# MODEL 840S

## HP 9000 Series 800 Computer Systems

## Product Description

The HP 9000 Model 840S utilizes the RISC-based HP Precision Architecture to deliver a highly reliable, cost-effective solution to the data-processing needs of an entire department. Using the HP-UX operating system, the Model 840S is an excellent solution in multi-user, multi-tasking environments that require high performance and the flexibility of an AT&T System V-compatible UNIX* operating system.

## System Features

- HP Precision Architecture
- 4.5 MIPS CPU performance
- High-performance Floating Point Coprocessor
- 125-nanosecond instruction cycle time
- 128-Kbyte high-speed CPU cache
- 48-bit virtual addressing
- 4096-entry Translation Lookaside Buffer for virtual-to-physical address translations
- Advanced instruction pipelining techniques
- 8 Mbytes ECC memory standard, expandable to 96 Mbytes
- Two-level I/O hierarchy providing high I/O bandwidth
- Battery backup, auto restart standard
- Support for up to 128 users and 6.85 Gbytes disc storage (later to be increased to 9.14 Gb)
- Support for HP discs, tapes, and printers
- HP-UX operating system, a superset of AT&T's System V Interface Definition (Issue 2, Volume 1), SVVS (System V Verification Suite) compliant, with over 200 utilities from AT&T's System V.2 and Berkeley 4.2 BSD enhancements, as well as added enhancements such as Native Language Support (Internationalization), Real-Time features and Powerfail Recovery capabilities.

- Support for:
    - C, FORTRAN 77, and Pascal programming languages with optimizing compilers
    - COBOL application development environment
    - ALLBASE network and relational database management system
    - HPtoday, a fourth-generation language and more, for transaction-oriented and data-management application development
    - Starbase graphics software based on evolving ANSI and international standards
    - AdvanceNet Networking solutions
    - ARPA/Berkeley Network Services
    - X Window System, a network-compatible, configurable window system
- Remote console capability for invoking diagnostics and system reset
- Optional I/O Expander Bay

## HP Precision Architecture

The HP 9000 Model 840S utilizes HP Precision Architecture to achieve high performance and reliability at a low cost. Precision Architecture embodies the principles of Reduced Instruction Set Computing (RISC), a design approach leading to greatly simplified computers that are optimized to provide the highest performance for a given integrated circuit technology. In addition to offering higher performance, the inherent simplicity of HP Precision Architecture means lower cost and higher reliability because machines can be manufactured with fewer components.

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*UNIX is a registered trademark of AT&T in the U.S. and other countries.

At the core of HP Precision Architecture is an instruction set containing 140 carefully selected, fixed-format instructions. Because the instruction set is simple, instructions can be hardwired directly in the central processing unit (CPU). This eliminates the need for microcode and the necessity to decode complex instructions. HP Precision Architecture utilizes a Load/Store design and register-to-register operations to minimize relatively slow access to cache and main memory. To enhance performance further, Optimizing Compilers are used to schedule instructions and manage the instruction pipeline. With hardwired control, a Load/Store design, and Optimizing Compilers, instructions are executed on almost every clock cycle. Single-cycle execution accounts for much of the superior performance of HP Precision Architecture compared with traditional architectures.

HP Precision Architecture also incorporates many other features unrelated to RISC which greatly enhance its capabilities, such as support for multiprocessors and coprocessors, extended virtual addressing, and a memory-mapped I/O subsystem. These features will be described in more detail in this data sheet.

## System Organization

The processor communicates with memory and I/O via the Central Bus (CTB). The Central Bus provides a 32-bit data-path and can support sustained data-transfer rates of to up to 18.6 Mbytes/second. The CTB is interfaced to a 16-bit wide Channel I/O Bus via a CIO Adapter. The Channel I/O Bus supports I/O interfaces to peripheral devices and data communication links.
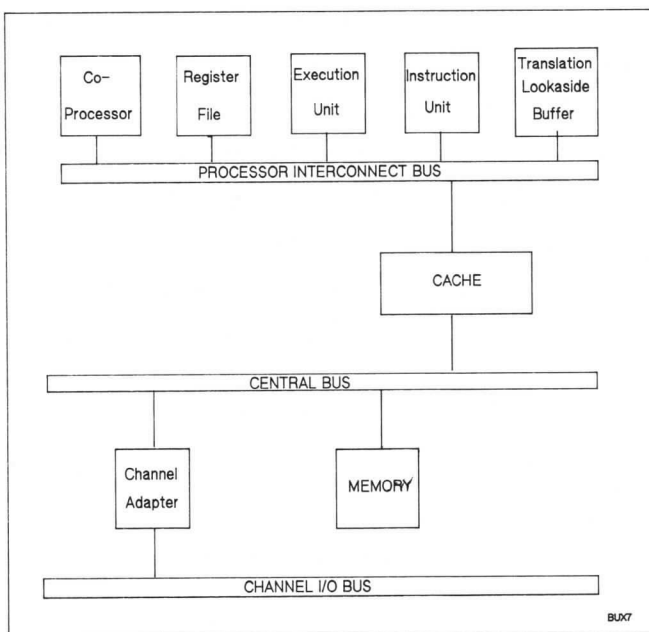


## The Model 840S Processor

The Model 840S processor is a five-board set (including the Floating Point Coprocessor) implemented with high-speed Schottky TTL logic. With hardwired control and a three-stage instruction pipeline, the Model 840S is capable of executing up to one instruction with every 125-nanosecond clock cycle. Separate Instruction and Execution Units facilitate pipelining and promote the efficient parallel use of processor resources.
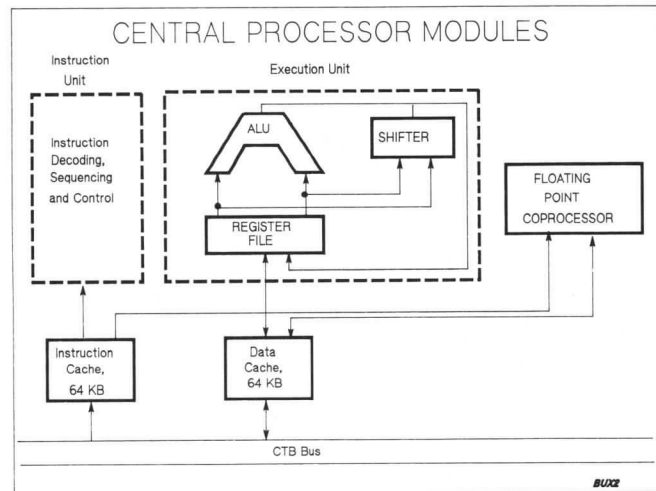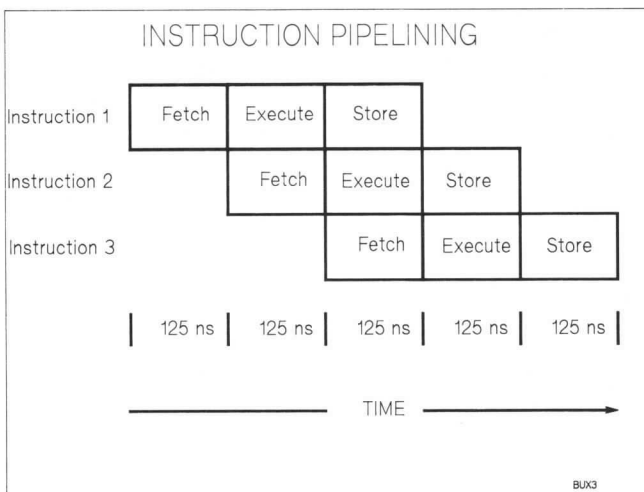


## Caches

A total of 128 Kbytes of high-speed CPU cache is utilized on the Model 840S. Utilization of separate instruction and data caches, each 64 Kbytes, allow the two to operate in parallel, thus increasing processor efficiency and providing higher performance.

Both the instruction cache (I-cache) and the data cache (D-cache) are one-way associative (direct mapped), and are organized as sets of 4096 cachelines, with 16 bytes per cache line. The instruction cache is read-only, as code is typically assumed to be non-modifiable. A write-to cache management scheme is utilized with the data cache. Modified data in the cache is written to main memory only when the processor requires other data to be in that cache location, when a Direct Memory Access (DMA) operation is performed within that data area, or upon a power fail.

## Instruction Pipelining

The Model 840S is pipelined at the instruction level, such that three instructions can be operated on simultaneously. The instruction pipeline consists of three 125-nanosecond stages. During the first stage, the instruction is fetched from the I-cache and decoded. The specified function or calculation is performed during the second stage, and in the third stage the result of the calculation is saved to a CPU general purpose register. Excepting penalties for cache misses, etc., the net effect is that one instruction completes with every 125-ns CPU cycle.



INSTRUCTION PIPELINING

| | Fetch | Execute | Store | | |
| Instruction 1 | Fetch | Execute | Store | | |
| Instruction 2 | | Fetch | Execute | Store | |
| Instruction 3 | | | Fetch | Execute | Store |

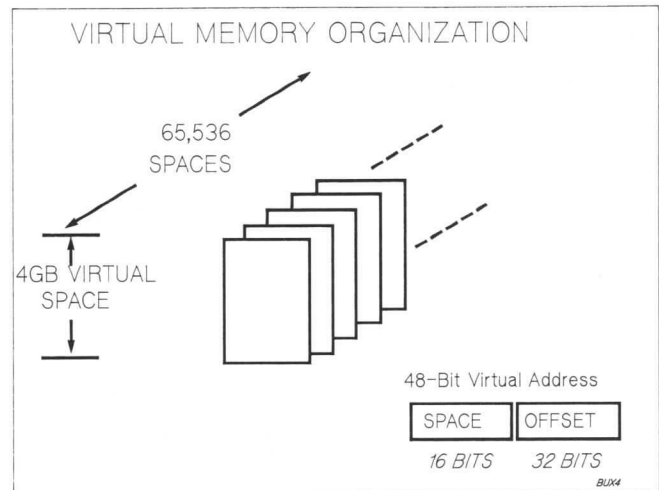125 ns | 125 ns | 125 ns | 125 ns | 125 ns

TIME

BUX3

## Floating Point Coprocessor

Single-precision and double-precision floating point calculations are performed by the Floating Point Coprocessor. The coprocessor significantly decreases the time required to perform floating point calculations. The Floating Point Coprocessor and the CPU can operate in parallel, thus allowing for increased performance in applications which are computation intensive.

## Virtual Memory Management

Virtual Addresses on the Model 840S are 48 bits in length, ensuring sufficient expandability to meet growing software needs. Virtual Memory is divided into a set of 65,536 spaces, with each space four Gbytes in length. Spaces are further divided into fixed-length two-Kbyte pages, with a given page holding either data, code, or both. A single data structure can be up to one Gbyte in length and can span multiple spaces.



VIRTUAL MEMORY ORGANIZATION

65,536 SPACES

4GB VIRTUAL SPACE

48-Bit Virtual Address

| SPACE | OFFSET |
| 16 BITS | 32 BITS |

BUX4

## Virtual Address Translation

Virtual-to-Physical address translation is done by Translation Lookaside Buffers (TLBs), which cache recently-accessed virtual page translations, and convert the 48-bit virtual address into a 27-bit physical address. The Model 840S TLB holds translations for 4096 virtual pages and is split into a 2048-entry instruction TLB and a 2048-entry data TLB to allow for parallel translation of instruction and data addresses. Page-level access protection is provided on the Model 840S, and the TLB hardware supports protection mechanisms to ensure that the currently executing process has sufficient authorization to perform the requested data, code, or I/O access.

## Memory Subsystem

The Model 840S includes 8 Mbytes of ECC memory, expandable up to 96 Mbytes in different increment options. The memory subsystem uses 256 Kbit or 1 Mbit dynamic RAMs. Main memory is backed up such that if AC power is lost, and restored within 15 minutes, the operating system is automatically restarted and processing can resume without data loss.

The internal memory word-size is 39 bits, with 32 data bits plus seven bits for error detection and correction. Single-bit memory errors are automatically corrected. Double-bit errors are automatically detected, causing an interrupt or a high-priority machine check. Overall, the ECC memory of the Model 840S guarantees high performance and high availability.

## I/O Subsystem
## I/O Buses

The Model 840S SPU and the optional I/O Expander both contain one general-purpose Channel I/O (CIO) bus. These 16-bit buses are used for connection of peripheral devices and data communication cards. The SPU CIO has 10 available I/O slots, two of which are used for included HP-IB and multiplexer interfaces. The I/O Expander CIO has 16 available slots.

## The I/O Manger

Each Channel I/O Adapter interfaces the central system bus to the CIO bus, synchronizing their differing speeds and bandwidths. The CIO Adapter manages Direct Memory Access (DMA) transfers between CIO interfaces with their associated peripherals and main memory. Because the CIO Adapter accomplishes this function with little CPU intervention, interrupting only to signal completion of DMA transfer, it leaves the CPU free to perform other operations during I/O. Large blocks of data can be transferred to/from main memory at rates of up to five Mbytes per second with negligible CPU overhead.

## Peripheral Connection

Discs, tapes, printers, and plotters are connected via an HP-IB channel which supports the 8-bit wide, IEEE-488 standard Hewlett-Packard Interface Bus (HP-IB). Each HP-IB channel supports up to four high-speed devices.

Six-channel multiplexers are available for workstations, serial printers, and other serial devices.

## System-to-System Data Communications

The Model 840S connects to other HP 9000 systems via an IEEE 802.3-compatible Local Area Network (LAN) provided in the LAN/9000 Series 800 Link product. Higher-level Network Services are supported by the NS/9000 Series 800 software. Together, these software products support Remote File Access (RFA) between HP-UX-based HP 9000 systems, Network File Transfer (NFT), and the Network Interprocess Communication (NET IPC) within the HP 9000 Series 800 family.

In addition to LAN communication, the Model 840S can communicate with other UNIX-based systems via one or more multiplexer channels and hardwired modem links using the uucp capability of the HP-UX operating system. The uucp capabilities include file transfer, remote command execution (uux), and terminal emulation (cu).

ARPA/Berkeley networking services based on the TCP/IP protocol are also available.

IBM communications are supported via SNA 3270 products using an HP 9000 Series 300 on a LAN as a gateway. The Series 300 can also emulate IBM batch terminals of type RJE 2780/3780. A Series 800 computer can utilize a 300 in this mode using the virtual terminal capacity of the ARPA Services ("Telnet").

## SPU Environmental Specifications
### Temperature

**Operating:** 0° to 55°C (32° to 131°F).

**Non-operating:** −40° to 70°C (−40° to 158°F)

### Relative Humidity

5 % to 95 % at 40°C (104°F), non-condensing.

### Altitude

**Operating:** To 4.6 km (15,000 ft)

**Non-operating:** To 15.3 km (50,000 ft)

### Vibration and Shock

HP 9000 Model 840S Systems are type-tested for normal shipping and handling shock and vibration. Contact the factory for review of any application that requires operation under continuous vibration.

### Acoustics

65 dB (A) Sound Power

### Physical Characteristics

**Dimensions**
1000 mm (39.4 in.) high, 600 mm (23.6 in.) wide, 970 mm (38.0 in.) deep.

**Weight**
160 kg (382 lb)

**Ventilation**
Forced air cooling where air flows from top to bottom.

## Electrical Specifications
### AC Power Input

**Voltage/Frequency:**
208 to 240 V AC, 47.5 to 66 Hz

**Maximum Power Required:** 1350 W.

**Maximum Operating Current:** 13A.

DC Current available and required for I/O Interfaces and Accessories. The Model 840S system power supply provides enough current and power for any combination of I/O interfaces or other plug-in cards that can be installed in the system's card cage.

## Regulatory Compliance
### Safety

UL Listed, CSA Certified Compliant with IEC 380/415

## Electromagnetic Interference

Complies with FCC Rules and Regulations, Part 15, Subpart J, as a Class A computing device. FTZ licensed as a Level A computing device.

# System Software

Below are listed software products currently available for the HP 9000 Model 840S. This list will be expanded in the near future as development and testing of additional software products continues.

### Operating System

HP-UX: the HP-UX Operating System is compatible with AT&T System V, Release 2, and includes HP Added Value. This Added Value includes the following enhancements:

– Real time features
– The Device I/O Library (DIL)
  for instrument control
– Native Language Support (Internationalization)
– Powerfail Recovery capabilities

### Data communications

LAN, NS, ARPA and IBM 3270 Gateway/SNALink are all supported on the Model 840S.

### Languages

HPtoday: HPtoday is a Fourth Generation Language and much more. HPtoday integrates all of the facilities needed to define, test and maintain applications into a single cohesive language.

COBOL: The LEVEL II COBOL/ET* compiler complies with the ANSI X3.23-1974 COBOL standard and the current X/OPEN definition for COBOL (portability guide issues I and II).

The portable C compiler is the de facto industry standard. Compatibility with the ANSI C standard, which is in the process of being formulated, will be provided soon after the standard is defined.

HP Pascal is a superset of the ANSI/IEEE 770X3.97-1983 and ISO 7185-1983 standards for Pascal.

HP FORTRAN 77 is a superset of the ANSI FORTRAN'77 standard and includes MIL-STD-1753 extensions and other frequently offered extensions.

### Information Management

ALLBASE: In a single database management system, ALLBASE provides both a network model HP IMAGE interface and an industry standard, SQL-compatible, relational model interface.

ALLBASE/HPtoday: HPtoday provides a high-productivity, application development environment which can access an HP SQL database.

HP Visor: With HP Visor, users of the HP SQL interface to ALLBASE can quickly and easily perform ad hoc queries and generate reports.

### Graphics

The Model 840S supports several graphics packages for development of sophisticated graphics applications based on industry graphics standards. The Starbase Graphics Library provides high performance graphics based on the evolving Computer Graphics Interface standard from ANSI. HP GKS implements the Graphics Kernal System standard from ANSI and ISO. X-Window supports construction of window-based user interfaces across networked systems and is based on a multi-vendor de facto standard. Display List supports hierarchical display lists for modeling of graphics data. For migration of existing applications based on DGL and AGP, a DGL/AGP Library package is provided.

The Model 840S also provides advanced bit-mapped graphics capabilities when configured with their respective Solid Rendering Display Subsystems. The Model 840S implements state-of-the-art graphics in hardware and firmware to provide high speed performance for high end graphics applications.

# Supported Peripherals
## Supported Terminals

HP 2392A Display Terminal**

HP 2393A Graphics Terminal

HP 2394A Data Entry Terminal

HP 2397A Color Graphics Terminal with 35741A Monitor

HP 45711A Portable Plus Computer

HP 45610B Touchscreen Terminal

HP 45850A Touchscreen II Terminal

HP 45851A Touchscreen II Personal Computer

HP 72425A VECTRA PC (req. 35731A or 35741A)

HP 72435A VECTRA PC (req. 35731A or 35741A)

HP 72445A VECTRA PC (req. 35731A or 35741A)

HP 9807A INTEGRAL Personal Computer

HP 98561A Model 310 System Processor Unit (req. 35731A, 35741A, 98791A or 98782A monitor)

HP 98561B Model 320 System Processor Unit (req. 35731A, 35741A, 98791A or 98782A monitor)

HP 98562A Model 330 System Processor Unit (req. 35731A, 35741A, 98791A or 98782A monitor)

HP 98562B Model 350 System Processor Unit (req. 35731A, 35741A, 98791A or 98782A monitor)

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* LEVEL II COBOL/ET is a trademark of Micro Focus Limited.
** Supported as system console with option 512.

## Supported Discs

HP 7933H 404 MB CS/80 Fixed Disc

HP 7935H 404 MB CS/80 Disc Removable Media

HP 7936H* 307 MB CS/80 Fixed Disc

HP 7937H* 571 MB CS/80 Fixed Disc

HP 7937FX* 571 MB AMUX Fixed Disc

HP 7957A** 81 MB CS/80 Fixed Disc

HP 7958A** 130 MB CS/80 Fixed Disc

HP 7914CT 132 MB CS/80 Fixed Disc with CTU backup

HP 7914P/R 132 MB CS/80 Fixed Disc with CTU backup

HP 7914ST 132 MB CS/80 Fixed Disc and 1600 cpi Mag Tape Unit, cabinet included

## Magnetic Tape Units

HP 7974A Magnetic Tape Unit

HP 7978B Magnetic Tape Unit

HP 7979A** Magnetic Tape Unit

HP 7980A** Magnetic Tape Unit

HP 35401A Cartridge Autochanger Tape Subsystem

HP 9144A CS/80 Cartridge Tape Subsystem

## Supported Printers

HP 2563B 300 LPM Dot Matrix Line Printer

HP 2564B 600 LPM Dot Matrix Line Printer

HP 2565A 600 LPM Dot Matrix Line Printer

HP 2566B 900 LPM Dot Matrix Line Printer

HP 2567B 1200 LPM Dot Matrix Line Printer

HP 2686A LaserJet Printer

HP 2686A + 300 LaserJet Plus Printer

HP 2684A LaserJet 2000 RS-232C Printer

HP 2934A 200/67/40 cps Office Printer

HP 2932A 200 cps Office Printer

HP 2225D ThinkJet RS-232C Printer

HP 2227A QuietJet RS-232C Printer

HP 2228A QuietJet Plus RS-232C Printer

## Supported Plotters

HP 7440A 8-pen ColorPro Plotter

HP 7475A 6-pen Plotter

HP 7550A 8-pen Plotter with auto sheet feed

HP 7586B 8-pen Roll-Feed Drafting Plotter

HP 7595A 8-pen Draftmaster I Plotter

HP 7596A 8-pen Draftmaster II Plotter

## Supported Data Communications Devices

HP 37212 Intelligent 300/1200 baud modem

HP 92205A Hayes Smartmodem 1200TM

HP 92223A LAN Repeater Kit

## Support Services

A wide range of hardware and software support services is available worldwide for all HP 9000 products. Contact your HP Sales Representative for details on available support services.

## Ordering Information

**Product Number** **Description**

| Product Number | Description |
|---|---|
| 9741A | HP Model 840S SPU package. Includes a CPU, floating point coprocessor, power supply, 8 Mbytes of ECC memory, 16-user HP-UX license, CIO channel, access port (for diagnostics), disc interface, 6-channel multiplexer, installation, and manuals. |
| 19746B or 9741A option 601 | I/O Expander with 16 I/O slots. |

Notice: The information contained in this document is subject to change without notice. Consult your HP Sales Representative for the most current information.

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\* Note that the 7936 and the 7937 are strongly recommended as system discs because of their high capacity and high performance.
\*\* Functionality available at HP-UX Release 1.2. Verify availability with your HP Sales Representative before ordering.

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