

The HP 1000 E-Series computers are intermediate-performance members of the HP 1000 Computer Family. Combining successful HP 1000 architecture with a unique design philosophy, the E-Series has the power to meet tough computing demands.

A comprehensive range of software is available for both models, including compilers, and operating systems. In addition, a full line of HP-manufactured peripherals and data communications interface kits is offered, enabling complete systems to be tailored around these members of the HP 1000 Family.

Features

- Proven HP 1000 architecture, providing extensive compatibility with HP 1000 Series processor options, peripherals, operating systems, and software
- Variable microcycle timing (VMT) for improved processor speed
- Powerful instruction set with 128 instructions
- 2.28 million byte/second direct memory access transfer rate available with Dual Channel Port Controller (DCPC)
- User microprogrammable, with complete user-microcode support
- Two models to choose from:
 - 2109E, with space for up to 2M bytes of memory and nine I/O channels in 8-3/4 inch mainframe
 - 2113E, with space for up to 2M bytes of memory and fourteen I/O channels in 12-1/4 inch mainframe
- Standard performance main memory is standard: 64k bytes in 2109E, 128k bytes in 2113E. 350 nanosecond High performance memory and/or fault control capability is optional
- Dynamic mapping system, optional in 2109E, standard in 2113E, provides for accessing up to two megabytes of memory
- Remote program load capability
- Self test for CPU and memory
- Microprogrammable processor port, permitting external processors to be interfaced directly to the E-Series control processor
- Microprogrammable block I/O for intelligent microprogrammed I/O channels
- Disc loader ROM is standard

Description

Architecture

HP 1000 E-Series architecture features a fully micro-programmed processor, which includes all arithmetic

All I/O channels are fully-powered, buffered, and bidirectional. Because of modular design, mainframe memory capacity is completely independent of I/O capacity, so that either memory or I/O modules may be added without taking valuable mainframe space from the other. Mainframe memory capacity is 2M bytes in the 2109E and 2113E.

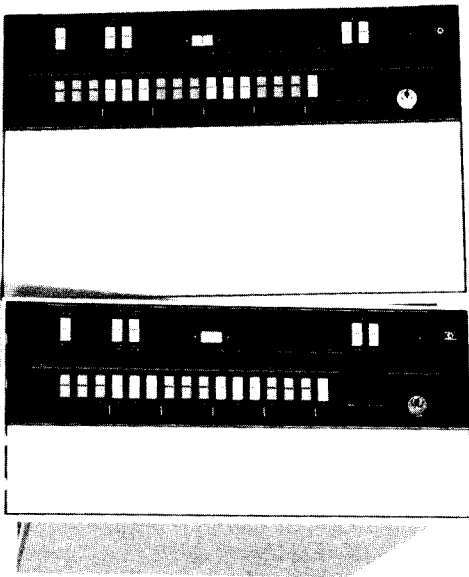
Efficiency of the microprogrammed routines that determine the machine language operation has also been improved through the mechanisms of instruction and operand prefetch. The CPU-memory interface is totally asynchronous in the E-Series, adding flexibility to the powerful memory structure.

The E-Series offers extensive software program and I/O compatibility with other HP 1000 computers. E-Series processors have been optimized for performance with a microprogrammed control processor that directs operations of the other functional units. The control processor speed has been increased for certain operations by a sophisticated technique that varies microinstruction cycle time, depending on the complexity of the operation.

Standard E-Series instructions include indexed instructions, integer and floating point arithmetic, data communications, I/O, and a full complement of instructions for logical operations and bit/byte manipulation.

The E-Series offers extensive software program and I/O compatibility with other HP 1000 computers. E-Series processors have been optimized for performance with a microprogrammed control processor that directs operations of the other functional units. The control processor speed has been increased for certain operations by a sophisticated technique that varies microinstruction cycle time, depending on the complexity of the operation.

Efficiency of the microprogrammed routines that determine the machine language operation has also been improved through the mechanisms of instruction and operand prefetch. The CPU-memory interface is totally asynchronous in the E-Series, adding flexibility to the powerful memory structure.



A full line of I/O interface controllers is available to interface HP-manufactured peripherals, instrumentation, communications devices, or specialized devices.

For applications which demand even higher performance, E-Series users can expand their instruction repertoire with HP-supplied microprogrammed subroutines. Enhancements include the Fast FORTRAN processor for fast handling of scientific routines and operating system mapping routines.

User-microprogramming

The power and flexibility of control processor microprogramming is readily available to E-Series users. Control processor access provides users with the ability to perform commonly-used subroutines 2-to-20 times faster than with conventional computing techniques. Control processor subroutines are written in a simple assembly language, stored in control processor memory, and called directly from Assembly, BASIC, or FORTRAN programs.

Control processor programmers have access to a powerful processor within E-Series computers that executes instructions in 175-to-280 nanoseconds, and provides multilevel nested subroutines, 211 instructions, 12 high-speed scratchpad registers, and an 11.5k word user address space, of which up to 3k words can be writable control store implementing a control processor program overlay arrangement. Control program overlays provide a flexible system able to react to dynamic changes in speed requirements dictated by user program mix.

Control processor program development is aided by HP's complete software development tools, which include an assembler, debug editor, program overlay utility, and ROM tape generator, as well as a complete documentation package.

Memory system

The E-Series includes a standard performance memory system that utilizes the same field-proven semiconductor memory modules as the HP 1000 M-Series. Based on 16k or 64k bit MOS/DRAM semiconductor chips, this system combines speed, reliability, and economy. High-speed, 420 ns cycle time memory (without Fault Control) is available to increase performance by up to 30%. For data integrity, memory parity check is standard and fault control capability may be added to improve the MTBF of memory systems. Memory is easily expandable by plug-in 64k, 128k, and 512k byte modules.

For efficient handling of large memory systems, the dynamic mapping system (DMS) is standard. A combination of hardware and control programs, DMS is a powerful memory manager that allows E-Series users to address up to 2048k bytes of memory, and provides read and/or write protection of each individual 2,048 byte page.

Input/output

Four independent memory maps are provided — one for full memory management instructions to the standard E-Series instruction set. This capability is fully supported by HP's RTE-6/VM and RTE-IVB real-time executive operating systems which offer multi-user access to as many as 64 multi-user program partitions. In RTE-6/VM, support of large-memory systems also gives the user access to data arrays up to 128 megabytes in Virtual Memory.

The E-Series I/O system features a multilevel vectored priority interrupt structure. There are 50 distinct interrupt levels, each with a unique priority assignment. Any I/O device can be selectively enabled or disabled or the entire interrupt system (except power fail and parity error interrupts) can be enabled or disabled under program control.

Data transfer between the computer and I/O devices may take place under program control, dual channel port controller (DPC) control, or microprogram control. The DPC provides two direct links between memory and I/O devices, and is program-assignable to any two devices. DPC transfers occur on an I/O cycle-stealing basis, not subject to the I/O priority interrupt structure.

For applications where higher transfer rates are desirable, the E-Series has a special Microprogrammable Block I/O capability that allows transfer rates up to 3.1 million bytes/second. This capability can be implemented through user-designed I/O cards and block I/O control microprograms.

Remote and local program load

The initial binary-loading (IBL) function is easily performed on E-Series computers. For local bootstrap loading, a 64-word ROM-resident IBL program is called by a push-button switch on the front panel. Disc loader ROM is standard. Up to two additional HP or user-supplied loader ROMs may be added to any E-Series computer. The user can plug in up to four different loader ROMs if the standard loader ROMs are removed.

Computers at remote sites can be force-loaded from a central location through the use of a remote program load (RPL) capability. Information normally keyed into the front panel is set in switches on the CPU board, so the bootstrapping sequence may be initiated from a remote site, or automatically initiated on power-up from a local peripheral.

Specifications

All E-Series specifications can be found in the E/F-Series Specifications data sheet located at the beginning of this section.

Ordering information

2109E computer

The 2109E includes:

1. 2109B computer
2. 2102B standard performance memory controller and one 12746A 64k byte standard performance memory module
3. 12791A Firmware Expansion Module
4. 02109-90001 HP 1000 E-Series reference manual
5. 02109-90002 HP 1000 E-Series installation and service manual
6. 02109-90014 Microprogramming manual
7. DMI ROMs (13307B) and 79xxM Disc Memory and 2645A Minicarttridge Loader ROMs

2113 computer

The 2113E Computer includes:

1. 2113 computer
2. 12786A 128k byte Standard performance memory package, including 2102B Memory controller, 12747A 128k byte memory module and 12731A Memory Expansion Module and 12892B Memory Protect Module
- 3-7. Same as items 3 through 7 of 2109E Computer, above.

2109E and 2113E options

003: 13304A Firmware Accessory Board instead of 12791A Firmware Expansion Module

2109E opt. 012: Replaces 64k bytes of standard performance memory with 64k bytes of high performance memory.

2113E opt. 012: Replaces 128k bytes of standard performance memory with 64k bytes of high performance memory (deletes 12731A Memory Expansion Module and 12892B Memory Protect Module).

2113E opt. 013: Deletes 64k bytes of memory and Dynamic Mapping System, leaving 64k bytes of memory in computer.

014: Deletes standard memory, item 2, above, from 2109E or 2113E, to permit its replacement with another HP 1000 E-Series compatible standard performance or high performance memory system, with or without fault control, which must be ordered separately.

015: 220V (176-264V) operation

2109E and 2113E accessories

See power specifications and applicability summary on page 8-3, referring to the E-Series applicability column.

Self test

A comprehensive set of diagnostic routines permanently stored in read-only memory (ROM) is standard in the E-Series. Two of these routines, executed each time the IBL/TEST function is executed, provide quick tests of the processor and first 64k bytes of physical memory for verification of operating condition. A third test, executed whenever the machine is powered up, thoroughly tests the processor and all installed memory. This test may also be run manually.

Microprogrammable processor port (MPP)

The microprogrammable processor port provides a direct interface to the CPU for user-designed hardware processors. The MPP provides address, data, and control capability, so external processors can be controlled and can transfer data at burst rates up to 11.4M bytes/second.

Power system

HP 1000 E-Series power systems will operate normally in environments where power fluctuates widely. Input line voltages and frequencies may vary considerably without affecting computer operations. The optional power fall recovery system provides a minimum of 1.6 hours of memory sustaining power for the largest memory configuration, in the event of complete power failure.

Software

The HP 1000 E-Series maintains extensive program compatibility with earlier members of the HP 1000 Family, so users can take advantage of many man-years of software development.

A wide range of operating system software is available. Real-time executive (RTE) systems, available in disc and main memory-resident versions, are multi-programming systems that permit priority scheduling of several real-time programs while concurrent background processing takes place.

The memory-based RTE-M and disc-based RTE-IVB and RTE-6/VM operating systems can support up to 2,048M bytes of memory, managed by DMS. Comprehensive software systems are also available for computer networking.

Languages supported by HP operating systems include FORTRAN 4X, FORTRAN 77, Pascal, HP BASIC, Assembler, and user microprogramming. Utility software includes a debugging routine, a powerful screen editor, and an extensive library of commonly-used computational routines.

E-Series users may also take advantage of a wide variety of thoroughly-tested and documented programs that have been contributed to the HP User Library, PLS/1000.