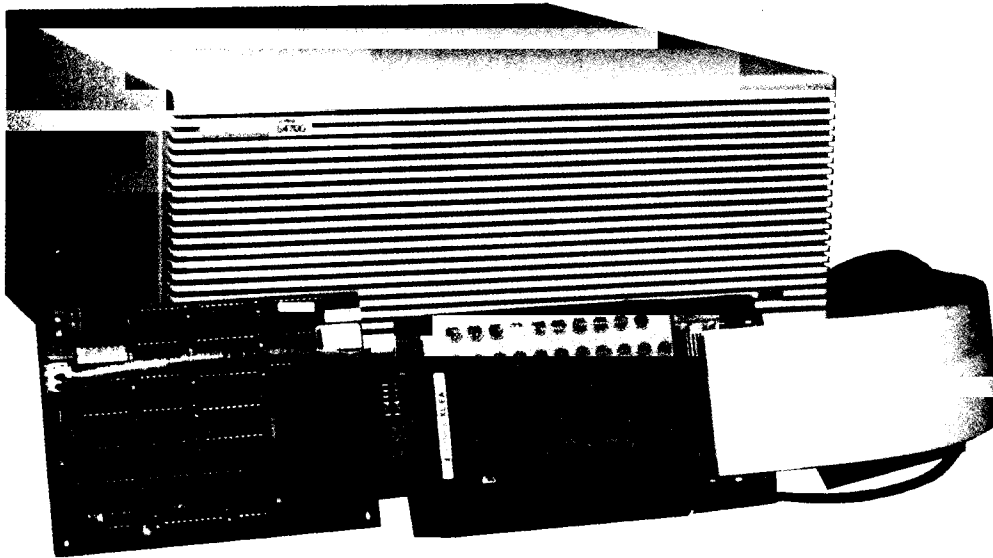


# Microprocessor Emulators

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## Tools for Embedded Software Development

HP 64000 Series



### A Complete Software Debugging Environment

The HP 64000 series development tools compose a comprehensive embedded software development, debugging, and analysis environment. The system continues to meet the increasing demands of software design with powerful tools that complement the emulators and analyzers. The resulting combination of development tools and system integration and analysis tools are integrated under a common user interface and operating environment to create an embedded design system that accelerates the development process.

### Superior Design Tools at a Lower Cost per User

The addition of lower-cost debugging tools, such as processor probes that complement the emulators, allows each team member to have the necessary tools to accomplish his or her part of the task efficiently, at a lower cost per team member than was previously possible. These new lower-cost options also reside under the common user interface that allows software designers to move easily between simulators and debuggers and real-time analysis.

### HP 64700 Series Emulators/Analyzers



#### Real-Time, Transparent Emulation and Analysis

HP 64700 series emulators/analyzers provide real-time, transparent emulation and analysis for popular microprocessors. The HP 64700 series is made up of modular emulation and analysis tools that can be controlled from a terminal, an optional HP 9000 or Sun Motif-style interface, or a Windows-based PC-hosted interface. This choice of interfaces, plus high-speed program download, over LAN, makes for efficient embedded system development.

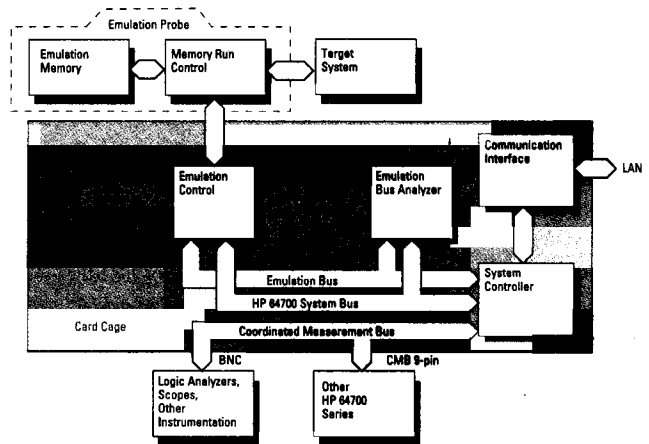
#### High Performance

- Real-time, transparent emulation
- Triggering capabilities in an emulation bus analyzer support eight-level sequencing, time tags, pre-store analysis for establishing software interrelationships
- 1K, 8K, 64K, or 256K trace memory
- PC-hosted real-time C debugger
- Workstation-hosted embedded debug environment
- In a workstation environment, a software performance analyzer card is available for evaluating and improving code performance and efficiency
- An 80-channel emulation bus analyzer available with trace buffer depths of 1K, 8K, 64K or 256K
- Synchronized operation and cross-triggering between multiple emulators for multiple processor designs

- Dual-bus architecture and dual-ported emulation memory to ensure nonstop, real-time emulation
- Fully tested to rugged electrical, temperature, and shock standards to ensure continued reliability and performance
- Meets international requirements for RFI/EMI emissions
- LAN interface provides high-speed, industry-standard communications to PCs or workstations

### Choice of Design Environments

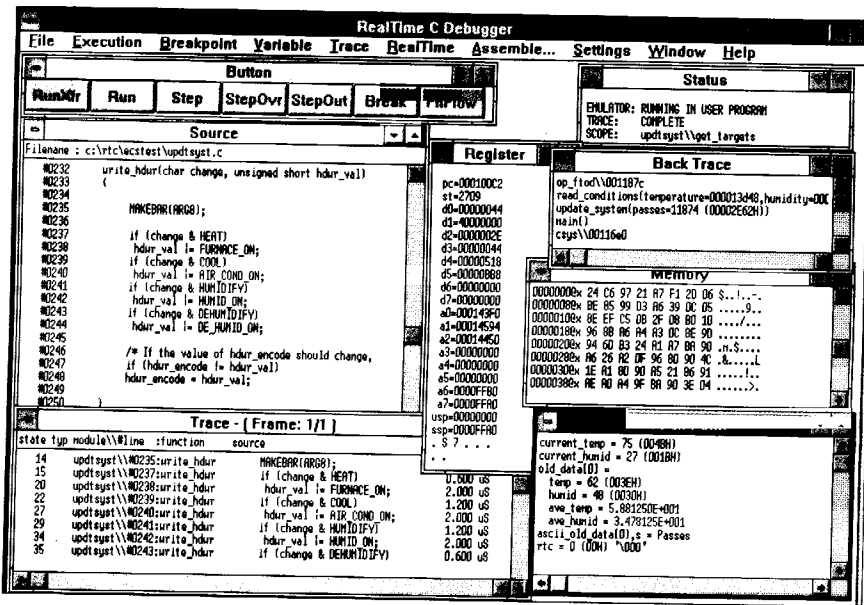
HP 64700 series emulators/analyzers offer several flexible configuration options. These host-independent emulation and analysis vehicles can be controlled from a simple terminal, or the emulator interface can be hosted on an MS-DOS-compatible PC, such as the HP Vectra PC. For large team-oriented or complex designs, the HP 64700 integration environment hosted on MS-DOS-compatible PC, HP 9000, or Sun workstations offers powerful development solutions.



HP 64700 series emulators/analyzers have a dual-bus architecture. This dual-bus architecture gives you maximum transparency by allowing traces to be executed and displayed without halting processor execution.

### Key Literature

HP 64700 Series Development Tools for Embedded Design,  
p/n 5963-5141E



Real-time C debugger for PC-hosted HP 64700 series emulators offers powerful, nonintrusive debugging of embedded C and assembly code. Real-time concurrency allows several views to be active while a target system runs.

### PC-Hosted Environment

The real-time C debugger is an MS-Windows-based, graphical user interface for HP 64700 emulators. It provides a mouse-driven method of controlling emulator functions, making measurements of target system activity, and controlling the state of a target system. The debugger takes full advantage of the HP 64700 emulator's dual-bus architecture to perform many C and assembly debug functions while the target runs at full speed. This means that C debugger functions such as setting breakpoints, display and edit of C variables, and measurement of C program behavior, which traditionally could only be performed when a user program was stopped, can now often be performed without interrupting program execution. Other operations, such as register display and modify are performed with much less intrusion than is possible with traditional debuggers.

This real-time C debugger provides the functions and features expected of a C debugger, as well as the capabilities expected of a traditional emulation interface. It supports a variety of HP emulators for Intel and Motorola processors and popular language tool file formats for those processors such as IEEE-695 and OMF-86. An Ethernet LAN connection to the emulator provides high performance while RS-232C capability is available for a serial connection. The real-time C debugger requires a PC running Windows 3.1, Windows 95 or Windows NT.

### Workstation Interface

Easy-to-use interfaces are available on HP and Sun workstations. These interfaces are Motif-style, including terminal window operation, 3D look-and-feel, pull-down menus, point and click, cut and paste, and pop-up recall buffers and help screens. This interface makes it easy to move about an emulation session with pop-up windows, recall commands, specifications, and file history, reducing the need to remember many commands or file names.

### Emulation Memory

Dual-ported emulation memory in the HP 64700 series emulators runs at maximum processor speeds with no wait states for accurate duplication of target system performance. The dual-ported memory allows emulation displays and modifications of emulation memory without halting the processor during emulation. Memory can be mapped in 256-byte, 512-byte, or 1-Kbyte blocks, depending on the processor, and can be configured as either emulation or target RAM, emulation or target ROM, or guarded memory. The emulator checks for writes to ROM or guarded memory.

### Popular File Formats

Popular absolute file formats are accepted by the HP 64700 series emulators, including Intel OMF-86, OMF-51, OMF-286, OMF-386, and IEEE-695.

### Key Literature

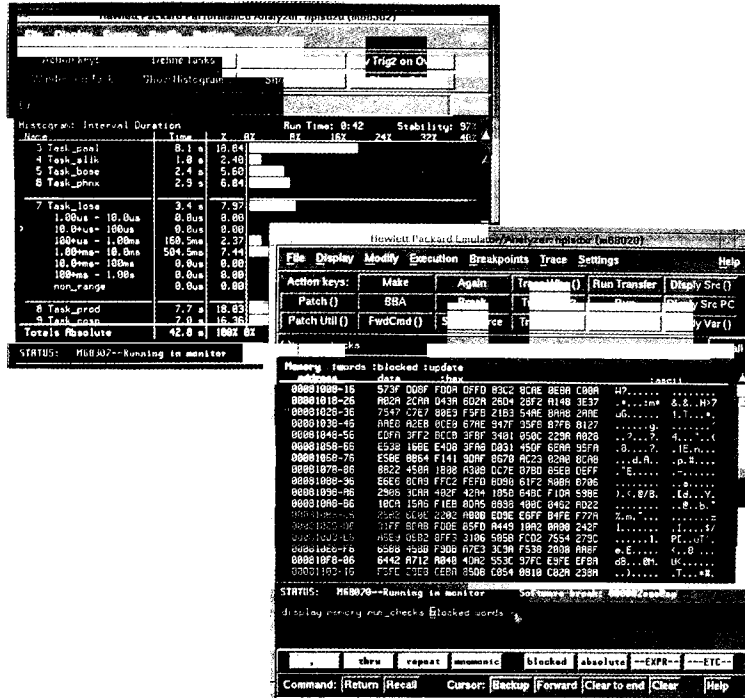
Real-Time C Debugger for PC-hosted HP 64700 Emulators, p/n 5091-7156E  
 HP 64700B Card Cage, p/n 5962-6209E

# Microprocessor Emulators

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## Tools for Embedded Software Development

HP 64000 Series



The graphical user interface combined with the HP Software Performance Analyzer provides a complete, real-time view of program execution.

### 8-, 16-, and 32-Bit Emulation

High-quality, real-time emulators are the core from which HP has evolved support for the microprocessor software development process. Full-speed execution of microprocessor code can be traced and analyzed nonintrusively with or without functional prototype hardware. Emulation of multiple processors makes possible interactive measurements and coordinated execution starts of complex designs.

Emulators provide an essential link between the software development environment and the target system. Programs developed on the HP 64700 development environment are run on the emulation subsystem for real-time debug and analysis. The emulation bus analyzer provides the displays and triggering conditions for the emulator and is the access point for interactive emulation analysis. Processor-run controls in the emulator allow you to single step, display, and modify memory. Modifications and improvements to software are made quickly in the early design phases; emulation gives you the flexibility to experiment before committing a product to firmware.

### Comprehensive Logic Analysis

#### Emulation Bus Analysis

Each HP 64700 series emulator includes an emulation bus analyzer for tracing microprocessor code flow. The analyzer trace depth may be selected to have 1K, 8K, 64K, or 256K states and has abundant resources for solving the most complex system problems. Up to eight hardware resources, each consisting of address, data, and status event comparators, can be combined in several fashions. Those resources can be grouped to establish complex sequential trace specifications using "find A, followed by B..." constructs, up to eight levels deep. A range comparator can be applied to address or data events at any one of the levels. Each event is tagged with an execution time for easy measurement of code execution times. A dual-bus architecture allows all traces to be set up and reviewed without breaking processor execution. A pre-store function allows tracking of relationships between a given software element and one or more other software events that influence that element. For example, pre-store helps pinpoint which of several different tasks accessing a variable is responsible for corrupting it.

Emulation bus analyzer features include:

- Eight levels of sequencing for complex program flow tracking
- Address, data, or status range resources
- Pre-store queue for variable access tracking
- Time tagging for instruction execution measurements
- Choice of 1K, 8K, 64K, or 256K trace memory
- Store qualification resources

### Emulator Probing Accessories

HP's advanced probing and interfacing technology makes it easy to connect HP emulators to your embedded processor designs. Transition boards, flexible extenders and adapters are available from HP to accommodate package types for processors supported by HP emulators. These include PGA, PLCC, PQFP/CQFP and TQFP packages.

HP offers several probing options for connecting the HP 64700 series emulator to your target. HP offers flexible extenders which are devices that allow you to plug into microprocessor sockets that are in tight places like card cages. Transition boards are available which turn a generic device into a processor-specific one. Connection adapters are also available. These devices usually convert the connection from one package type to another. As an example, allowing the connection of a PGA emulator probe into a PQFP target. Please refer to the following list for the appropriate probing scheme for the emulator you're using.

### HP 64000 Embedded Debug Environment

#### Tools of the HP Embedded Debug Environment

##### HP Processor Probes

- Provide debugging capabilities including run control
- Symbolic display and modification of memory and registers
- High-speed code download

##### HP Software Performance Analyzer

- Verify code performance by providing real-time measurements of code execution
- Works with RTOS measurement tool

Each tool provides a different perspective into the operation of embedded code. For example, using the software performance analyzer, you can trigger emulation trace measurements based on real-time code execution time. This makes it easy to determine why an important interrupt did not get serviced in the specified time interval. Emulation trace measurements can pinpoint problems and help direct you to a solution.

For more information on HP processor probes, see 369.

**Flexible Extenders**

Processor Type	Extender
68020 PGA	E3403A
68030 PGA	E3405A
68340 PGA	E3410A
68302 PGA	E3418A
80960SA/SB PLCC	E3419A
68000 PGA	E3420A
80C186XL PLCC	E3422A
80C186XL PGA	E3427A
68040 PGA	E3429A
68360 PGA	E3430A

(for emulator only)

**Emulator Probing Accessories**
**Motorola Microprocessor**

	Package	Emulator	Flexible Extender	Probing Accessory	Comments
MC68000	PGA	HP 64744C	E3420A	—	PGA flexible extender
MC6800/HC001	PLCC	HP 64744D	E3422A	—	PLCC flexible extender
MC68020	PGA	HP 64748D	E3403A	—	PGA flexible extender
MC68020	PQFP	HP 64748D	—	E3404A	PGA to PQFP adapter
MC68EC020	PGA	HP 64748D	—	E3400A	020 to EC020 PGA adapter
MC68EC020	PQFP	HP 64748D	—	E3401A	PGA to PQFP adapter
MC68030/EC030	PGA	HP 64747B	E3405A	—	PGA flexible extender
MC68030/EC030	PQFP	HP 64747B	—	E3406A	PGA to PQFP adapter
MC68040/EC040	PQFP	HP 64783A/B	E3429A	—	PGA flexible extender
MC68040V	PQFP	HP 64783A/B	—	E3440A	040 to 040V adapter
MC68302	PGA	HP 64798C	E5367A	—	PGA adapter kit
MC68302	PQFP	HP 64798C	—	E3437A	PGA to PQFP adapter kit
MC68302	TQFP	HP 64798C	E5336A	—	144-pin TQFP adapter
MC68302	TQFP	HP 64798C	—	E5338A	TQFP flexible extender
MC68LC302	TQFP	HP 64798F	—	E5356A	100-pin adapter kit
MC68EN302	TQFP	HP 64798C	E5336A	—	144-pin TQFP adapter
MC68EN302	TQFP	HP 64798C	—	E5338A	TQFP flexible extender
MC6833x	PQFP	HP 64746J	E3407A	—	PGA to PQFP adapter
MC6833x	PQFP	HP 64782x	E3407A	—	PGA to PQFP adapter
MC6833x	TQFP	HP 64782x	—	E5359A	144-pin PQFP adapter
MC68340	PGA	HP 64751A	E3410A	—	PGA flexible extender
MC68340	PQFP	HP 64751A	—	E3409A	PGA to PQFP adapter
MC68340	TQFP	HP 64751A	—	E5358A	144-pin transition board
MC68360/EN360	PQFP	HP 64780A	—	E5363A	240-pin PQFP adapter
MC68360/EN360	PGA	HP 64780A	E3430A	—	PGA flexible extender

**Intel/Hitachi Microprocessor**

	Package	Emulator	Flexible Extender	Probing Accessory	Comments
I80186	PGA	HP 64767A	E3427A	—	PGA flexible extender
I80186XL	PGA	HP 64767A	—	E3413A	PGA to PQFP adapter
I80186	PLCC	HP 64767A	E3422A	—	PLCC flexible extender
I80C186EA/188EA	PQFP	HP 64767A	—	E3412	PGA to PQFP adapter
I80C186EB/188EB	PQFP	HP 64767B	—	E3414A	PGA to PQFP adapter
I80186EB/188EB/C186	PLCC	HP 64767B	E3419A	—	PLCC flexible extender
I80186XL	PGA	HP 64767A	E3427A	—	PGA flexible extender
I80L186/188EC	PQFP	HP 64767C/CL	—	E3432A	PGA to PQFP adapter
I80C186EC	PQFP	HP 64767C	—	E3424A	PGA to PQFP adapter
I80960SA/SB	PLCC	HP 64761A	E3419A	—	PGA flexible extender
I80386EX	PQFP	HP 64789C	—	E3417A	PGA to PQFP adapter
I80386EX	PGA	HP 64789C	—	E3442A	PGA transition board
H8S/2000	TQFP	HP E3471A	E3471B	—	TQFP flexible extender
H8S/2000	PQFP	HP E3471A	E3471C	—	PQFP flexible extender
H8S/2000	P/TQFP	HP E3471A	E3471D	—	TQFP/PQFP extender
H8/3003	PQFP	HP 64784A	—	64784C	QFP adapter
H8/3002/4X	PQFP	HP 64784A	—	64784D	QFP adapter
H8/300H	PGA	HP 64784A	—	64784E	QFP adapter
H8/3003	PGA	HP 64784A	—	64784F	PGA flexible extender
H8/3002/Rx	PGA	HP 64784A	—	64784G	PGA flexible extender
H8/303x	PGA	HP 64784A	—	64784H	PGA flexible extender
H8/3001	PGA	HP 64784A	—	64784J	PGA flexible extender
H8/3004/5	PGA	HP 64784A	—	64784K	PGA flexible extender

HP 64000 Series

### Software Performance Analysis

Software performance analysis verifies and benchmarks both high-level and assembly-level code, even when they are mixed. The software performance analyzer (SPA) can measure activity generated by your entire program, find the most active modules, determine if they are being called too often, and measure how long any subroutine takes to execute. These measurements show where your optimization effort will yield the greatest benefit.

An additional advantage of SPA is its ability to show convergence when measuring, for example, the duration of a process. SPA calculates a measurement error tolerance level each time additional data is acquired. Best of all, SPA lets you make software performance benchmarks and predictions before any costly hardware is produced.

SPA is closely coupled to the emulation/analysis environment by such features as cross-triggering and an enable/disable window. You can control when data is collected and filter out irrelevant activity.

The software performance analyzer provides overview measurements to aid in evaluating total system effectiveness of programs operating in real time. Global measurements let software designers determine where resources are being used in terms of execution times, memory usage, and interaction traffic. Software performance measurements aid in determining where to focus optimization efforts for maximum effect on system performance.

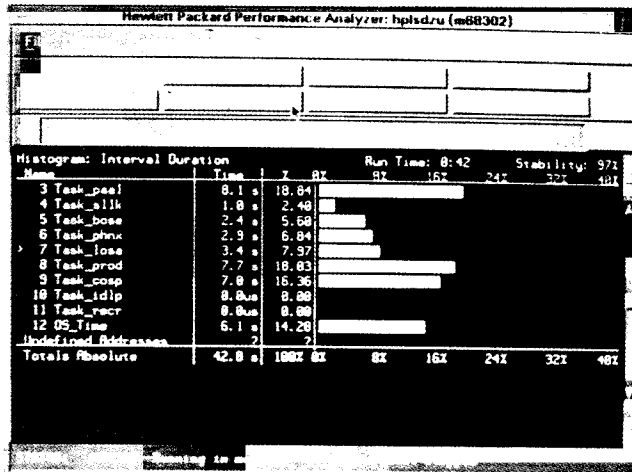
- Monitors up to 254 specified simultaneous events during activity measurements
- Monitors up to 84 simultaneous events in real time for duration measurements
- Supports 16- and 32-bit processors
- Graphical user interface that is compatible with X11/Motif
- Histogram or statistical data list displays
- Statistical data list includes mean, percentage, standard deviation, and maximum and minimum times by either state or time counts
- Hosted on HP 9000 Series 700 workstations and Sun SPARCstations

### HP 64000 Debugger Relationships

HP has strong ties with several embedded software development partners. Our partners offer products including: development environments, optimizing compilers, source code control, graphical browsers and explorers, and source level debugging. These high-performance software products, combined with HP emulators, provide a full suite of tools for every phase of embedded systems design.

#### HP Software Development Partners

- Microtec
- Cadul
- Cygnus
- Diab Data
- Green Hills
- Intermetrics
- ISI
- Microware
- Paradigm
- Pharlapp
- Rational
- SDS
- Tartan Ada
- Thompson Software
- Wind River



Optimize your code using the software performance analyzer and real-time, non-statistical measurements. With this analyzer you can measure program activity, locate the most active modules, determine if they are being called too often, and measure how long any subroutine takes to execute. The software performance analyzer operates in a workstation environment.

### Ordering Information

The HP 64700 modular analyzers/emulators are a dynamic family of software and hardware development tools for embedded microprocessor-based systems. With development support for 8-, 16-, and 32-bit microprocessors, there are many combinations of solutions available. It is recommended that an HP field engineer be contacted for a suggested system configuration that will fit your application. For information about our products, visit our website (<http://www.hp.com/go/emulator>).

Processor Vendor	HP Emulator Support
Hitachi	H8/300X, H8/303X, H8/304X H8/510, H8/532, H8/536, H8/536S H8S/2000 Series, SH7032/34
Intel	80186, 80C186, 80C/L186EA, 80C/L186EB, 80C186XL 80188, 80C188, 80C188EA, 80C188EB, 80C188XL 80C186EC, 80L186EC 80386DX, 80386EX
Mitsubishi	MELPS 7700, 7750/51, M16C/60 Series
Motorola	68000, 68HC000, 68HC001 68EC000 68302, 68LC302, 68EN302 68020, 68EC020 68030, 68EC030 68040, 68EC040, 68LC040 68331, 68332, 68334, 68336, 68338 68340 68360, 68EN360, 68MH360
NEC	V40, V40HL V50, V50HL V53A, V55PI
Toshiba	TLCS 9000/42