HITAC 10

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Introduction

HITAC 10 is versatile general purpose computer designed for use as a personal computer in scientific applications and as a system computer in automation applications.

Fully integrated for high reliability and mini-sized, this low-cost, high-performance minicomputer with a cycle time of 1.4 microseconds is plug-in expandable in memory size from 4 kw to 32 kw.

HITAC 10 is able to accommodate a wide range of peripheral equipment, and its flexible I/O bus is capable of handling up to 64 peripherals with priority interrupt. Extensively supported with instruction repertoire and software such as FORTRAN (from 4 kw) Calculator. Assembler, MACRO Assembler, HITAC 10 is a powerful minicomputer highly recommended for educational and research applications as well as data acquisition, reduction, and analysis applications.

Features

General
16-bit plus parity, single address, fixed word length.

Fully parallel, two's complement arithmetic.

4,096 words (basic) core memory expandable to 32,768 words (up to 8,192 words within basic frame).

1.4 microseconds memory cycle time.

Desk-top and rack mountable.

TTL integrated circuit.

Over 50 instructions.

Power failure protection.

Page addressing (512 words per page)

Single-level indirect addressing and optional indexing.

Hardware multiply and divide option.

Double-precision arithmetic option.

Input/Output
Up to 64 channels for program-controlled I/O bus facility.

Direct memory access with one-cycle and three-cycle data break facility.

Program interrupt facility.

Software
Assemblers and Utility Package
FORTRAN
Calculator
Diagnostics

Specifications

Memory
Memory size	: 4,096 words expandable to 32,768 words in modules of 4,096 words
Word length	: 16-bit plus parity bit
Cycle time	: 1.4 microseconds

Arithmetic
Parallel, two's complement binary

Computer speed
Add/Subtract	: 2.8 microseconds
Load/Store	: 2.8 microseconds
Branch	: 1.4 microseconds
Indirect address	: 1.4 microseconds

Instruction
Over 50 instructions.

Multiply, divide, double length arithmetic, and index operation are optional.

Input/output capability
Maximum optional multiplexed I/O devices: 64

Standard I/O device
H-9331 Data Typewriter, 10 char/sec.

Software

HITAC 10 is supported by Assembler, MACRO Assembler, FORTRAN, FAP (Floating Arithmetic Package), Subroutine, Debugging Utility, EHS (Extended Hardware Interpreter System) and Calculator. These softwares will prove very useful for both scientific and system applications.

The Calculator is a conversational language developed by Hitachi for simple scientific calculations.

Assembler (ASSY)

The basic Assembler is a one-pass assembler which translates symbolic language into standard machine language.

MACRO Assembler (MASS)

The MACRO Assembler is a more advanced two-pass assembler having the same functions as the basic Assembler. It also has the capability to process machine language and the floating point operation of the expanded hardware instruction, as well as MACRO language specified by the user.

FORTRAN

The FORTRAN language, operational from the basic 4K core memory, consists of twelve statements: ARITHMETIC, CONTINUE, DIMENSION, DO, END, FORMAT, GO TO, IF, PAUSE, READ, STOP, WRITE. FORTRAN functions include square root, sine, cosine, tangent, hyperbolic tangent, arctangent, exponential, logarithm, and absolutes.

FAP (Floating Arithmetic Package)

The FAP performs floating point arithmetic operations without the requirement of additional hardware.

Subroutine

The Subroutine package provides mathematical function routines, which perform the following operations in both single and double precision.
 Multiplication, Division
 Fixed point square root, sine,
 cosine, arctangent
 Double-word fixed point square
 root, sine, cosine, arctangent
 Binary to decimal conversion
 Decimal to binary conversion

Debugging Utility

The Debugging Utility provides a set of routines such as memory dump, trace, symbolic tape editor, etc., useful for debugging purposes.

EHS (Extended Hardware Interpreter System)

The EHS is a routine providing the same functions as Extended Instruction but without the requirement of additional hardware.

Calculator

The Calculator permits the use of the HITAC 10 as an electronic type calculator with no programing on the part of the user. Simple scientific calculations can be performed in a quasi-conversational language.

Optional Features and Controllers

H-P1610-11 Extended Instruction Feature

This feature performs automatic multiplication, division, double length arithmetic, and index operation. H-P1610-11 can be installed within the basic frame of the HITAC 10 processor.

H-P1610-2 Basic Expansion Feature

H-P1610-2 is a multilayered printed circuit board indispendably required for all additional peripherals other than the I/O typewriter, and for all optional features other than the Extended Instruction Feature. It also provides space for an amplifier plug-in required for information transfer to additional memory expanded beyond 8K words contained in the HITAC 10 basic frame. H-P1610-2 is mounted within the HITAC 10 basic frame.

H-P1610-21 Memory Expansion Feature

H-P1610-21, a feature for memory expansion to 8,192 words, is plug-in mounted on the above H-P1610-2. The amplifier plug-in mentioned above is provided with this feature.

H-P1610-23 Power Failure Feature

H-P1610-23 feature will receive an interrupt when a power failure occurs, storing the data and operation status. When power is restored, this feature will automatically restore the operating condition and restart the processor. H-P1610-23 is plug-in mounted on the H-P1610-2.

H-P1610-25 Tape Reader Controller

H-P1610-25 is an optional feature that controls the H-8226-2 tape reader and sends information from the paper tape to the processor. H-P1610-25 is plug-in mounted on the H-P1610-2.

H-P1610-26 Tape Punch Controller

H-P1610-26 controls the H-8227-2 tape punch and sends information from the processor to the tape punch. This feature is plug-in mounted on the H-P1610-2.

Peripherals

H-8226-2 Tape Reader

H-8226-2 is an 8-level code, 500 characters-per-second, high-speed, photo electric tape reader.

H-8227-2 Tape Punch

H-8227-2 is an 8-level code, 110 characters-per-second tape punch.

H-1613-1 On-line Analog Data Processor

H-1613-1 permits the HITAC 10 processor to perform data acquisition. It provides for 8 analog input channels, 1 analog/digital convertor channel, 1 digital input channel, and 1 digital output channel, each digital input or output channel holding 16 bit information.

H-1613-2 On-line Analog Data Processor

H-1613-2 permits the HITAC 10 processor to perform data acquisition. It provides for 16 analog input channels, 1 analog/digital convertor channel, 1 digital input channel, and 1 digital output channel.

H-1613-3 On-line Analog Data Processor

H-1613-2 permits the HITAC 10 processor to perform data acquisition and device control. It provides for 8 analog input channels, 1 analog/digital convertor channel, 2 digital/analog convertor channels, 1 digital input channel, and 2 digital output channels.

H-1613-4 On-line Analog Data Processor

H-1613-4 permits the HITAC 10 processor to perform data acquisition and device control. It provides for 16 analog input channels, 1 analog/digital convertor channel, 2 digital/analog convertor channels, 2 digital input channels, and 4 digital output channels.

External mass memories and other peripherals are under development.

Physical Specification

Dimensions
Height : 11.8 inches (300 mm)
Width : 17.7 inches (450 mm)
Depth : 23.6 inches (600 mm)

Weight
100 pounds (45 kg),
including power source

Power requirements
Source : 115V ± 10%, 50 to 60 Hz,
single phase
Consumption : 500W

Environmental conditions
Temperature : Operating + 5 to 35°C
Humidity : Operating 35 to 85%

Applicable to basic console with all options excluding I/O divice.

Instruction

Memory Reference Instructions
LOAD-STORE

		Time (μ S)
L	: Load	2.8
ST	: Store	2.8
* LE	: Load EC	2.8
* LD	: Load Double	4.2
* STE	: Store EC	2.8
* STD	: Store Double	4.2

ARITHMETIC

A	: Add	2.8
S	: Subtract	2.8
* AD	: Add Double	4.2
* SD	: Subtract Double	4.2
* M	: Multiply	9.8
* D	: Divide	11.2

LOGICAL

N	: And	2.8
X	: Exclusive Or	2.8
O	: Or	2.8

CONTROL

B	: Branch	1.4
BAL	: Branch and Link	2.8
XCT	: Skip on Count	4.2

SHIF-ROTATE

SRL	: Shift Right Logical	1.4
SLL	: Shift Left Logical	1.4
SRA	: Shift Right	1.4
SLA	: Shift Left	1.4
* SRDL	: Shift Right Double Logical	1.4
* SLDL	: Shift Left Double Logical	1.4
* SRDA	: Shift Right Double	1.4
* SLDA	: Shift Left Double	1.4

Status Control Instructions
MISCELLANEOUS CONTROL GROUP**

		Time (μ S)
NE	: No Effect	2.8
LCAR	: Load Carry Register	2.8
SCAR	: Set CAR	2.8
LDSW	: Load Data Switch	2.8
SIM	: Set Interrupt Mask	2.8
RIM	: Reset IM	2.8
HLT	: Halt	2.8

SKIP GROUP**

Skip on Condition	2.8
Skip on Error	2.8
Skip on Error and Clear	2.8

I/O Transfer Instructions
TELETYPE KEY BOARD/READER

KTI	: Skip on TI (Flag)	4.2
STI	: Start TI	4.2
RTI	: Read TI	4.2
RTLF	: Read TI and Feed	4.2

TELETYPE PRINTER/PUNCH

KTO	: Skip on TO	4.2
WTO	: Write TO	4.2
CTO	: Clear TO	4.2

TAPE READER

KTR	: Skip on TR	4.2
STR	: Start TR	4.2
RTR	: Read TR	4.2
DTR	: Send TR Status	4.2

TAPE PUNCH

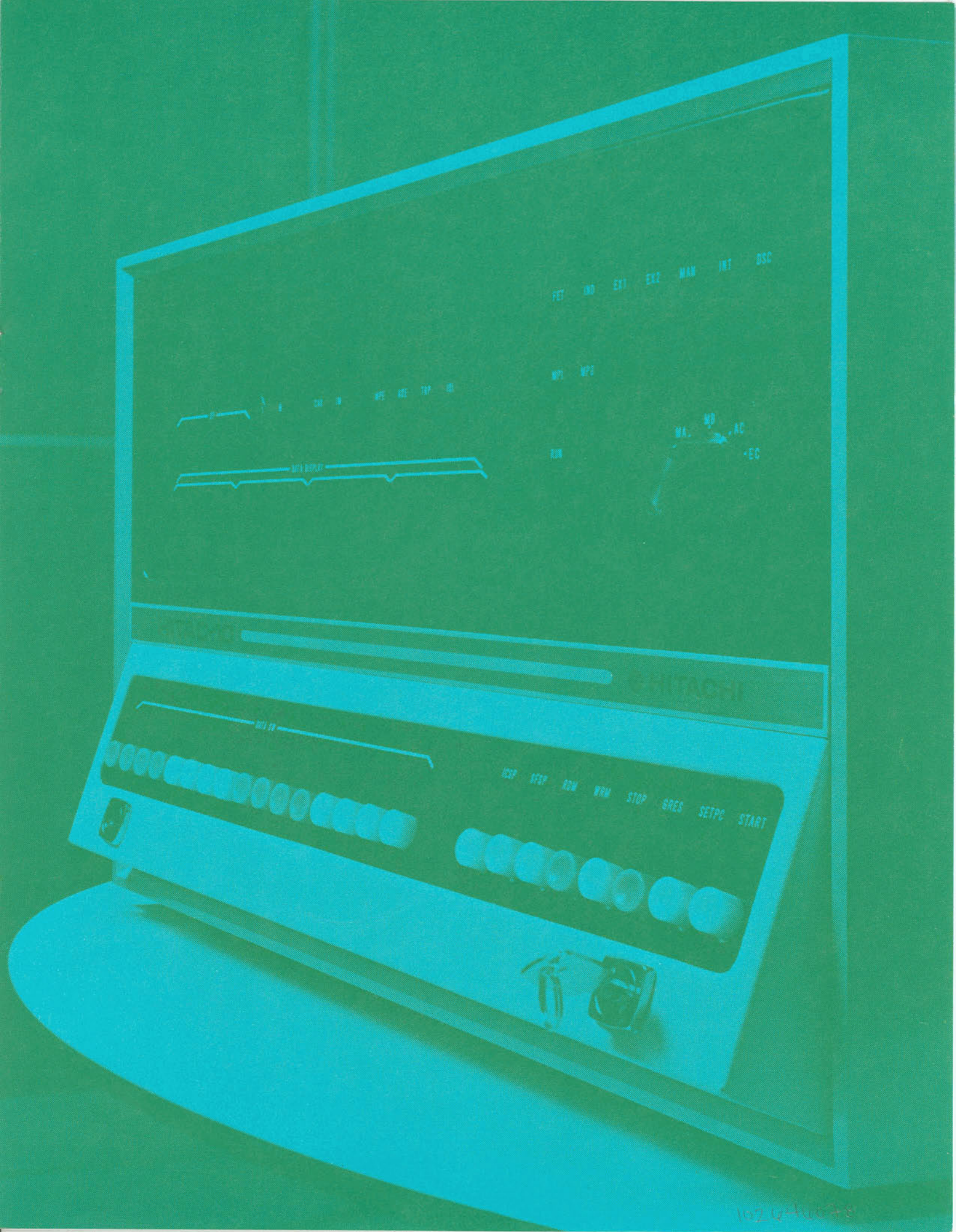|		
KTP	: Skip on TP	4.2
CTP	: Clear TP	4.2
WTP	: Write TP	4.2
DTP	: Send TP Status	4.2

Others
* : Option
** : Produced by bit microprograming

Specifications are subject to change without notice.