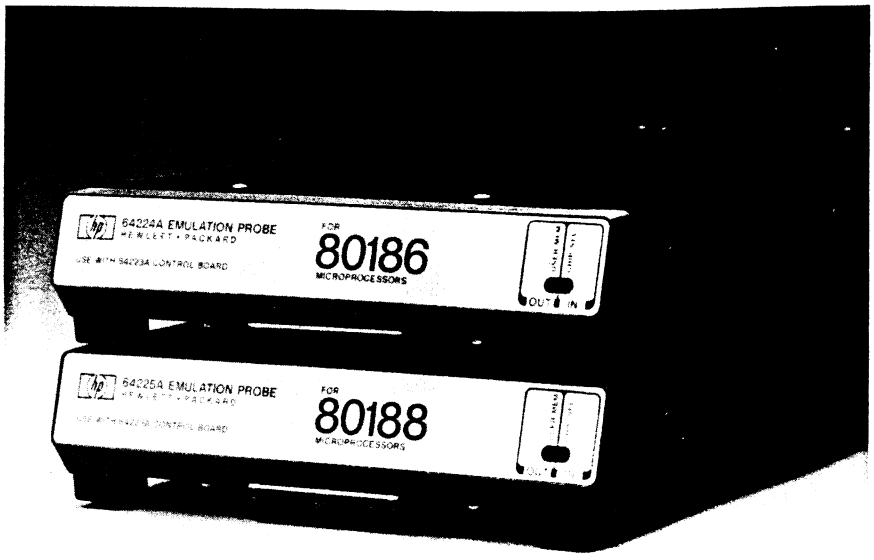
HEWLETT PACKARD

Real-Time Emulator Intel® 80186/80188

MODEL 64224S
MODEL 64225S

TECHNICAL DATA 1 JUN 1984



Description

Models 64224S and 64225S Emulators provide real-time, transparent emulation for 80186 and 80188 microprocessor-systems. As an integrated subsystem of the HP 64000 Logic Development System, either model adds the power of emulation to all phases of 80186/80188 product design, development, and maintenance.

Model 64224S/64225S consists of an emulation control card, emulation pod, and operating system software. Connection to the target system is made with a 305 mm (12 in.) cable that terminates in a 68-contact leadless, chip-carrier probe. A typical 80186/80188 emulation system includes Model 64224S/64225S Emulation subsystem, Model 64156S Emulation Memory system, and Model 64302A Emulation Bus Analyzer. With this configuration, the HP 64000 system's extensive set of development aids can be readily applied to 80186/80188-based designs.

Directed syntax softkeys and an easy-to-use editor streamline software development and documentation. Logic State/Software Analysis and/or Logic Timing/Hardware Analysis can be combined with emulation for a variety of interactive, cross-triggered measurements. Model 64310A Software Performance Analyzer is effective in optimizing 80186/80188 programs, resulting in more efficient end products. With Model 64224S/64225S emulator and the many compatible HP 64000 analysis and development tools, you can produce a better 80186/80188-based product in less time, to gain a competitive edge.

Features

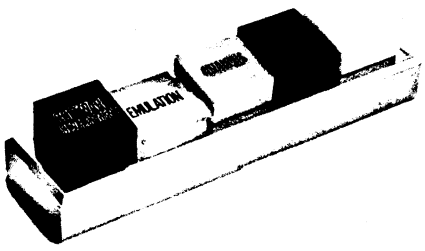
- Real-time execution up to 8 MHz independent of emulator/target system memory assignment
- Instruction dequeueing in either normal or queue status operating mode
- Disassembly of 80186/8087 and 80188/8087 or 8089 instruction sets
- Nonintrusive, real-time tracing of all 80186/80188 cycles, including: Memory, DMA, I/O, Coprocessor
- Comprehensive display and modify functions for Internal registers, Peripheral Control registers, memory, and I/O ports
- Expanded measurement systems through interactive operation with other HP 64000 subsystems

  Another 80186/80188 emulator or any other HP 64000 emulator

  HP 64620S Logic State/Software Analyzer

  HP 64600S Logic Timing/Hardware Analyzer

  HP 64310A Software Performance Analyzer



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Getting Started

Even before target system hardware is ready, you can begin analyzing and debugging software as soon as the first code is written. The 8 MHz internal clock and emulation memory provide a base for exercising software with or without functional hardware. Real-time execution is fully maintained to assure correspondence between the emulated system and the final product.

Flexible mapping allows you to assign memory to the emulation system or target system in 256-byte blocks. Blocks are assigned as emulation ROM/RAM, target system ROM/RAM, or guarded, across the full address range of the 80186/80188 microprocessor. The 256-byte blocks are a convenient size for efficiently transferring newly developed resources from the emulator to the target system.

Nonintrusive Analysis: A Must for Real-time Systems

Many designs based on the 80186/80188 processor are used to control or monitor real-time critical processes. Model 64224S/64225S emulator performs a wide variety of real-time measurements at full operating speeds, without intruding on 80186/80188 resources or execution. The emulator monitors all address, data, and status buses; you may display all bus cycles or a dequeued trace.

Information monitored by the emulator is passed to the HP 64302A Emulation Bus Analyzer where trigger and storage directives are applied. Triggers are 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 softkeys, and trigger and store specifications may include address, data, status, ranges, don't-care bits, and occurrence counts.

As well as tracing the activity of the 80186/80188 system, the emulator/analyzer combination supports coprocessor functions. Instructions and memory cycles of the 8087 Numeric coprocessor or the 8089 I/O coprocessor may be traced and displayed in mnemonics. Figure 1 is an example of a real-time trace of processor activity.

Controlling Your 80186/80188 System

Development and analysis tasks are simplified when the emulator provides complete control over the target system. HP 64224S/64225S emulator controls program execution with run-from, single-stepping, and run-until directives. You can display and modify any register, memory

```
Trace:execution data                    break: none        count:
line#  address opc data  i/o data:hex  mnemonic opcode or status   time, rel.
-011    92400    2875          read  mem. wd 8087                    1.    uS
-010    92402    6BA1          read  mem. wd 8087                    1.    uS
-009    92404    20FF          read  mem. wd 8087                    1.    uS
-008    01294      25      AND AX,#000FFH                           1.    uS
-006    01297      86      XCHG AH,AL                               1.    uS
-004    01299    D08B      MOV DX,AX                                1.    uS
-003    0129B      83      ADD DX,#00020H                           1.    uS
-001    0129E      6D      INSW                                     1.    uS
about   0FF20    FF20          read  i/o  wd                       1.    uS
+001    02066    0000          write mem. wd                       1.    uS
+002    0129F    C283      ADD DX,#00002H                           1.    uS
+004    012A2      6D      INSW                                     1.    uS
+005    0FF22    FF22          read  i/o  wd                       1.    uS
+006    02068    80FF          write mem. wd                       1.    uS
+007    012A3    C283      ADD DX,#00004H                           1.    uS
+009    012A6    C783      ADD DI,#00002H                          <1.    uS

STATUS: I80186--Running              Trace complete                      4:35

trace  about NEW.TASK  data 0XX20H  status read_io

 run   trace   step   display   modify   break   end   ---FIC---
```

Figure 1. The logic analysis capabilities of Model 64224S/64225S trace executed 80186/80188 instructions. In addition, all coprocessor instructions and memory cycles are identified to assist in debugging. Model 64224S/64225S traces are based on data collected nonintrusively and in real time.

```
I80186 Registers :repetitively

 Next IP 0000   SP 201E   SI 2614   DI 5C3B   BP 201E
     CS FFFF   SS 0000   DS 0000   ES 0000   FL [oditsz a p c]
     AX 0000   BX 0026   CX 0000   DX 0000       0000000000000
 Relocation register:  RR 20FF
 DMA 1:  CNT1 73A7   DP1 0B74B   SP1 0C96B   CTL1 0000 0000 0000 0000
 DMA 0:  CNT0 D56E   DP0 03EFF   SP0 07DFD   CTL0 0000 0000 0000 0000
 Chip select:  MPCS B778   MMCS EBF8   PACS FF88   LMCS 3DF8   UMCS FFFB
 Timer 2:  MC2 A021   MA2 FFFF   CR2 BA67
 Timer 1:  MC1 A03F   MB1 FFFF   MA1 FFFF   CR1 FFFF
 Timer 0:  MC0 A03F   MB0 FFFF   MA0 FFFF   CR0 FFFF
 Interrupt Control:  IN3 000F   IN2 000F   IN1 000F   IN0 000F
     DMA1 000F   DMA0 000F   TC 000F   IST 0004   IRR 0001
     ISR 0000   PM 0007   MSK 00FD   PSR 0000



STATUS: I80186--Running in  monitor       Trace complete              4:42

modify register SP0 to SERIAL_BUFF

 run   trace   step   display   modify   break   end   ---FIC---
```

Figure 2. The comprehensive register display of Model 64224S/64225S shows all the 80186/80188 internal registers. Sets of pertinent Peripheral Control Registers can be selected by the operator to achieve the most appropriate display.

location, I/O port, or Peripheral Control register. These functions are especially valuable in intial design stages, as they allow you to thoroughly investigate the details of target system operation.

Register displays, as shown in figure 2, are comprehensive, yet easily understood. The operator can display all or a subset of the Peripheral Control registers.

Memory displays show you any location or range of locations. Select a display in bytes, words, and ASCII equivalents, or the memory locations translated into the processor mnemonics. Modifications are by bytes or words, either singly or by ranges.

Advanced Analysis Power — from Micro to Macro Measurements

As your 80186/80188 system grows, it becomes more complex and sophisticated. You can add correspondingly more sophisticated HP 64000 measurement systems as they are needed to serve new levels of measurement applications. Analyzers are available for the whole spectrum of logic measurements — from a micro level for a bit-by-bit analysis to a total system performance analysis for the macro view.

As the target system hardware evolves, Model 64600S Logic Timing/Hardware Analyzer may be added to check timing relationships at speeds up to 400 MHz. Postprocessing capabilities capture and hold timing measurements to store timing traces, compare measurements, mark significant signal combinations, and compute means and variances of specified intervals. HP 64600S hardware analyzer lets you take a close look at the detail of the operating system.

At the next level of measurements, 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.

When programming in high-level languages, it is far more convenient to use the same language for analysis. With the HP 64620S software analyzer, you can generate a mixed display of high-level statements and the assembly level code associated with each statement (figure 3).

For optimizing and characterizing software performance, Model 64310A Software Performance Analyzer provides macro views of total system performance, by activity, interaction, or duration (figure 4). The performance analyzer becomes an integral part of the emulation system, so you can begin optimizing the program flow as soon as code exists. Module names are loaded into the HP 64310A performance analyzer automatically.

For multiprocessor applications, the HP 64224S/64225S emulator may be used interactively with any other HP 64000 system emulator with the Intermodule Bus (Model 64964A). The Intermodule Bus (IMB) also supports cross-triggering modes between analysis systems and emulators. The larger measurement system possible with the IMB is not restricted to analysis and emulation subsystems in a single development station; HP 64303A IMB Extender board gives you access to measurement systems resident in other development stations.

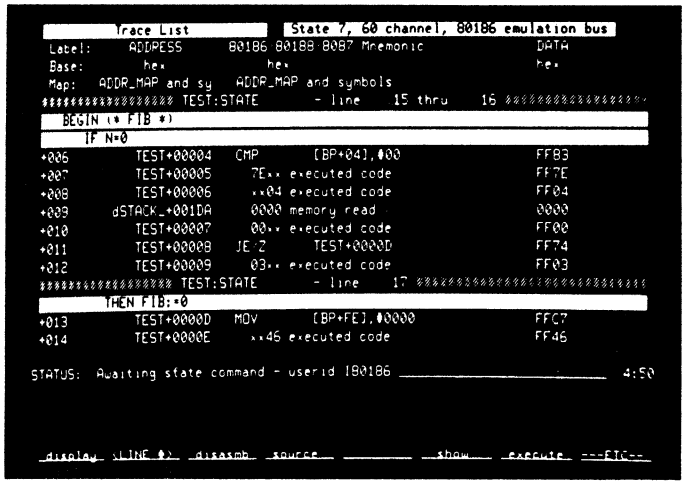

Figure 3. Model 64224S/64225S supports high-level language debugging by adding Model 64620S. One display mode of the HP 64620S traces high-level statements together with the assembly-level microprocessor instructions. Traces are based on system activity monitored nonintrusively in real time.

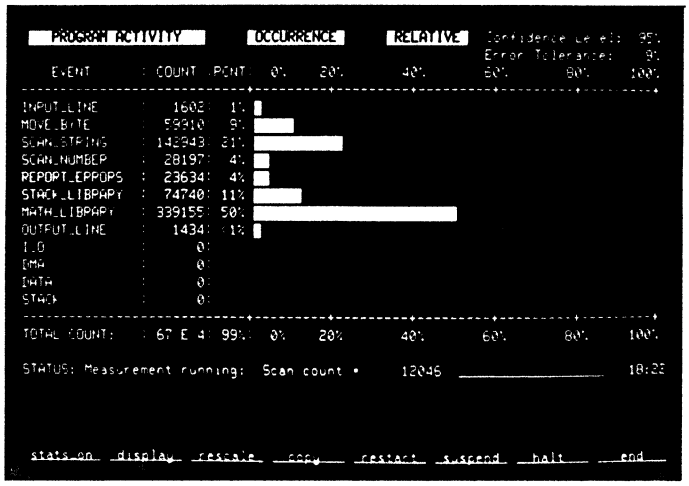

Figure 4. Total system performance can be monitored by adding Model 64310A Software Performance Analyzer to Model 64224S/64225S. A wide range of activity and duration measurements are available for a macro view of 80186/80188 system interactions, identifying where optimization efforts will yield the greatest performance improvement.

Making a Difference

As an 80186/80188 hardware or software designer, the HP 64000 system design aids and development tools make you more efficient. You can focus your skills on the design and troubleshooting tasks because many of the time-consuming, repetitive chores inherent in creating new products are executed automatically by the HP 64000 system.

Specifications

Processor compatibility: compatible with Intel 80186/80188 and any other microprocessors that comply with the specifications of either one of these processors.

Note: To properly connect and operate either emulator, the target 80186/80188 system must have an AMP® 55162-X socket and AMP® 55478-2 lid, an IDT 3M® Textool 68-pin JEDEC socket (part no. 268-5400-52), or equivalent socket assembly.

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Ordering Information

Model 64224S 80186 Emulation Subsystem
Model 64225S 80188 Emulation Subsystem
Model 64156S Emulation Memory System with memory control board and 32k-byte memory board
- **Model 64156S Option 011:** expand to 64k-byte
- **Model 64156S Option 012:** expand to 128k-byte
- **Model 64156S Option 013:** expand to 256k-byte
- **Model 64156S Option 014:** expand to 512k-byte
- **Model 64156S Option 015:** expand to 1024k-byte

Model 64302A 48-channel Emulation Bus Analyzer
Model 64853A 8086/88/186/188 Assembler/Linker
Model 64814A 8086/88/186/188 Pascal Compiler
Model 64818A 8086/88/186/188 C Compiler

COMPONENTS
Model 64223A 80186/80188 Emulation Control Board
Model 64224A 80186 Emulation Pod (includes software)
Model 64225A 80188 Emulation Pod (includes software)

ELECTRICAL
Maximum clock speeds: 8 MHz (CLKOUT) with no wait states required for emulation or target system memory; 16 MHz max crystal frequency.
Data inputs: one LS TTL load plus approx 40 pF capacitance.
Power: 25 mA drawn from target system; all other power supplied by 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 64224S 80186 Emulator and Model 64225S Emulator each include an emulation control board (Model 64223A) and an emulation pod (Model 64224A 80186 pod and Model 64225A 80188 pod); appropriate cables for connections from the board to the pod and from the pod to the target system; operating software supplied on flexible disc; and operators manual.

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For more information call your local HP Sales Office or nearest Regional Office: Eastern (301) 258-2000; Midwestern (312) 255-9800; Southern (404) 955-1500; Western (213) 877-1282; Canadian (416) 678-9430. Ask the operator for instrument Sales. Or, write: Hewlett-Packard, 1501 Page Mill Road, Palo Alto, CA 94304. In Europe: Hewlett-Packard S.A., 7, rue du Bois-du-Lan, P.O. Box CH-1217 Meyrin 2, Geneva, Switzerland. In Japan: Yokogawa-Hewlett-Packard Ltd., 29-21, Takaido-Higashi 3-chome, Suginami-Ku, Tokyo, 168.