Real-time Emulator Motorola MC68000/68008

Model 64243AA
Model 64243AB
Model 64244AA

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Description

Models 64243 and 64244 provide real-time, transparent emulation for Motorola MC68000/68008 microprocessor-based systems. As integrated subsystems of the HP 64000 Logic Development System, these models add the power of emulation to all phases of MC68000/68008 product design, development, and maintenance.

HP Model	Cable Connection	Motorola Processor
64243AA	64-pin DIP probe	MC68000
64243AB	68-pin PGA probe	MC68000
64244AA	48-pin DIP probe	MC68008

Models 64243 and 64244 each consists of an emulation control card, emulation pod, and HP 64000 operating system software. Connection to the target system is made with a 305 mm (12 in.) cable that terminates in either a 64-pin DIP probe for the Model 64243AA, a 68-pin PGA probe for the Model 64243AB, or a 48-pin DIP probe for the Model 64244AA. A typical MC68000 or MC68008 emulation system includes a Model 64243 or 64244 Emulation Subsystem, Model 64156S Emulation Memory, and Model 64302A Emulation Bus Analyzer. With this configuration, the HP 64000 system's extensive set of development aids can be readily applied to MC68000 and MC68008-based designs.

HP 64000 features include directed-syntax softkeys and an easy-to-use editor to streamline software development and documentation. High-level software, logic state, and timing analyzers can be combined with the emulators for a wide variety of interactive, cross-triggered measurements. With the Model 64243 and 64244 Emulators and the many compatible HP 64000 development tools, you can produce a better MC68000/68008-based product in less time, to gain a competitive edge.

Features

- Real-time execution up to 12.5 MHz for the MC68000 emulator
- Real-time execution up to 10 MHz (no wait states) for the MC68008 emulator
- Up to 896 kbytes of emulation memory
- Real-time instruction execution and bus cycle analysis
- No modification to user vector table for emulator operation
- Flexible memory mapping for the emulator and target system
- Both DIP and PGA versions of the MC68000 are supported
- Simulated I/O supports software debugging before target system hardware is operational
- Full use of DMA arbitration
- Expanded measurement systems through interactive operation with other HP 64000 subsystems:
  Another MC68000 or 68008 emulator or any other HP 64000 emulator
  HP 64610S High-speed Timing/State Analyzer
  HP 64620S Logic State/Software Analyzer
  HP 64310A Software Performance Analyzer
  HP 64331B High-level Software Analyzer for HP 64243AA/AB
  HP 64337A High-level Software Analyzer for HP 64244AA
  HP 64341GA Real-time High-level Software Analyzer for HP 64243AA/AB

Getting Started

Analysis and debugging can begin as soon as the first code is written. A 10 MHz internal clock and the appropriate emulation memory provide a method for exercising software with or without functional target system hardware. Real-time software execution is fully maintained to ensure accurate duplication of the final product performance.

Flexible mapping allows you to assign memory to the emulation or target system in 4-kbyte blocks with Model 64243 and 256-byte blocks with Model 64244. Blocks are assigned as emulation ROM/RAM, target system ROM/RAM, or guarded access across the full address range of the MC68000/68008 microprocessor (figure 1). These block sizes are convenient for transferring resources from the emulator to the newly developed target system.

Simulated I/O supports concurrent software and hardware development and debugging. Program development can continue uninterrupted using the HP 64000 facilities for I/O signals. Your printer, display, keyboard, disc, and RS-232 channel can all be simulated on the HP 64000 development station.

Nonintrusive Analysis: A Must for Real-time Systems

Many MC68000/68008-based products are applied to controlling or monitoring critical real-time processes. With the HP 64243 and 64244 Emulators, your development tools support a wide variety of real-time measurements without intruding on target system operation. The emulators allow you to monitor all MC68000/68008 memory activity nonintrusively and in real time, while the target system is operating at full speed.

Information monitored by the emulator is passed to the HP 64302A Emulation Bus Analyzer, where trigger and storage directives are applied. Triggers can be defined for any event and set for the start, center, or end of the trace measurement. Storage qualifiers let you specify which kinds of events are captured and stored in analyzer memory. Commands are entered with easy-to-use softkeys. Trigger and store specifications can include address, data, status, ranges, don't-care bits, and occurrence counts.

The MC68000/68008 processors have two-word prefetches that allow the processor to fetch instructions before using the information. Normally, a display of all bus activity would include the prefetches along with the executed instructions. This makes it difficult to analyze software execution (figure 2). Both HP 64243 and 64244 have an execution mode which provides instruction stream dequeuing. This shows the instructions actually executed for an easy-to-understand display (figure 3). A bus cycle mode is also available when needed to monitor all bus activity.
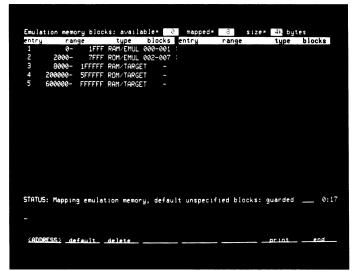

Figure 1. *Flexible mapping allows assignment of memory as emulation ROM/RAM, target system ROM/RAM, or guarded access in 4-kbyte blocks with Model 64243 (256-byte blocks with Model 64244).*

Figure 2. *A measurement trace of an MC68000 instruction stream shows all activity in bus cycle mode, including memory accesses and instruction prefetches.*

Figure 3. *Execution mode shows actual instructions executed by the MC68000. This provides for accurate analysis and display.*

Controlling Your MC68000/68008 System

With the HP 64243 and 64244 Emulators, you have direct control over your evolving MC68000/68008 system. You can display and modify any register or memory location. You also have complete control of the program flow with step, run-from, and run-until directives. Run controls initiate or terminate program execution at a specified address or symbol. These functions allow you to thoroughly investigate the details of target system operation in the early design stages.

Register displays are comprehensive, yet easily understood. All registers are clearly identified, and status bits are labeled for easy interpretation (figure 4).

Memory displays show you any location or range of locations. Display selections include bytes, words, and ASCII equivalents, or memory locations translated into MC68000/68008 mnemonics. Memory modifications are allowed in either single- or multiple-word ranges.

Figure 4. *Register displays are labeled for easy interpretation of all registers and status bits.*

Advanced Analysis Power — from Micro to Macro Measurements

As your MC68000/68008 system grows, it becomes increasingly more complex. You can add correspondingly more powerful HP 64000 measurement tools as they are needed to serve new levels of analysis. Analyzers are available for the whole spectrum of logic measurements—from a bit-by-bit analysis of individual signal lines for a micro view to a total system performance analysis for a macro view.

High-level software analyzers are available for debugging Pascal and C language programs for the 68000/68008 emulators. Programs are debugged using source-level constructs such as functions, procedures, statements, variables, and data structures. This simplifies correlations between executing software and written programs, making the analyzers powerful tools for testing and revising high-level software (figure 5).

As target system hardware evolves, a Model 64610S High-speed Timing/State Analyzer can be added to check timing relationships at speeds up to 400 MHz. Postprocessing capabilities capture and hold timing measurements in order to store timing traces, compare measurements, mark significant signal combinations, and compute means and variances of specified intervals. With an HP 64610S analyzer you can closely examine the detail of the executing system. An external clock mode provides state analysis capabilities at clock speeds up to 125 MHz with up to 32 input channels. This allows you to analyze the operation of high-speed logic in bit-slice and state machines in real time.

At the next level of measurement, a Model 64620S Logic State/Software Analyzer has the functions to support intricate analysis modes: up to 120 input channels, 15 levels of sequential triggering, broad definitions for storage qualifiers, and measurement window specifications. The HP 64620S analyzer can be connected to the emulation subsystem through the HP 64304A Emulation Bus Preprocessor to enhance or replace the HP 64302A Emulation Bus Analyzer.

For optimizing and characterizing software performance, the HP 64310A Software Performance Analyzer provides macro views of total system performance by activity, interaction, or duration. The performance analyzer becomes an integral part of
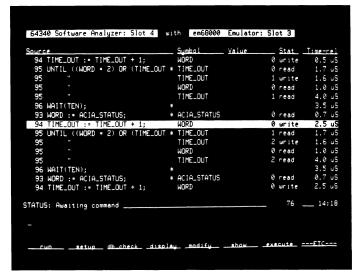

Figure 5. *The addition of an HP High-level Software Analyzer provides source code level debugging.*

the emulation system, so you can begin optimizing time-critical software early in the design cycle.

For multiprocessor applications, HP 64243 and 64244 Emulators can be used interactively with other HP 64000 system emulators through the HP 64964A Intermodule Bus (IMB). The IMB also supports cross-triggering between analysis tools and emulators. The larger measurement system possible with the HP 64000 is not restricted to analysis and emulation subsystems in a single development station; the HP 64303A IMB Extender Board gives you access to measurement tools resident in other development stations.

Making a Difference

Model 64243 and 64244 Emulators offer development support for all phases of MC68000/68008 microprocessor-based designs. HP 64000 tools have the flexibility, power, and convenience required for designing and implementing effective MC68000/68008-based products, quickly and efficiently. Friendliness and the powerful measurement subsystems of the logic development system foster good design practices and complete debugging, from the first design statements to the finished product.

Specifications

Processor compatibility: HP 64243AA/AB: Motorola MC68000 microprocessor; HP 64244AA: Motorola MC68008. These models can be used with any other processor that complies with the specifications of these devices.

Electrical

Maximum clock speeds: 12.5 MHz for the MC68000 emulator. (No wait states when executing from user memory; one wait state from emulation memory above 10 MHz). 10 MHz (no wait states) for the MC68008 emulator.

Data inputs: all inputs meet Motorola specifications plus one ALS TTL load and 40 pF capacitance.

Power: 6 mA drawn from the target system; all other power supplied by the development station.

Physical

Cable length: development station to emulation pod, approx 1.5 m (5 ft); emulation pod to target system interface, approx 305 mm (1 ft).

Environmental

Temperature: operating, 0° to 40°C (32° to 104°F); nonoperating, −40° to 75°C (−40° to 167°F).

Altitude: operating, 4600 m (15 000 ft); nonoperating, 15 300 m (50 000 ft).

Relative humidity: 5% to 80%.

Accessories Supplied

Model 64243AA/AB and 64244AA Emulation Subsystems each includes an emulation control board, emulation pod, and operating system software; appropriate cables for connections from the control board to the pod and from the pod to the target system; operating software supplied on flexible disc; and operator and service manuals. Emulation/analysis bus cables must be ordered separately.

Ordering Information

Model	Description
64243AA	MC68000 Emulation Subsystem (configured with 64-pin DIP probe)
64243AB	MC68000 Emulation Subsystem (configured with 68-pin PGA probe)
64244AA	MC68008 Emulation Subsystem (configured with 48-pin DIP probe)
64156S	**Emulation Memory System, 32 kbytes**
Opt 011	Expand to 64 kbytes
Opt 012	Expand to 128 kbyes
Opt 013	Expand to 256 kbytes
Opt 014	Expand to 512 kbytes
Opt 015	Expand to 1024 kbytes
64302A	**48-channel Emulation Bus Analyzer**
64845S	**MC68000/08 Assembler/Linker System**
64845SR	**Right-to-reproduce HP 64845S**
64845SX	**One-time Update of HP 64845S**
64815S	**MC68000/08 Pascal Language System**
64815SR	**Right-to-reproduce HP 64815S**
64815SX	**One-time Update of HP 64815S**
64819S	**MC68000/08 C Language System**
64819SR	**Right-to-reproduce HP 64819S**
64819SX	**One-time Update of HP 64819S**

Software Support

Model	Description
64243AX	One-time Update of HP 64243 operating system software
64243A/S00	Monthly Software Materials Subscription for HP 64243 operating system software
64243A/W00	Extended Software Materials Subscription for HP 64243A/S00
64244AX	One-time Update of HP 64244 operating system software
64244A/S00	Monthly Software Materials Subscription for HP 64244 operating system software
64244A/W00	Extended Software Materials Subscription for HP 64244A/S00

Accessories

Model	Description
64960A	2-position Emulation/Analysis Bus Cable
Opt 001	3-position Emulation/Analysis Bus Cable
Opt 002	4-position Emulation/Analysis Bus Cable