

# HP 9000 Series 800 Systems Model 832S

## Technical Data

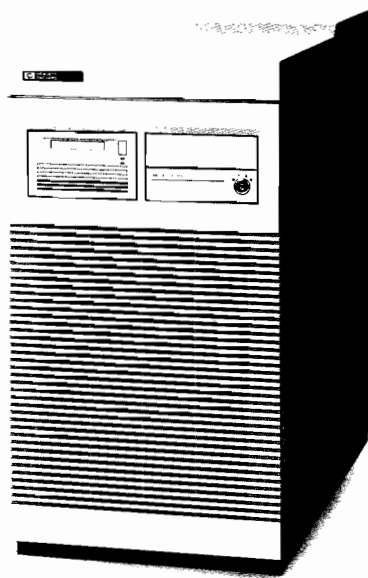
HP 9000 Series 800 Model 832S system offers a highly reliable, cost-effective solution to mid-range computational and data processing needs. Hewlett-Packard has combined HP Precision Architecture (HP-PA) with HP's Very Large Scale Integrated (VLSI) circuit technology to deliver the powerful uniprocessor performance needed in a multiuser, multitasking environment.

The Model 832S's space saving footprint is ideal for office environments. This fully integrated system combines the powerful RISC-based processor with high performance, reliable disk and tape drives in a compact desk-side cabinet. Cost-effective, high capacity backup comes standard with the unique Digital Audio Tape (DAT) drive using the DDS® (Digital Data Storage) format. Since the Model 832S has been designed for the office environment, no special flooring or air conditioning is required.

Like all other HP 9000 Series 800 systems, the Model 832S runs the standards-based HP-UX operating system, a superset of AT&T's

UNIX® System V Interface Definition (SVID). HP-UX provides an excellent environment for both compute intensive and transaction-based processing. Since the Model 832S is compatible with other HP 9000 Series 800 systems, a multitude of business solutions are available making it an ideal computing system for the small to medium sized businesses, departments, and remote office locations.

Figure 1. HP 9000 Series Model 832S



## HP 9000 Series 800 Integrated Midrange System

### Features

- compact desk-side package with integrated disk and tape drives
- Single-chip VLSI central processing unit (CPU) utilizing HP Precision Architecture
- 90 percent multiuser performance of the HP 9000 Model 835S
- 128-Kbyte high-speed CPU cache
- high-performance floating-point coprocessor
- high-speed HP Precision Bus
- 16-Mbytes ECC memory standard, expandable to 64-Mbytes
- up to 2.68 Gbytes of internal disk storage and up to 8.0 Gbytes of total disk storage
- high-capacity backup with integrated 1.3 Gbyte Digital Audio Tape drive
- 16-user, HP-UX operating system preinstalled on disk
- automatic restart after power failure\*
- support for HP disks, tapes, and RS-232C printers

\*AutoRestart not supported with DAT drive.

**Table 1. HP 9000 Series 832S system at-a-glance**

<b>Processor</b>	HP-PA
<b>MIPS**</b>	12
<b>IC technology</b>	NMOS
<b>CPU frequency (MHz)</b>	30
<b>Memory</b>	16 - 64 Mbytes
<b>Internal disk storage</b>	304 Mbytes - 2.68 Gbytes
<b>Maximum disk storage</b>	8.0 Gbytes
<b>Cache size</b>	128 Mbytes

\*\*Performance data is projected. Please see HP-UX 7.0 Performance Brief for detailed performance data.

## HP Precision Architecture

The HP 9000 Series 800 computer systems use HP Precision Architecture to provide high performance and reliability at a low cost.

HP-PA is built upon Reduced Instruction Set Computing (RISC), a design approach that delivers greatly simplified computers that are optimized to provide the highest performance for a given integrated circuit technology. The inherent simplicity of HP-PA means machines can be implemented with fewer components to achieve higher reliability.

At the core of HP-PA is an instruction set containing 140 carefully selected, fixed format instructions. Because the instruction set is simplified, instructions can be hardwired directly into the CPU. Hardwiring eliminates microcode and the necessity to decode complex instructions.

HP-PA utilizes a Load/Store design and register-to-register operations to reduce the number of memory accesses. To further enhance performance, optimizing compilers schedule instructions and manage the instruction pipeline. With hardwired control, a

Load/Store design, and optimizing compilers, instructions can be executed on virtually every clock cycle. Single cycle instruction execution accounts for much of the superior performance of HP-PA.

## VLSI technology

HP-PA was designed to provide user benefits independent of the particular semiconductor technology implementation. HP's use of NMOS III VLSI technology for the Model 832S processor allows the entire CPU to be integrated onto a single chip. This high performance HP technology has allowed the entire processor including the cache, Translation Lookaside Buffer (TLB), and floating-point coprocessor to be implemented on a single printed circuit board. HP's reduced complexity means fewer components and higher reliability to you, all at a lower cost.

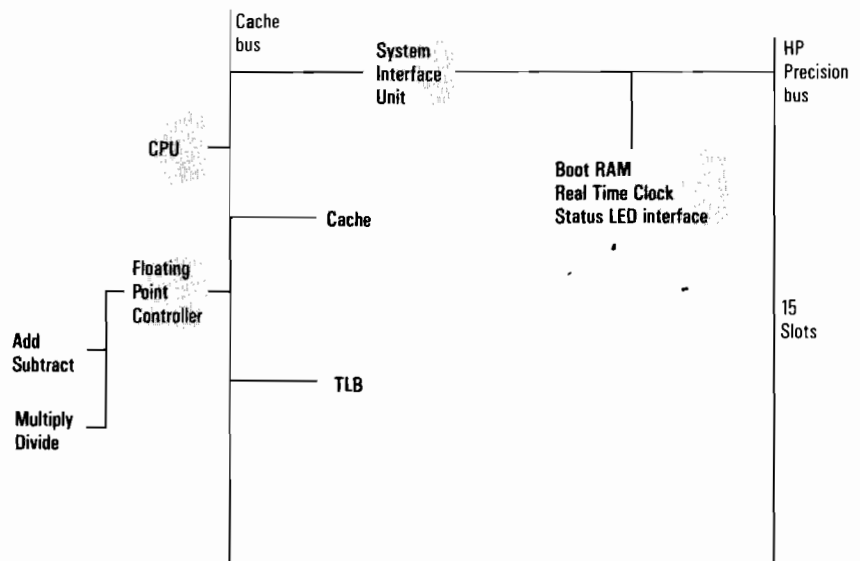
## System organization

The processor communicates with memory and I/O via the HP Precision Bus (HP-PB). The HP-PB synchronously transfers processor, memory, and I/O data over a 32-bit data path. Data is transferred at a maximum sustained throughput speed of 21 Mbytes/sec. Communication between the HP-PB and the processor is handled by the System Interface Unit (SIU). The HP-PB backplane has 16 slots and interconnects the processor, memory, and I/O slots.

## System processor

The processor for the HP 9000 Model 832S resides entirely on one printed circuit board. The Model 832S processor module contains several VLSI chips including the CPU, the control unit for the Translation Lookaside Buffer (TLB); two control units for the cache; the System Interface Unit (SIU); and a Floating-Point Coprocessor (FPC), which comes standard. The processor module also contains the TLB,

**Figure 2. HP 9000 Model 832S SPU organization**



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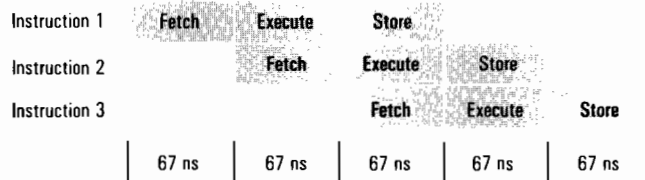
which provides virtual memory capability, and the cache, which minimizes the need to access system memory.

**Caches**

The use of a cache enhances system performance by minimizing CPU requests for instructions or data stored in memory. By storing frequently used instructions and/or data in a high speed cache memory instead of relying on system memory, the CPU can execute instructions or process data without using the System Interface Unit (SIU) and the Precision Bus (PB). The Model 832S uses 128-Kbytes of two-set associative, combined instruction and data cache.

The cache efficiently operates in a write-back mode, which means that the cache writes modified data to system memory only when the processor needs the cache location for other data. The operating system flushes the cache location due to a direct memory access operation and in the event of a power failure. Parity checking protects the cache, and a parity error triggers a recovery algorithm that resolves most failures. This efficient cache operation maximizes system throughput.

**Figure 3. Instruction pipelining**



**Instruction pipelining**

Instruction pipelining is a technique that overlaps instruction processing so that one instruction can begin to execute before the previous one has finished. The efficient use of pipelining can greatly increase system performance.

The Model 832S uses staged instruction pipelining that allows operation on three instructions simultaneously. The net effect is that one instruction completes essentially every 67 nanoseconds.

**Floating-point coprocessor**

Single 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

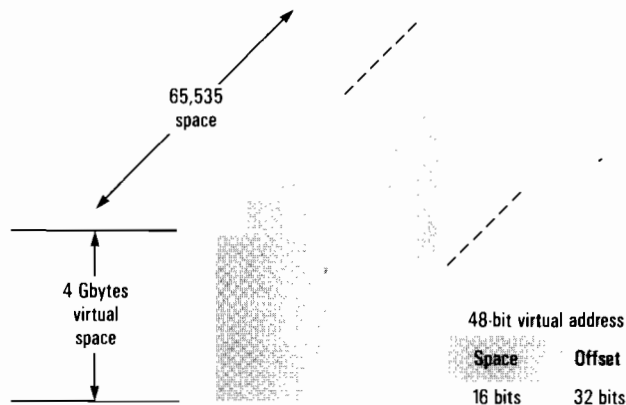
Floating-Point Control (FPC) unit allows floating-point operations to overlap with CPU operations, as long as there is no interlocking data. This ability to operate in parallel allows for increased performance in applications that are compute-intensive.

The FPC comes standard on the Model 832S.

**Virtual memory**

Virtual addresses are 48 bits in length, ensuring ample expandability to meet growing software needs. Virtual memory is divided into 65,535 spaces with each space 4-Gbytes in length. Spaces are further divided into fixed-length 2-Kbyte pages, with a page holding code or data. A single data structure can be up to 1-Gbyte in length. The virtual memory scheme can accommodate memory of more than 260,000 Gbytes.

**Figure 4. Virtual memory organization**



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The Translation Lookaside Buffer (TLB) performs translations from virtual addresses to physical addresses. The TLB stores recently accessed virtual page translations and converts the 48-bit virtual address into a 29-bit physical address. The TLB holds translations for 4096 virtual pages (enough room to map 8-Mbytes of system memory). The memory for the virtual pages is split into two parts, half for an instruction TLB and half for a data TLB. This split allows parallel translation of instruction and data addresses.

All Series 800 high-end systems provide page-level access protection. The TLB hardware supports protection mechanisms to ensure the currently executing process has sufficient authorization to perform the requested data, code, or I/O access. The TLB also uses parity checking which signal the CPU when errors are found.

**Memory subsystem**

The Model 832S includes 16-Mbytes of main memory standard and is expandable up to 64-Mbytes in 8-Mbyte increments. The memory subsystems use 1 Mbit, fast page mode dynamic RAMs.

The internal memory word size is 72-bits, with 64-bits for data and 8-bits for error detection and correction. Rare double bit errors are automatically detected causing an interrupt that is a high priority machine check. Single bit errors are automatically corrected. The ECC (Error Checking and Correcting) memory assures high memory performance and availability.

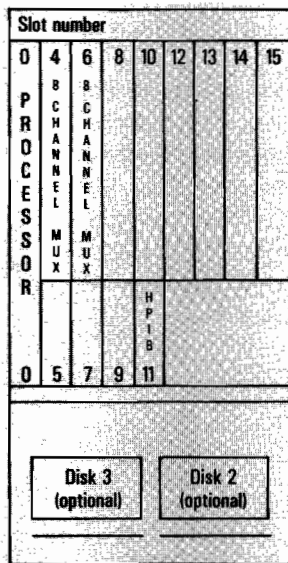
In the event of a power loss, the powerfail battery backup protects the system. If AC power is lost, the state of the processor is secured in memory for at least 15 minutes. Maximum storage time

depends on the amount of memory in the system. If power is restored within this limit, the system restores itself and resumes processing.

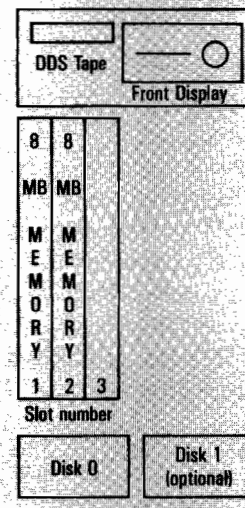
**Compact desktide packaging**

The Model 832S is the first midrange HP 9000 Series 800 system available in an integrated package. This compact system includes a processor with one to four embedded disk drives and one Digital Audio Tape (DAT) drive. This package, which measures 75 cm high, 37.5 cm wide, and 71 cm deep, has been uniquely designed to hold an entire modular system in a very small amount of space, maximizing the efficiency of office or computer room space.

Figure 5. HP9000 Model 832S card cage



Rearview



Frontview

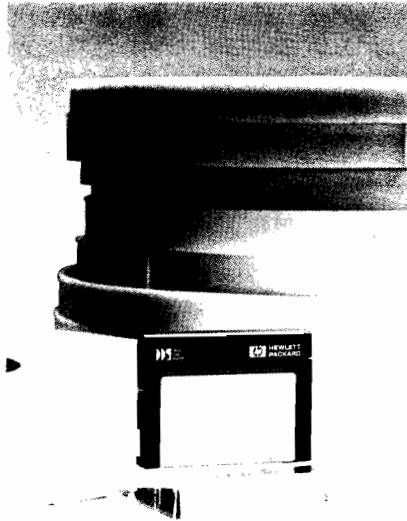


### Digital data storage

Cost-effective backup for the Model 832S is provided with HP's Digital Audio Tape (DAT) unit which uses the Digital Data Storage (DDS) format. DAT is the latest development in the use of helical-scan recording technology similar to that used in analog Video Cassette Recorders (VCRs) but enhanced to provide digitally encoded, high quality data storage. The DAT stores data on tape using the Digital Data Storage (DDS) format. The DDS backup unit integrated in the Model 832S system stores up to 1.3-Gbytes of data on a single DAT cassette, measuring only  $7.3 \times 5.4 \times 1.05$  cm. This large capacity storage on a single DAT cassette eliminates the need for operator intervention and offers a convenient and compact storage medium. High data reliability is achieved through read-after-write, additional third-level error detection, and correction circuitry. The DDS tape drive also offers:

- 1.3-Gbyte capacity on a 120-minute (60m) tape
- typical transfer rate of 11-Mbytes/minute
- a large 512-Kbyte data buffer to maintain host transfer rate
- automatic error detection and correction
- three levels of Error Correcting Code (ECC)
- standard 5.25-inch form factor

Figure 6. Digital Audio Tape cassette



### Disk storage

The Model 832S package takes advantage of the state-of-the-art disk storage devices by integrating up to four disk drive units into the compact package. These internal storage devices offer reliable, high capacity, high performance mass storage.

Excellent performance and superior reliability is accomplished with the use of a sample servo system in each drive that provides fast head positioning with the precise accuracy required by high track densities. This type of mechanical control system coupled with one of HP's sophisticated controllers provides a high degree of data integrity. This also improves reliability by making the drive less susceptible to the effects of environmental stress. The MTBF of the internal disk mechanisms is 100,000 hours.

The 304-Mbyte 5.25-inch and the new 670 Mbyte 5.25 disk drive mechanism will be supported in

the Model 832S package. Maximum disk capacity of 8.0-Gbytes is achieved by augmenting the internal storage with external standalone disk subsystems.

### I/O subsystem

The HP 9000 Model 832S backplane has 16 HP Precision Bus slots available for the processor, memory, and I/O cards. One slot is utilized by the processor card, leaving 15 slots for memory and I/O cards.

In compliance to the Eurocard form factor, the HP-PB was designed to accommodate single-high (3U) and double-high (6U) I/O cards. The 832S has 4 single-high and 11 double-high card slots. Each double-high card slot can support one double-high card or one single-high card.

As shown in Figure 5, the Model 832S base system comes with two 8-channel mux cards, one HRIB interface card, and two 8-Mbyte memory cards, leaving 10 available slots.

The single-high cards that require a single-high slot include the 8-channel mux, HP-IB, GPI0, 8-Mbyte memory cards, and the X.25/9000 Model 832 Link.

The double-high card that requires a double-high slot is the LAN/9000 Model 832 Link.

## Peripheral connections

Disks, tapes, and plotters are connected via an HP-IB channel card which supports the 8-bit wide IEEE-488. Each HP-IB channel card supports up to four high speed peripheral devices or 14 low speed devices.

RS-232 eight-channel multiplexers are available to connect workstations, terminals, modems, serial printers, and other serial devices.

LAN/9000 Model 832 Link provides all the necessary hardware and software to interface between an IEEE 802.3 or Ethernet LAN.

X.25/HP 9000 Model 832 Link provides all the necessary hardware and software to interface between an HP 9000 Series 800 and an X.25 public data network.

## System software features

All HP9000 Series 800 and Series 600 computers are based on the standards-based multiuser, multi-tasking HP-UX. HP-UX provides object code compatibility among these computers and source code compatibility with Series 300 systems. The operating system is based on AT&T's UNIX® System V Release 3.0, and passes AT&T's System V Interface Definition (SVID 2). It also incorporates

selected features from U.C. Berkeley Software Distribution 4.3 (BSD). In addition, HP-UX conforms to \*X/Open™'s Portability Guide Issue 2 (XPG2), the IEEE's POSIX 1003.1, and the Federal Processing Specification (FIPS) 151-1. Compliance with these standards facilitates portability of applications developed on other standards-based operating systems.

HP-UX meets the growing need for highly available, powerful systems by supporting a disk mirroring product\*\* for environments where no data can afford to be lost due to disk failures. In addition, HP-UX supports a diskless

computing environment, which significantly reduces costs and increases the information shared by different users over the LAN.

HP's standards-based operating system also contains features intended to fulfill the Department of Defense C2 Trusted System Requirements. Finally, HP-UX supports all the popular languages in the computing world and a rich assortment of tools for Computer-Aided Software Engineering (CASE), Networking Database Management, and Graphics. For detailed information on the HP-UX operating system, please see the HP-UX Technical Data Sheet.

\*\*Disk mirroring is not currently supported on Models 808S, 815S and 832S.

**Table 2. Technical specifications**

<b>Electrical specifications</b>			
AC power input voltage/frequency	Nominal	Range	Rated current
	100-120V, 50/60 Hz	90-132 VAC/47-63 Hz	12A
	200-240V, 50/60 Hz	180-264 VAC/47-63 Hz	6.3A
Power dissipation	1790 BTU/hr (typical), 3410 BTU/hr (maximum)		
<b>Environmental specifications</b>			
Temperature	Operating: +5° to +40°C (41° to 104°F) Non-operating: -40° to +65°C (-40° to 149°F) Non-operating: -40° to +45°C (-40° to 113°F) for tape media		
Maximum rate of temperature change	20°C (68°F)/hour without DDS 10°C (50°F)/hour with DDS		
Relative humidity	Operating: 20% to 80%, non-condensing Non-operating: 5% to 80%, non-condensing		
Maximum rate of humidity change	30% RH/hour		
Altitude	Operating: To 3.0 km (10,000 ft) Non-operating: To 15.0 km (50,000 ft)		
<b>Regulatory compliance</b>			
Electromagnetic interference	Complies with FCC Rules and Regulations, Part 15, Subpart J, as a Class A computing device. Manufacturer's Declaration to German FTZ 1046. Registered with Japanese VCCI.		
Safety	UL listed, CSA certified, compliant with IEC 950		
<b>Physical characteristics</b>			
Dimensions	Height: 750 mm (29.5 in) Width: 375 mm (14.8 in) Depth: 710 mm (27.9 in)		
Weight	110 kg (243 lbs)		
Acoustics	5.8 bels (A) sound power below 30°C		
ESC, power transients, vibrations	Designed for office and factory floor environments		



**Table 3. Supported peripherals**

Terminals	Disk drives	Magnetic tape drives	Printers	Plotters	Data communication devices
HP C1001A/G/W*	HP 7936H	HP 7979A	HP 2225D	HP 7440A	HP 2334A
HP C1002A/G/W	HP 7937H	- Opt. 800	HP 2227A	HP 7475A	HP 28650A
HP C1003A/G	HP 7957B	HP 7980A	HP 2228A	HP 7550A	HP 28651A
HP C1004A/G/W	HP 7958B	- Opt. 800	HP 2235A/B/C/D	HP 7570A	HP 36944A
HP C1006A/G/W	HP 7959B	HP 7980XC	HP 2276A	HP 7595A	HP 37212B
HP C1007A/G/W	HP 7962B	HP 9144A	HP 2562C	HP 7596A	HP 40299A
HP 2393A	HP 7963B	HP 9145A	- Opt. 049	HP C1600A	HP 92205A/C
HP 2397A	HP 9122C	HP 35401A	HP 2563B	HP C1601A	HP 98189A
HP 3082B	HP 9127A		- Opt. 049	HP 17440A	
HP 700/32	HP 9153C Opt. 040		HP 2564B	HP 7575	
HP 700/X	HP 9262B		- Opt. 049	HP 7576	
HP C1010T	HP 9263B		HP 2566B		
HP C1010C	HP 97902B		- Opt. 049		
HP C1010J	HP 97903B		HP 2567B		
	HP 97962B		- Opt. 049		
	HP 97963B		HP 2684A/D/P		
	HP C2203A		HP 2934A		
	HP C2200A		HP 33440A		
	HP 50710A		HP 3630A		
			- Opt. 001		
			HP 2277A		
			HP 2562C		
			HP 41063		
			HP 33447A		
			HP C1200A		
			HP C1602A		

Note: HP 9000 Series 300 computers and HP Vectra personal computers may also be used as terminals on Series 800 systems.

\*Supported as System Console

### Application software

Over 1000 application software packages are available for Series 800 and Series 600 systems. Contact your HP sales representative for information regarding specific applications.

### Supported peripherals

Table 3 contains peripherals supported by the HP 9000 Model 832S multiuser system at the time of publication.

The list of supported peripherals changes as new peripherals are introduced and other peripherals are discontinued. Contact your HP sales representative for more information on currently supported peripherals.

### 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.

### Warranty information

The warranty covering your specific system is determined by the HP Warranty and Installation Terms in effect at the time of purchase. Please contact your HP sales representative for a copy.

For more information, call your local HP sales office listed in your telephone directory or an HP regional office listed below for the location of your nearest sales office.

**United States:**

Hewlett-Packard Company  
4 Choke Cherry Road  
Rockville, MD 20850  
(301) 670-4300

Hewlett-Packard Company  
5201 Tollview Drive  
Rolling Meadows, IL 60008  
(312) 255-9800

Hewlett-Packard Company  
5161 Lankershim Blvd.  
No. Hollywood, CA 91601  
(818) 505-5600

Hewlett-Packard Company  
2015 South Park Place  
Atlanta, GA 30339  
(404) 955-1500

**Canada:**

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(416) 678-9430

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29-21, Takaido-Higashi 3-chome  
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West Tower  
89 Queensway  
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**Greece:**

(01) 68 28 11

**Iceland:**

(01) 67 000

**Ireland:**

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