r 4000 COMPUTER ®

S P E C I F I C A T I O N

RC 4000 - A GENERAL-PURPOSE COMPUTER OF THE THIRD GENERATION

Instruction Format and Speed
Single-address, digital computer with typical instruction execution times of 3 to 4 μsec (add 3, multiply 15.5, add floating 11 μsec) and instruction length of 24 bits (plus 3 protection bits and 1 parity bit).

Data Formats
Integer arithmetic with operands of 12, 24, and 48 bits. Floating-point arithmetic with 48-bit operands (36-bit mantissa and 12-bit exponent), and with short and long precision for significance analysis.

Instruction Set
Repertoire of 58 instructions includes manipulation of 12-bit bytes, word comparison, setting and testing of single bits, and inter-register operations.

Protection System
Privileged instructions and storage protection guarantee complete monitor control and interprogram protection of up to 7 independent user programs plus a monitor program and a basic operating system.

Register Structure
Four accumulator registers, three of which also function as index registers.

Addressing Modes
Address modification includes indexed, indirect, and relative addressing. Direct addressing of up to 8 M words of 24 bits (plus 3 protection bits and 1 parity bit).

Internal Store
Ferrite core store (cycle time 1.5 μsec) with minimum of 16 K words for extended, time-sharing system (field-expandable in 16 K modules up to 128 K) or minimum of 4 K words for small system.

Secondary Stores
Optional backing stores: magnetic drum store of 64 K, expandable in 64 K modules up to 512 K, and/or magnetic disc stores with exchangeable packs of 2 M words. Block length variable in multiples of 256 words.

Input/Output System
Data channel for transfer of single words between low-speed devices and working registers. Direct store access via high-speed data channel for block transfers to and from high-speed devices. Program execution concurrent with operation of input/output devices. Extensive automatic checking of device status allows complete program control of peripherals.

Interrupt System
Program interruption system with 24 maskable priority levels, each expandable to desired number of interrupt inputs.
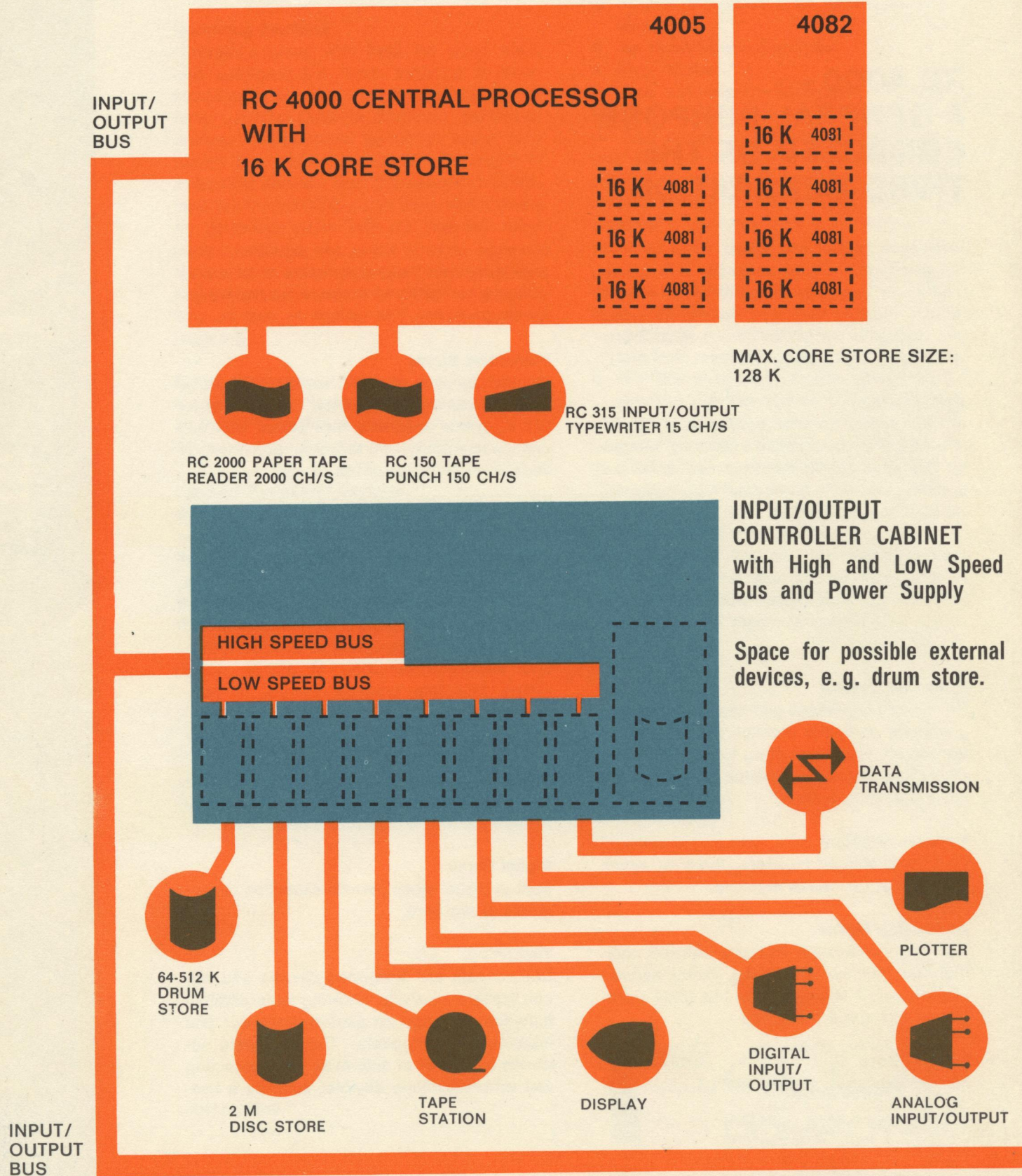
Digital Clock
Built-in digital clock permits execution of programs in real time.

Technology
Components are integrated circuits and silicon types exclusively, allowing wide ambient temperature range for central processor and input/output controllers. The hardware includes a number of automatic error-detecting and error-indicating devices, such as a two-

rc 4000
SYSTEM OUTLINE

4005

4082

RC 4000 CENTRAL PROCESSOR WITH 16 K CORE STORE

INPUT/ OUTPUT BUS

16 K 4081

16 K 4081
16 K 4081
16 K 4081

16 K 4081
16 K 4081
16 K 4081
16 K 4081

MAX. CORE STORE SIZE: 128 K

RC 315 INPUT/OUTPUT TYPEWRITER 15 CH/S

RC 2000 PAPER TAPE READER 2000 CH/S

RC 150 TAPE PUNCH 150 CH/S

INPUT/OUTPUT CONTROLLER CABINET with High and Low Speed Bus and Power Supply

Space for possible external devices, e. g. drum store.

HIGH SPEED BUS

LOW SPEED BUS

DATA TRANSMISSION

PLOTTER

64-512 K DRUM STORE

2 M DISC STORE

TAPE STATION

DISPLAY

DIGITAL INPUT/ OUTPUT

ANALOG INPUT/OUTPUT

INPUT/ OUTPUT BUS

Low-Speed Data Channel

Slow, character-oriented devices like input/output typewriters, paper tape punches, and paper tape readers are connected to a single low-speed data channel, which communicates directly with the internal working registers. Each device has a separate buffer register of 24 bits, which transmits or receives one character at a time to or from the external data medium.

The data channel consists of a control unit and an input/output bus, with 24 bits for transfer of data to or from device buffers and 6 bits for channel control information.
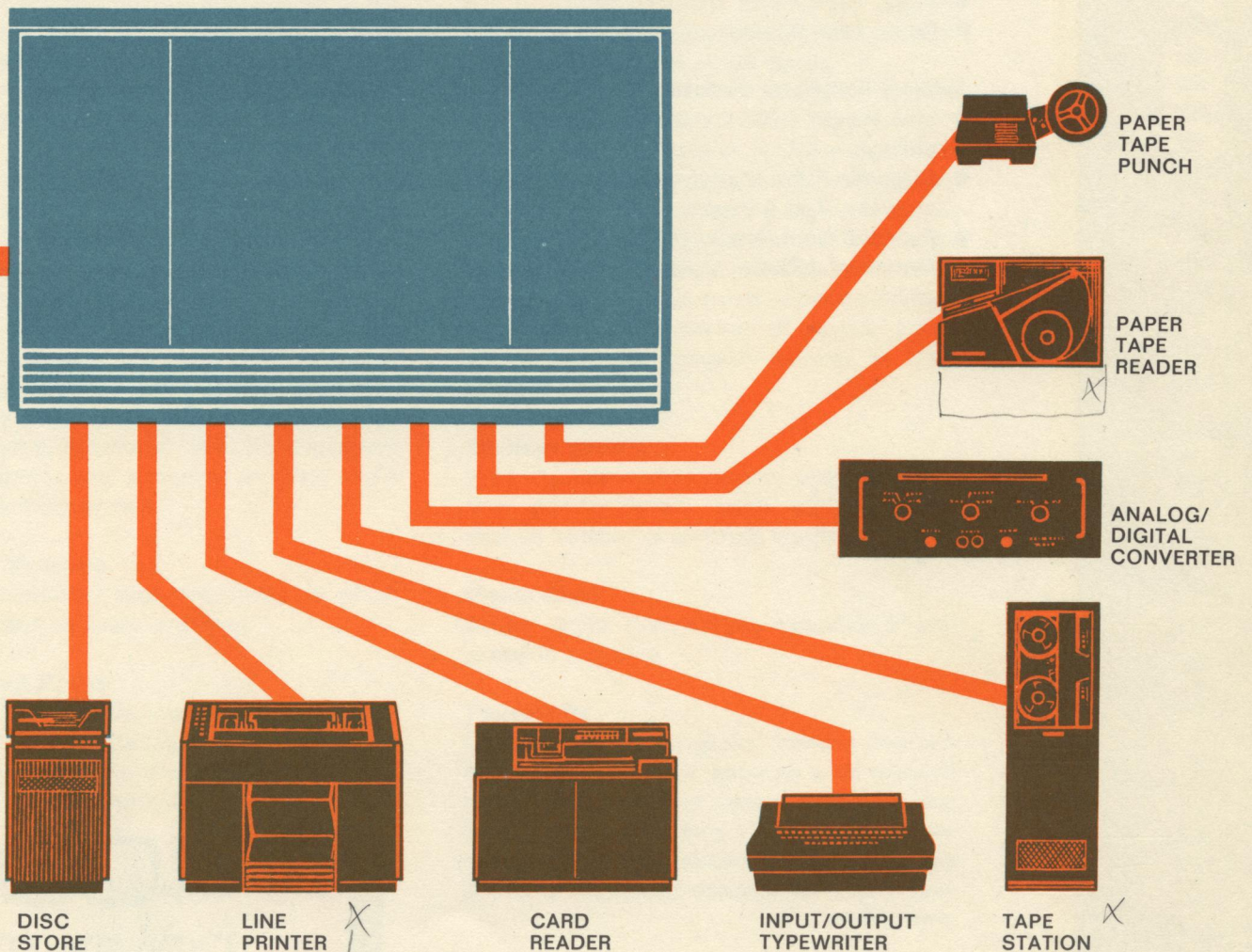
Transfers of data between working registers and device buffers take place one at a time under program control. Transfers between buffer registers and external data media, however, are controlled independently by the devices, so that several such transfers can occur simultaneously.

High-Speed Data Channel

Input/output devices such as magnetic drum stores, magnetic disc stores, and magnetic tape stations, which transmit large volumes of data at high speeds, are connected to a single high-speed data channel. This channel provides input/output directly to or from the internal store on a cycle-stealing basis. Program execution and input/output operations occur simultaneously.

Block transfers can take place on several devices at once. A multiplexer switches rapidly among the devices, connecting them whenever they are ready to transfer a complete data word to or from the store. All input/output operations are handled by a single instruction, and high-speed devices are simply addressed in continuation of low-speed devices.

INPUT/OUTPUT CONTROLLER CABINET

PAPER TAPE PUNCH

PAPER TAPE READER

ANALOG/ DIGITAL CONVERTER

DISC STORE

LINE PRINTER

CARD READER

INPUT/OUTPUT TYPEWRITER

TAPE STATION

INPUT/OUTPUT BUS

level temperature check in the cabinets, parity check of the core store and microprogram unit, and voltage check of all supply voltages. Modular construction facilitates repair and minimizes spare parts costs.

Operating Facilities
Operator's panel with keys for reset, start, and autoload, the latter initiating a bootstrapping routine for program loading. Operator's console contains standard peripheral devices – input/output typewriter, paper tape punch, and paper tape reader – arranged in a sensible manner. With the operator's panel, facilities for handling paper tape, and shelves for typewriter paper and the like, the computer is ready to use.

Maintenance panel enables manual operation and includes execution of instructions step by step as well as display and alteration of all registers.

Standard Peripheral Devices
- Input/Output Typewriter (15 char/sec)
- Paper Tape Punch (150 char/sec)
- Paper Tape Reader (2000 char/sec)

Optional Peripheral Devices
- Line Printer (1000 lines/min, 64 or 96 graphics)
- Magnetic Tape Station (25,000 to 120,000 char/sec, 7 or 9 tracks)
- Punched Card Reader (1200 cards/min)
- Incremental Plotter or Analog Drafting Machine

- Teletype Terminals for Multiple, Local, or Remote Access
- Cathode Ray Display with Light Pen and/or Keyboard
- Large Magnetic Disc Store
- Process Input/Output for Analog and Digital Signals
- Set Point Station Controller
- Strip Printer
- Data Transmission Controllers

The character set observes the ISO standard for 7-bit codes. Standardized channel interface and true modular construction make it possible to install and connect peripheral devices to existing RC 4000 systems at the customer's premises with a minimum of installation work.

Off-Line Equipment
- RC 3000 Converter System converts a wide variety of input/output media off-line to and from magnetic tape.
- RC 1600 Graphic Converter automatically operates drafting devices off-line, generating vectors and symbols on the basis of paper tape and magnetic tape input.
- RC 1100 Scanlog System performs automatic, off-line scanning, analog to digital conversion, and recording of data on paper tape or magnetic tape.
- Accessories include: automatic winder and stand for paper tape reader; mechanical punch, hand punch, splicer, gauge, and electric winder for handling paper tape.

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