Honeywell

μ-COMP DDP-124 General Purpose I/C Digital Computer

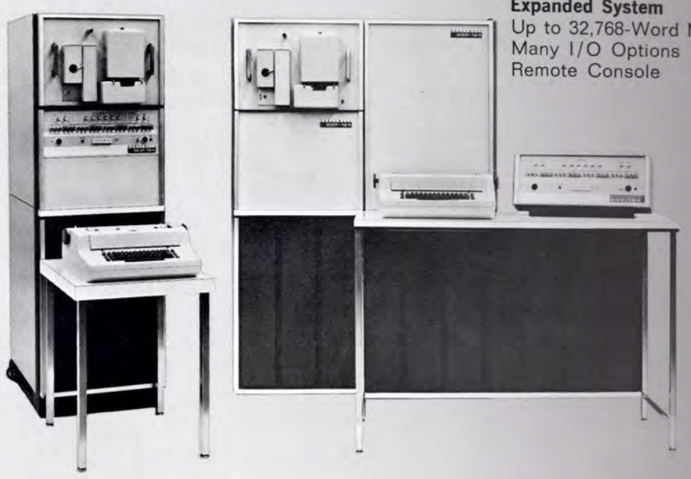
DDP 124

Honeywell

COMPUTER CONTROL
DIVISION

POWERFUL 24-BIT COMPUTER SYSTEMS
μ-COMP DDP-124 WITH EXPANDABLE CAPABILITY

Basic System
8192-Word Memory
Indirect Addressing
Hardware Index Register
Hardware Multiply and Divide
I/O Typewriter
300 cps Paper Tape Reader
110 cps Paper Tape Punch
Integral Console



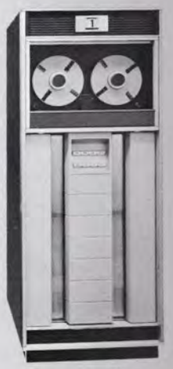
Expanded System
Up to 32,768-Word Memory
Many I/O Options
Remote Console

Peripheral Options

Fast-access Auxiliary Mass Storage

Card Punch

Line Printer



Magnetic Tape

Card Reader

FAST...COMPACT...I/C...LOW COST

Your Finest 24-Bit Computer Buy...μ-COMP DDP-124 Available with 380 Software Programs

INTRODUCTION

Introduced in 1965 as the first truly I/C computer, the *μ-COMP* DDP-124 has proved to be highly reliable and to have an excellent cost/performance ratio. This 24-bit, stored-program digital processing system is widely used in areas such as flight simulation, message switching, physics research, radar tracking, data acquisition, scientific computation, missile tracking, and impact prediction.

SPECIAL ENGINEERING SUPPORT is available for customers who require sophisticated hardware, specially designed to fit their particular problems. Implementation problems are minimized by using the same standard *μ-PAC* modules from which the computer is built. Acting as a digital partner to both user and systems designer for over twelve years, Honeywell, Computer Control Division provides required engineering capabilities and back-up support in the areas of programming, hardware maintenance, training, and application engineering.

BACKGROUND

μ-PAC I/C DIGITAL LOGIC MODULES provide high reliability, speed, flexibility of field expansion and easy implementation of options. All logic modules, including memory circuits, are standard and interchangeable. Front access to all modules and wiring simplifies maintenance.

μ-STORE ICM-40 CORE MEMORY, heart of this computer, is the same compact, high-speed core memory system used by computers in many installations. These computers include the highly successful DDP-516 and DDP-416.

DDP-124 is the newest member of our 24-bit computer family that includes the DDP-24 and the DDP-224. It is program-compatible with both.

HIGH PERFORMANCE HARDWARE

Fully parallel/binary
Single address with indexing
Indirect addressing
24-bit word, sign/magnitude
8192-word memory, directly addressable
1.75 μsec memory cycle time
3.5 μsec add
14 μsec multiply (average)
19.60 μsec divide (fixed)
285,000 computations per second
Displays for data entry, and index register
Separate maintenance displays and system malfunction detection controls
Operates on normal housepower
Temperature range 10° to 40°C
No airconditioning, sub-flooring, or special installation required

INPUT/OUTPUT

1.75 μsec I/O word transfer
Program-controlled I/O, 571,000 words per sec
Automatic interrupt for I/O channels
Typewriter and high-speed paper tape I/O
Input and output can occur asynchronously and be interleaved with processing

OPTIONS (all I/C)

Memory expansion to 32,768 words directly addressable
Memory lockout system
Direct memory access I/O channel
Word-forming buffer
Up to 16 priority level interrupt lines
Up to 64 sense lines
Up to 64 output control lines
Character buffer registers
Parallel I/O channels
Additional hardware index registers
Single execute interrupt for automatic counting
High-speed multiply — 8.75 μsecs
Remote console and multi-station capability
Power failure interrupt
Fast-access disc storage
High-capacity disc storage
High-speed I/O card equipment
Line printers
Magnetic tape

SOFTWARE

380 field-proven programs, ready to use

RELIABILITY

Silicon monolithic integrated circuits
Designed for operation in hostile environments
Backed by over twelve years' experience in circuit module design and computer/system design
Field proven
Wide reliability performance margins provided by 5mc circuitry/parallel organization
Rigid inspection, test, and overall quality programs
MTBF: about one year under normal 40-hour week operation

USER SERVICES

Programmer training course
Maintenance training course
Logistic support program
Installation service
Users Group membership

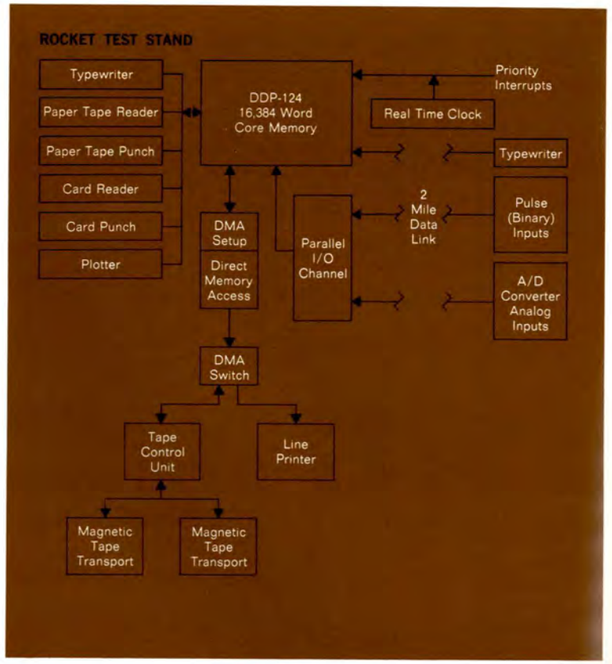
APPLICATIONS

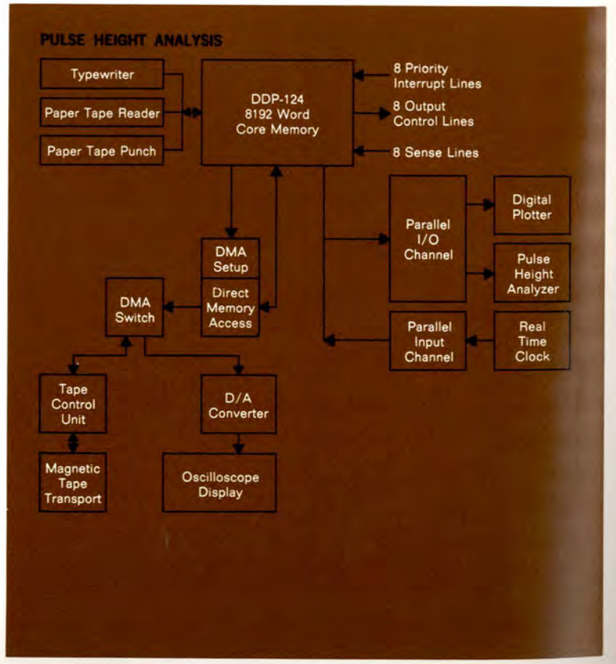
Computer Control Division of Honeywell has, in its long history of digital systems design and development, built and delivered a wide variety of computer systems. (These range in complexity from relatively simple free standing units for scientific computation, to complex real-time simulation systems.) CCD's success in this area is due to its ability to provide *both* building blocks and complete systems using the same digital logic modules throughout.

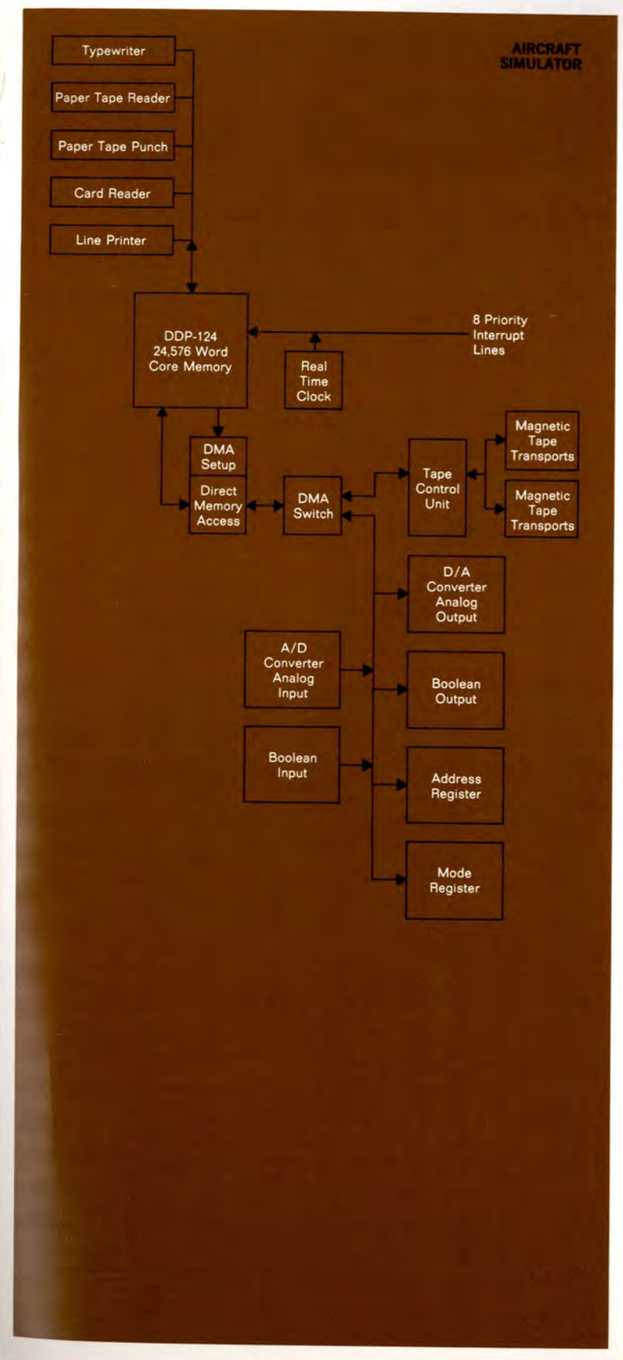
The DDP-124, with its advantage of long word length, speed, extensive software, and highly reliable integrated circuitry has proven to be an excellent performer where computation accuracy, flexibility, and control is important.

Ground Check-out

An example of high speed data acquisition is well illustrated by the DDP-124 rocket test stand system. Scanning at a 20 kilocycle rate, analog signals representing operating temperatures and thrust, plus pulsed binary signals for fuel flow, valve sequencing, and other operating events are inputted to the computer and stored on magnetic tape. Continual limit checking is performed to detect malfunctions. Post-test data reduction is later performed to obtain the operating characteristics of the test engine. In this system a high speed communications link was built to connect the remote test site with the central computer location. The parallel I/O channel permits the combining of a 15 bit analog conversion word with a pulse data word. The DMA channel transfers formatted data to magnetic tape at the same time.







Nuclear Research

Acquisition speed and calculation accuracy are just two of the more important features that make the DDP-124 the favorite in a variety of nuclear research projects. The pulse-height analysis configuration shown illustrates the necessity of flexible I/O data channels, as well as channels whereby the computer program can not only test conditions but also respond to external equipment actions, and to issue commands to initiate action changes. A set of priority interrupt lines permit the functions of the external system to demand immediate service from the computer. The system to which this DDP-124 is connected is a cyclotron for which it performs pulse height analysis and data reduction functions. Various test isotopes are bombarded and their analog signals detected. These are displayed as three-dimensional contours and isometric drawings on an oscilloscope display as well as on a high speed digital plotter for permanent record. Further data reduction results in the compilation of isotope signature characteristics.

Aircraft Simulator

The major world-wide suppliers of simulators and trainers have designed many of their systems around the DDP-124. The computer is programmed to make continual iterations of the equations which describe the behavior of a particular aircraft, such as air speed, fuel consumption, attitude, and flight controls. Alterations of input data by pilot actions or instructor inputs cause variations in the equation solutions which are fed back to indicators and controls in the cockpit. Associated systems such as radio navigation aids and communications are also realistically simulated. The Direct Memory Access feature provides a high speed data path to the computer from a number of types of I/O interfaces. In this example, a DMA switch is used to implement magnetic tape for program and data storage by sharing the DMA channel.

TOTAL SOFTWARE SUPPORT

In-depth software is provided with every DDP-124. There are now 380 field-proven programs available. You can select from these to make up a software program library specifically designed to match your application.

FORTRAN IV — This one-pass compiler is designed to conform to ASA specifications and will operate on a minimum configuration of 8K memory, typewriter, and paper tape reader/punch. Among the various features that can be made use of in FORTRAN IV are: variables of up to three dimensions; full-word, fixed-point arithmetic, double precision floating-point arithmetic, and complex number arithmetic; logical or Boolean operations; chaining facility; BLOCK DATA and TRACE statements, and many other capabilities required for efficient programming.

Assembly Program (DAP II) — This program, which requires 8K of memory and a minimum I/O configuration, converts symbolic instructions into their binary equivalents on a one-to-one basis. This conversion is accomplished in two passes. The first pass develops a dictionary of symbols and the second assembles the object program by referencing the dictionary. Among the 25 available pseudo-operations, the more familiar ones are: ABS, BCI, BSS, DEC, OCT, ORG, PZE, REL, EQU. User-defined macro instructions are accepted by the assembler, and linkage between DAP II and FORTRAN IV is provided for by the CALL and SUBR pseudo-operations.

Loader 2 — This is a program used to load object programs generated by either the DAP II assembler or the FORTRAN IV compiler. It can be used to load both absolute and relocatable object programs, complete all subroutine linkages, and provide a memory map.

Input/Output Selectors (IOS) — These are several separate programs which call input/output subroutines from the I/O library and establish the communication link with I/O equipment. Individual selectors exist for use with FORTRAN IV, DAP II, and LOADER 2.

Test and Maintenance — This group of programs performs the following instructions:

1. Verification of correct operation
2. Localization of incorrect operation
3. Repetitive exhibition of problem area to keep a running record of the results of any adjustments being made

DEBUG — This routine, which is controlled through the typewriter keyboard, allows the programmer to: enter selective breakpoint halts in a program; display specified locations in memory and optionally change them; search memory for selected constants; and punch corrected programs on paper tape.

Memory Dumps — By means of DUMP and several associated subroutines, selected areas of memory can be either displayed or punched on paper tape. The output can appear in a variety of formats, such as, octal with mnemonics, integer decimal, or floating decimal.

Software Library Box can be conveniently located right at your programmer's fingertips. It holds everything he needs — including complete documentation, manuals, and software. (Illustrated)

Subroutine Libraries — The standard software package contains arithmetic and mathematical routines that perform a variety of operations. (See table) There is also an input/output library which has routines that operate peripheral devices in both BCD and binary modes, include error checking, and provide for recovery action whenever possible. Input/output routines are available for the following DDP-124 I/O peripheral devices:

Card reader/Card punch
Paper tape reader/punch
Line printer
Typewriter
Magnetic tape transport
Fast-access disc storage
High-capacity disc storage

In addition, there are numerous routines that deal with decimal/binary and binary/decimal conversions. These include both fixed and floating point, single and double precision conversion for real and complex numbers.

Operating Systems — For those machine configurations that have magnetic tapes, an operating system is available to compile or assemble, load, and execute programs.

Other Utility Programs — The following tasks may be performed with the aid of several utility routines:

1. Source program updating
2. Selective listing of programs
3. Transfer of data from one device to another
4. Symbolic paper tape revision
5. Updating of the subroutine library

Real-Time Monitor permits sharing DDP-124 capabilities among several real-time programs for improved computer utilization. It coordinates scheduling and control functions required for multi-programmed, priority-based execution. In addition, the RTM handles I/O functions, recognizes and records interrupts, and controls the interrupt-masking logic.

Dynamic Math Library with reentrant capability is now available for DDP-124 computers with three index registers. The reentrant feature allows the programmer to use one math subroutine to serve several real-time programs. This is possible even though the subroutine may be required by an interrupting program prior to completion of its original use. The reentrant capability is provided by special coding and by dynamic storage allocation of sub-routine variables especially useful when operating under control of a real-time monitor.

MATH LIBRARY

SUBROUTINES	COMPLEX	FIXED POINT Single Precision	FIXED POINT Double Precision	FLOATING POINT Single Precision	FLOATING POINT Double Precision	MIXED Double & Single Precision	MIXED Complex & Real
Add	X		X	X	X	X	X
Subtract	X						
Multiply	X						
Divide	X						
Sin	X	X					
Cos	X	X					
Tan		X					
Arcsin		X					
Arccos		X					
Arctan		X					
Square Root	X	X					
Log Base^N		X					
Log Base^e	X	X					
Log Base^2		X					
Log Base^{10}							
Exponential	X	X					
Absolute Value	X	X					
Remaindering		X					
Truncation							
Hyperbolic Tan							
Maximum Value		X					
Minimum Value		X					

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☐ Send me your complete DDP-124 catalog which contains detailed documentation and specifications.

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The application I have in mind for the DDP-124 is: _____

_____

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