3200
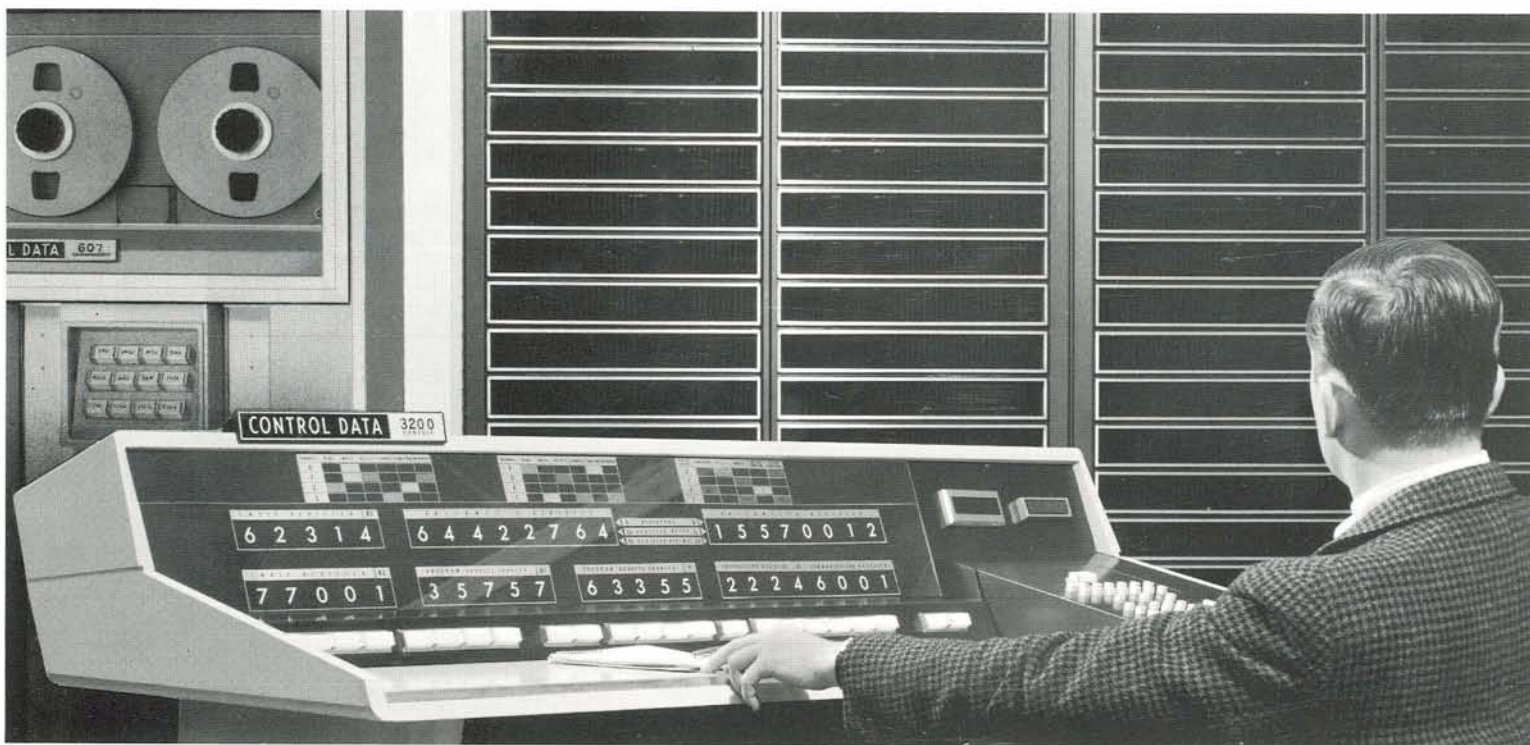
CONTROL DATA® 3200 Computer System / Real Time Applications

3200

At this precise moment, events in science and industry are occurring which demand solutions and control. Among these events-in-real-time are many that directly affect your field . . . in the aerospace industry, bio-medical research, industrial control, military, nuclear research, and others.

To provide the high-speed data handling required for solution and control of events in real time, the CONTROL DATA 3200 can be expected to function both as an immediate and long range answer . . . immediate because its big-computer capability is ready for delivery at a medium-range price now; long-range because its modular design permits steady expansion against problem growth. As you examine the CONTROL DATA 3200 Computer System in these pages, you will note an ideal system design for real-time operations . . . modular, expandable input/output communications system, core-to-core transfer capability between computers, a broad instruction repertoire to facilitate high-speed data handling.

You will discover something else also . . . "user selectivity", an important advantage that allows you to put into operation the most efficient CONTROL DATA 3200 Computer System for your immediate and long range application.

The CONTROL DATA® 3200 Computer System...
Characterized for Real-Time Applications

- 24-bit word length plus 4 parity bits

- Magnetic core storage:
  4,096; 8,192; 16,384; or 32,768 words

- Storage cycle time — 1.25 microseconds
  Access time — 750 nanoseconds

- True Storage bank overlap

- Hi-speed Register File
  Storage Capacity.......................64 words
  Total cycle time.................500 nanoseconds
  Access time .... 250 nanoseconds

- Bi-directional communication channels
  1, 2, 4, 6 or 8 communication channels with direct access to core storage
  all communication channels completely buffered

- Parity checking on core storage and input/output

- Input/Output Transfer rate on normal channels (12-bit)
  one million characters (6 bits each) per second

- 24-bit channels available as standard options for larger data movement

- For special applications, I/O may take place directly with storage at a rate of one 24-bit word per storage cycle (1.25 µs.)

- Three 15-bit Index Registers

- 64 external interrupt lines
  8 interrupt lines per communication channel
  built-in priority
  program accessible mask register

- 96 External Sense Lines
  12 sense lines per communication channel

- Power Loss Protection
  Register Protection in case of power failure

- Real-Time Clock (Program Selectable)

- Inter-Computer Transfer
  Core to core buffered block data transfer between computers

- Intra-Computer Transfer
  Buffered Block data transfer in magnetic core

- Computer Satellite Ability
  3200 to 3200
  3200 to 3600

- Instruction Repertoire includes:
  Fixed and Floating Point Arithmetic
  24 and 48-bit arithmetic
  Logical and Masking operations
  Storage Search
  6-bit BCD character arithmetic and data handling
  "Pause" for ultra-hi-speed I/O communication
  Multi-level indirect and indexed address modification
  Inter-Register transfer
  Block Search and Move (Buffered)

- Execution Times
  Fixed Point Add (24-bits)   2.5 µs.
  Floating Point Add (48-bits)   12.0 µs.
  Fixed Point Multiply (24-bits)   8.8 to 12.0 µs.
  Floating Point Multiply (48-bits)   29.0 µs.

- Input/Output Equipment

	IN	OUT
Punched Cards	1200/min.	250/min.
Magnetic Tape	15-120 K C	15-120 K C
Paper Tape	350 cps.	110 cps.
Printer		300-1000 lpm.

  (Also available: magnetic drum and disk file storage, A/D-D/A converters, line plotters, digital data terminals, and special interface equipment)

- Computer Console
  Keyboard entry
  Register display

- Storage Protection
  Protects designated sections of storage from unintentional destructive writing

- Buffered Arithmetic Section
  Multiply and divide instructions continue concurrently with any instructions not using the arithmetic unit, such as Input/Output control

- 3200 circuit modules developed for and proved on **Control Data's** 3600 large-scale computer
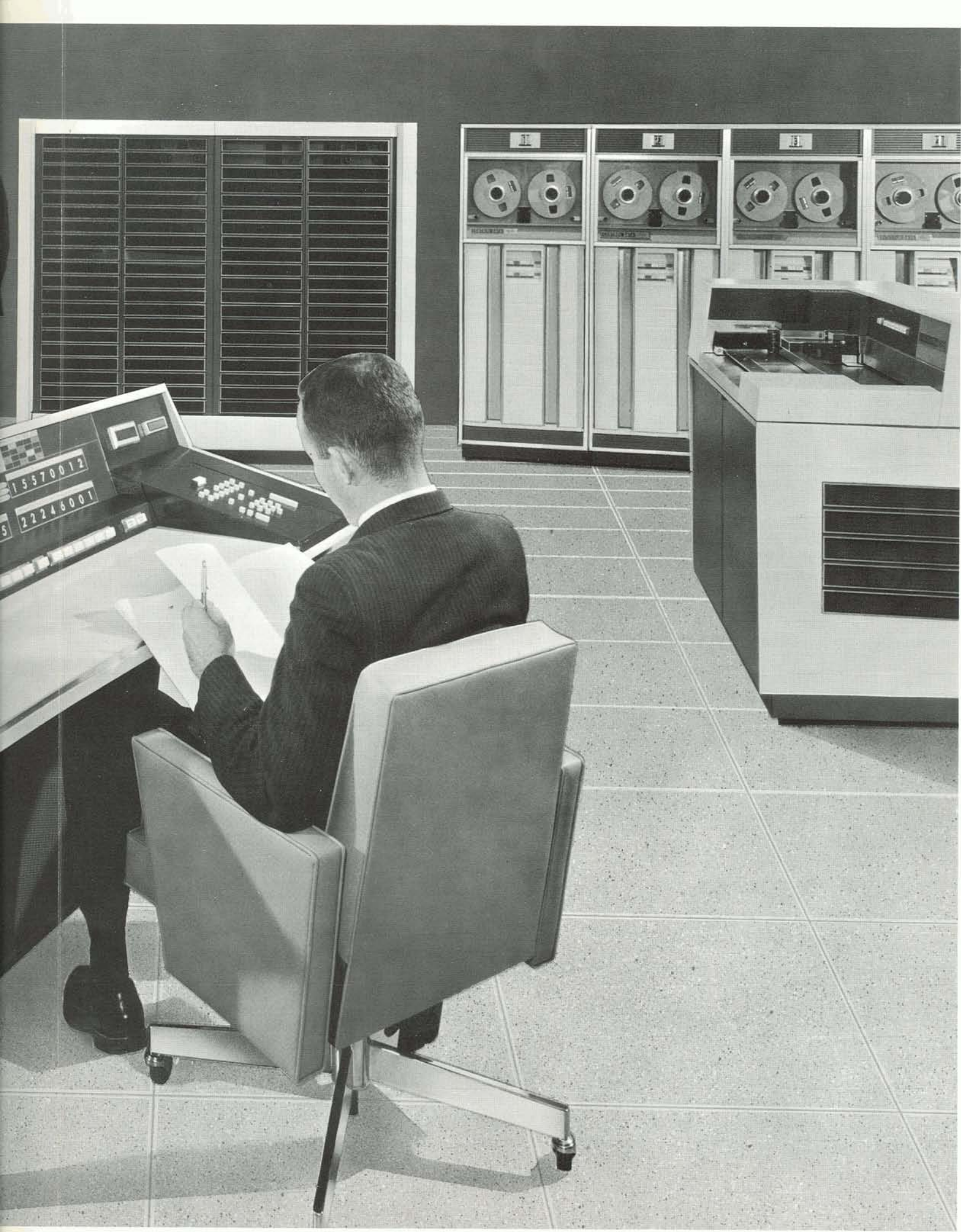

CONTROL DATA 166 Line Printer

CONTROL DATA 607 Magnetic Tape Transport

CONTROL DATA 405 Card Reader

3200 REAL-TIME PROGRAMMING SYSTEMS

Complete software systems for the 3200 Real-Time Computer are developed and, by thorough study, are pre-planned in a manner allowing you to operate all systems as a group or each system individually.

Included are a complete Monitor Operating System (SCOPE 32), a Symbolic Assembler (COMPASS 32) and a FORTRAN Compiler (FORTRAN 32). In profile . . .

SCOPE 32 (Monitor) . . . automatically monitors and controls the compilation and execution of programs written in various source languages. Among its advantages SCOPE provides:

- Job Stacking
  Programs written in different languages can be compiled and executed without operator intervention.

- Job Accounting
  Each job is automatically logged as it is processed, giving the user control over project time allocation and maximum computer utilization.

- Automatic storage allocation

- Assignment of input/output functions and initiation of all I/O activities

- Instructions to the operator through printed messages

COMPASS 32 (Symbolic Assembler) . . . Control Data's comprehensive assembly system permits the user to write machine language programs using symbolic instructions. Input to the assembler may be from cards, paper tape, or magnetic tape. The assembler output is a machine code, relocatable binary object program.

Some COMPASS advantages:

- Different types of data may be defined

- Macros can be defined by the programmer

- Arithmetic expressions can be used in address fields

FORTRAN 32 . . . FORTRAN for **Control Data's** 3200 Computer System takes full advantage of both the latest compiler techniques through the sophisticated 3200 hardware. **Control Data** FORTRAN compilers are notable for their extremely fast compilation and execution speeds. For example, the 3200's ability to perform character operations results in faster FORTRAN compilation. The 3200 does a character search directly rather than through a repeated instruction loop. The high-speed Register File is used to store ID List parameters during compilation which eliminates the need for special protective measures to prevent inadvertent destruction of the parameters. The result is faster, simpler storage allocation.

FORTRAN recompiling is not necessary when the 3200 system is expanded to include optional arithmetic. FORTRAN compiles all floating point source coding to floating point machine code. If the computer does not have floating point hardware, these instructions are automatically trapped and executed by floating point subroutines.

All of the above systems operate on a standard 3200 system including five input/output devices and 8,192 words of storage. For lesser systems with two input/output devices and 4,096 words of storage, a separate storage package is available which includes FORTRAN II and a basic assembly system.
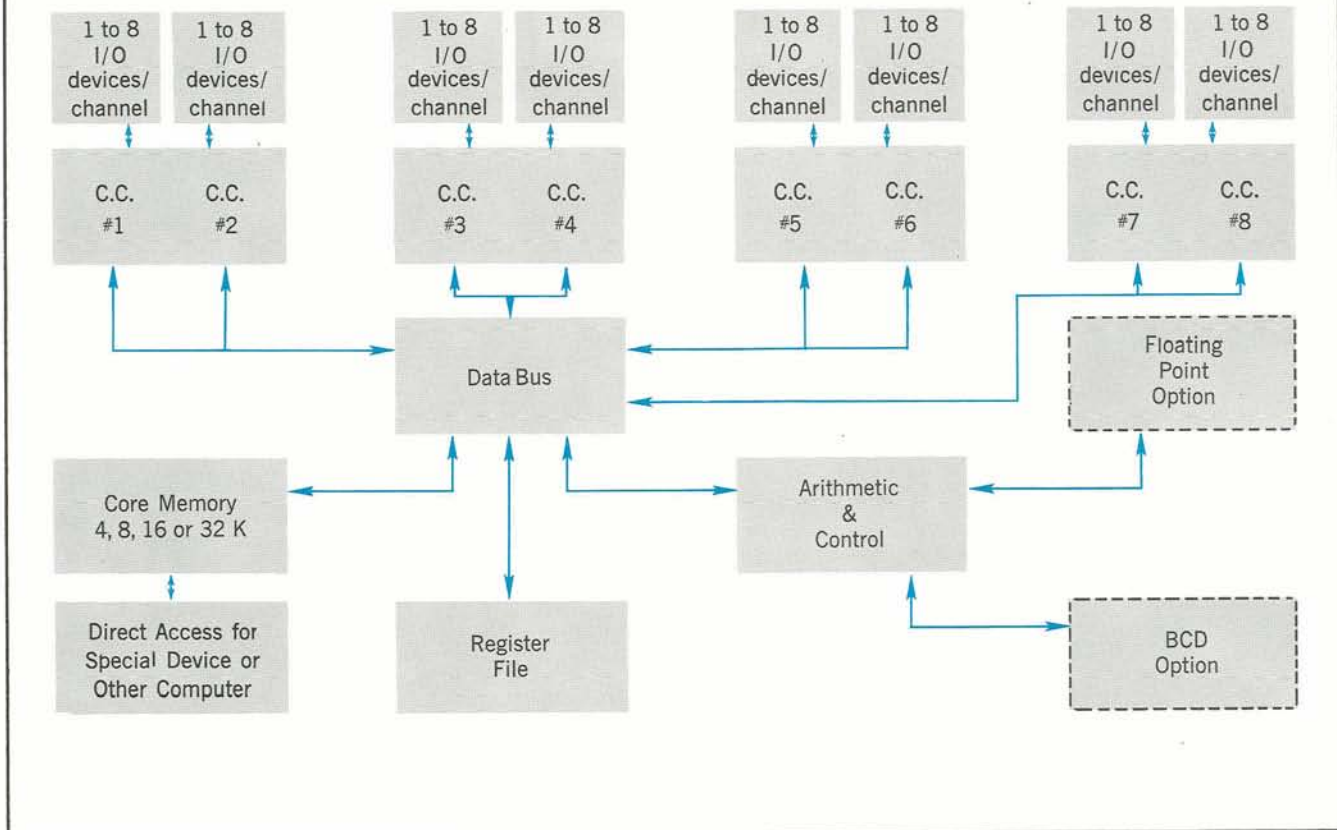
USER SELECTIVITY

A most significant feature for real-time use of the **Control Data** 3200 Computer System is system selection at the most important level . . . the user.

Modularity, as it is now defined by the 3200, puts in your hands the opportunity of selecting exact system power against your individual problem through Control Data's new "broad-line" equipment options.

If need be, only those system features valuable to the solution of your distinct real-time application may be used to broaden the basic 3200 System. Available now for selection or for field installation later are:

- Floating Point Arithmetic Hardware
- BCD Arithmetic Hardware
- Additional Core Storage
- Multiple Input/Output Communication Channels with 6, 12, or 24-bit parallel data transfer
- Additional "Arithmetic and Control" Processor Modules
- Stand-up or desk-sized consoles

THE 3200 INPUT/OUTPUT CAPABILITY

| 1 to 8 I/O devices/ channel | 1 to 8 I/O devices/ channel | | 1 to 8 I/O devices/ channel | 1 to 8 I/O devices/ channel | | 1 to 8 I/O devices/ channel | 1 to 8 I/O devices/ channel | | 1 to 8 I/O devices/ channel | 1 to 8 I/O devices/ channel |

C.C. #1   C.C. #2   C.C. #3   C.C. #4   C.C. #5   C.C. #6   C.C. #7   C.C. #8

Data Bus

Floating Point Option

Core Memory 4, 8, 16 or 32 K

Arithmetic & Control

Direct Access for Special Device or Other Computer

Register File

BCD Option

3200 COMPUTER CONFIGURATION

The 3200 Computer's flexible Input/Output capability can be seen in the above diagram. Two or more communication channels may be selected for any application with expansion to eight channels requiring only a simple field modification. Note the direct high-speed access to magnetic core which permits any special real-time device to communicate directly with storage on both input and output.

A TYPICAL REAL-TIME APPLICATION:
## Closed-Loop Control System

Many real-time closed-loop control systems contain both analog and digital inputs and outputs, as shown in the accompanying diagram (opposite page). The 3200 Computer receives the data from the acquisition system as the events occur. This data could be the parameters for the mathematical model within the computer which simulates the application.

Once the 3200 has the data, it formats these parameters and performs the calculations. The computer then sends the results back to the real-time devices for control, display, and up-dating of events.

Inter-computer communication and memory sharing techniques of the 3200 permit maximum data throughout. Functions can be divided to allow specialization by each computer, yet system performance can be monitored by both for backup and alarm. The input/output speed, arithmetic and formating capabilities, as well as system expansion and flexibility, determine any digital computer's value in real-time applications. Control Data engineers have designed the 3200 to meet the most stringent requirements of real-time operation.

3200 EXPANDED COMPUTER IN A REAL-TIME CLOSED-LOOP APPLICATION
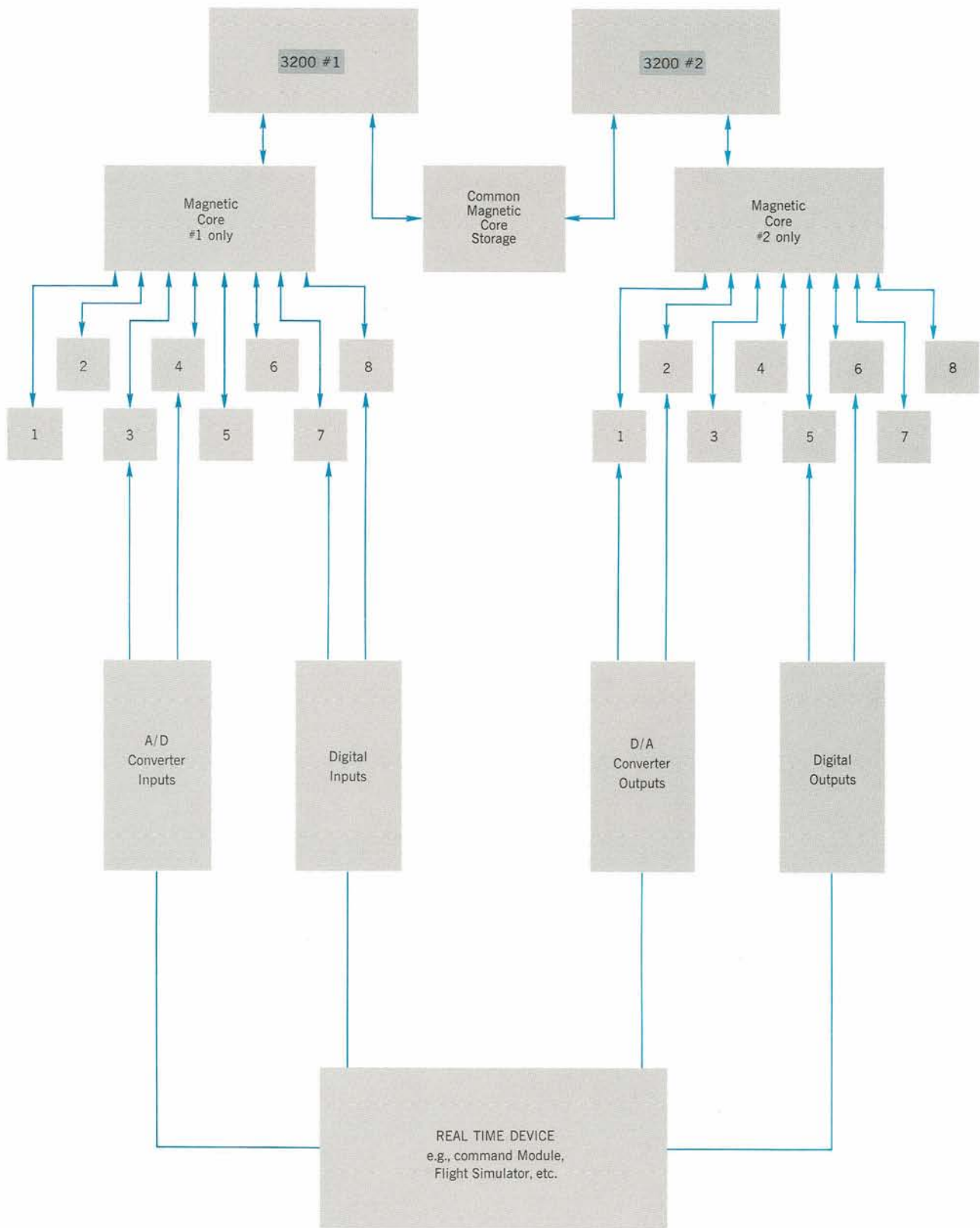
NOTE:
Numbers 1 through 8 above are bi-directional data channels. The unused data channels are normally connected to such peripheral equipments as magnetic tape units, line printers, plotters, displays, etc. to represent a complete real-time computer system.

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