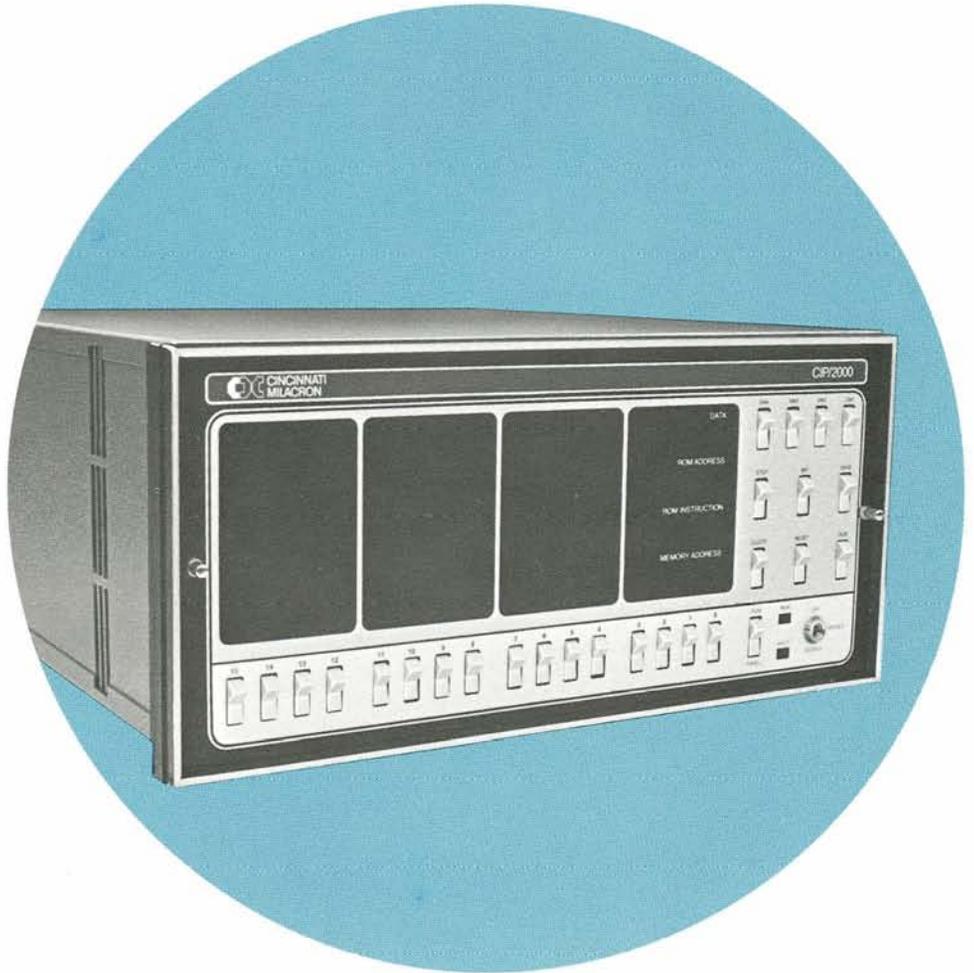


The auxiliary cabinet of the CIP/4000 which contains the I/O module, the tape reader, and the DRPE punch.

Another view of the CIP/4000 showing the modules which contain the motor-generator, the memory and the tape cassettes.



CIP/2100



Microprogrammed . . . Software Programmable

The CIP/2100 is a general-purpose microprogrammed computer. The basic elements of the CIP/2100 include the operational registers, core memory, interrupt system, input/output system and control console. A number of different processor and peripheral equipment options are available to meet a broad range of system requirements. The mechanical and electrical design is the basis for a series of machine configurations built with standard functional blocks.

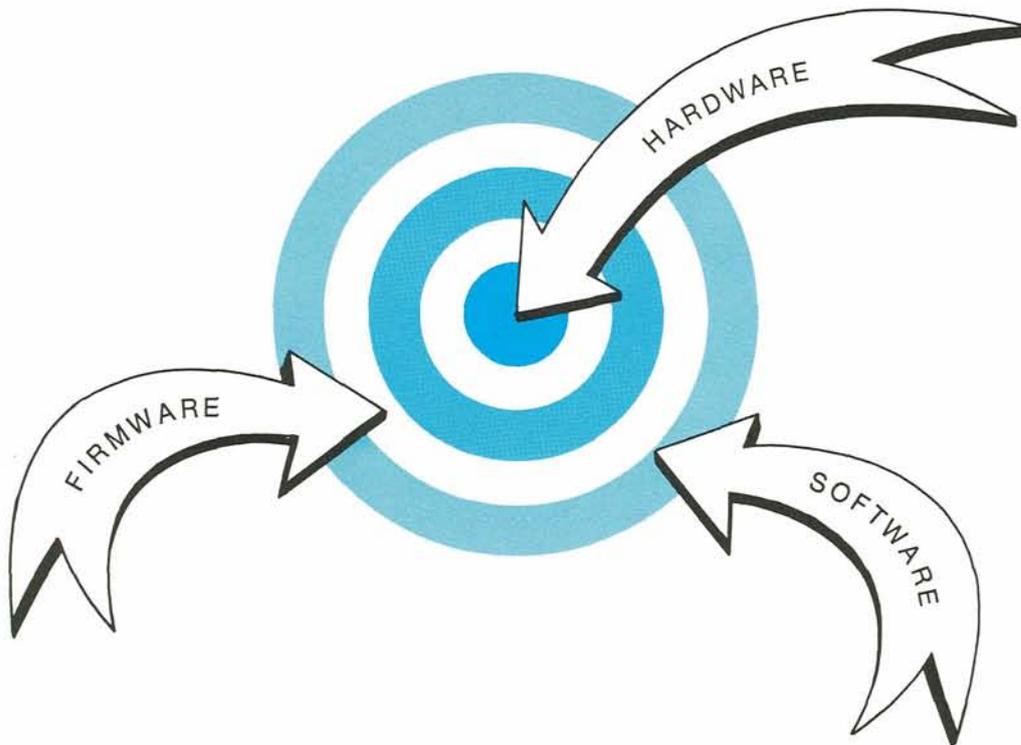
The design concepts embodied in the CIP/2100 provide a unique combination of features not available in other small computer systems. These include:

Speed The machine incorporates 220

nanosecond microcommand execution and a 1.1 microsecond core memory cycle time. The short microcommand clock step and core memory cycles allow for fast execution of the exceptionally powerful CIP/2100 instructions, high input/output transfer rates, and excellent overall throughput rates.

Flexibility Microprogramming permits tailoring of the system to specific applications. Application-oriented macroinstructions or microprogrammed subroutines may be added to the standard CIP/2100 instruction repertoire to increase system efficiency and throughput and to reduce hardware costs. The modular design of the core

CIP/2100



memory, read-only store, processor options, and input/output elements permits expansion of the basic system as required. The compact enclosure has a number of spare circuit board slots and ample power for system and peripheral interface, even when the computer is fully expanded.

Low System Cost The CIP/2100 uses TTL monolithic integrated circuits, including a large number of the medium scale integration types, for savings in parts and assembly time. The use of read-only storage for control further reduces the number of circuits required to provide functional capability. Packaging and powering has been designed for system applications rather than stand-alone computer operation to

reduce integration costs to a minimum. The higher microcommand execution speed can be used to minimize interface and controller hardware, resulting in further reduction of system cost.

The CIP/2100 computer with its eight address modes, variable byte data, and hardware multiply and divide constitutes an extremely powerful minicomputer. The ease of programming coupled with a true priority system, concurrent I/O data transfer, and modular construction allow the CIP/2100 to be applied to a wide variety of tasks. The reliability and quality of manufacturing and testing particularly tailor the unit for areas requiring reduced maintenance support. Training and support are structured to provide the services required for an OEM customer.

Specifications

Clock Rate 4.55 MHz (crystal controlled)

Read-Only-Memory 220 nanosec per instruction. 768 to 1,024 words in modules of 256 16-bit words.

Core Memory 1.1 microsec full-cycle; 0.66 microsec half-cycle. Modules of 4,096 bytes (8, or 9-bit) to maximum of 32,768 bytes.

Arithmetic Multiprecision, parallel, binary, fixed point, two's complement.

Addressing Eight modes including relative, index, indirect, and literal.

Input/Output 8-bit parallel byte I/O bus for programmed and fully automatic concurrent transfers. Serial I/O interface for teletypes or similar devices. Direct Memory Access (DMA) channel with maximum transfer rate of 909,000 bytes per second.

Interrupts A priority interrupt system allows internal interrupt on power failure, real-time clock, memory parity error, and external interrupts on the byte I/O bus. Up to 64 interrupts expandable in groups of 8.

Logic TTL logic elements including MSI types, in DIP ceramic packages. DTL circuitry for I/O interfaces.

Registers Six operational registers including A-accumulator, B-auxiliary accumulator, X-index, P-program counter, W-2-bit word length mode and O-1-bit overflow flag.

Instructions 89 standard instructions including 17 control, 16 conditional jump, 12 shifts, 8 input/output, 16 register operate, 18 memory reference, 1 multiply, and 1 divide.

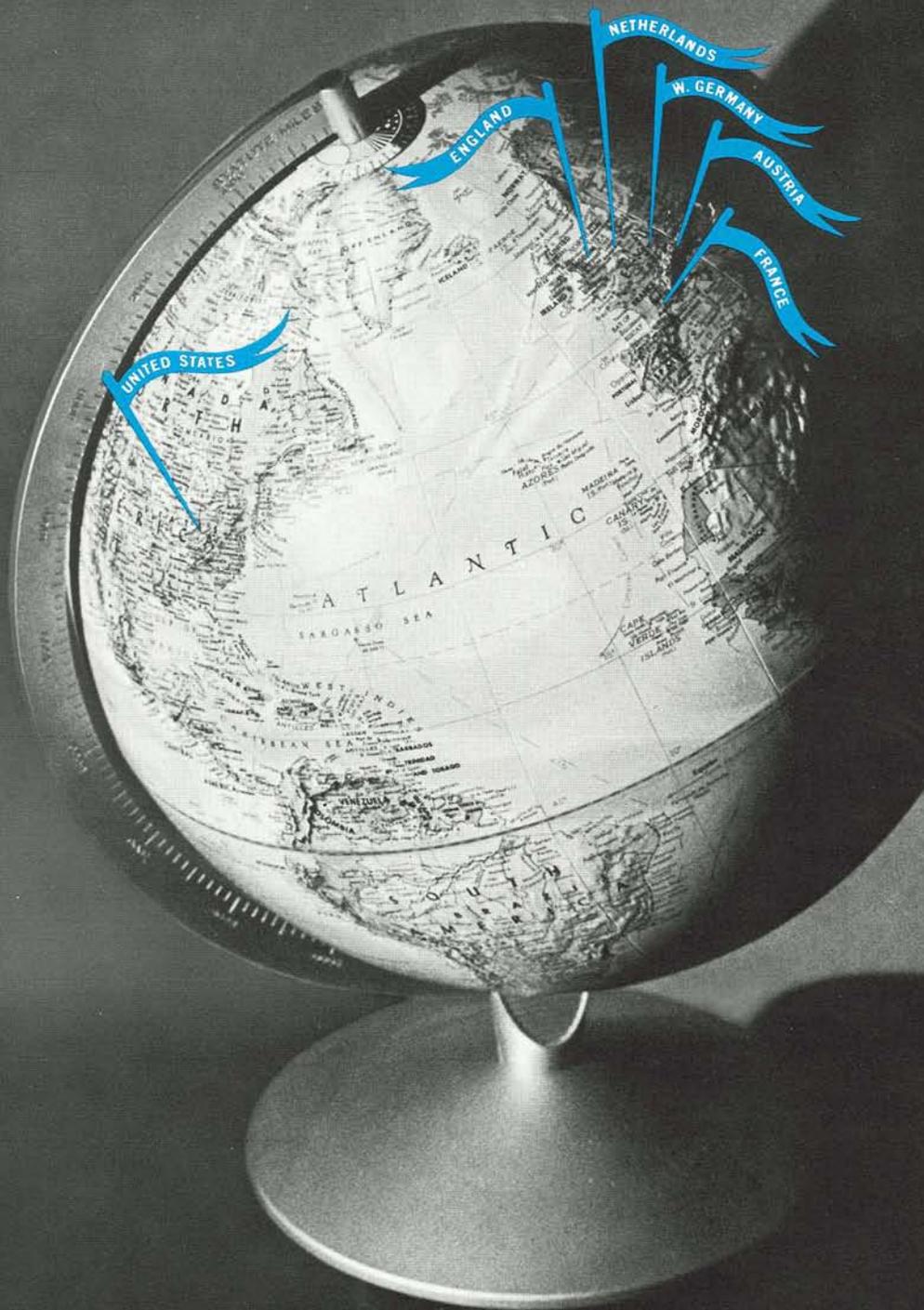
Cabinet The processor, memory to 16K, I/O interfaces, power supply and fan are enclosed in a cabinet 8 $\frac{3}{4}$ " high, 19" wide, and 23" deep. Fully expanded cabinet weighs 75 pounds.

Power 115/230 vac, 50-60 Hz. 340 watts.

Environment 0°-50° C (32°-122° F)

Panels The *system control panel* displays all registers, manual command execution, and control switches. The *basic control panel* provides only the basic control switches.

Software Cross assembler in Fortran IV, Two-Pass Assembler, Teletype Operating System, Tape Editor, CIP/2100 Simulator.



About Our Company

Cincinnati Milacron is a diversified international company with 30 modern manufacturing plants in the United States, England, The Netherlands, France, West Germany and Austria. Although we are the world's largest producer of precision machine tools, our product line has expanded over the years to include chemicals, abrasives, plastics, plastics processing equipment, process control systems, and computers.

Employing more than 15,000 people, we are a technology-oriented company in which more than 1500 employees are continuously engaged in some form of research, development, and engineering. Recent expansion and capital improvements programs have given us the most modern and effective production capabilities obtainable, with the paramount objective of providing the highest levels of product quality at

the lowest possible cost.

The present scope of our worldwide operations is exemplified by our sales and service organization with 175 offices, doing business in 57 countries. After more than 85 years of successful service to our customers, you can be assured of our desire to continue this relationship to the best of our ability.



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Chemicals
Plastics
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