

# CodeICE™ Emulator

## for Motorola 68040, 68EC040, 68LC040, and 68040V Microprocessors

### Highlights

- Full-scale 40 MHz emulator with dedicated probe tips for 68040/EC040/LC040 and 3-volt 68040V
- Powerful, multi-windowed debugger with C and C++ support on SUN 4, PC and HP 9000 hosts
- Debugger operates stand-alone or in the MRI MasterWorks environment
- MRI, DIAB, GNU, Intermetrics, and Greenhills compiler support
- Unique intelligent trace disassembler tracks register states
- RTOS-Link™ supports ISI pSOS+ and Wind River kernels with real-time task and kernel profiling, unique error detection, and unprecedented system visibility
- Supports cache coherency and bus snooping for multi-040 targets even while emulator is not running target code
- Integrated support for 68360 peripheral mode for targets using both 68040 and 68360 processors
- Auto-configured Performance Analysis System runs at full bus-cycle frequency and monitors an unlimited number of modules
- Trace memory with timestamp captures 136 bits of information about each bus cycle with a depth of 32 K frames
- Multi-threaded event system adds specification of variable and register values for event detection
- 1 MB to 16 MB overlay memory supports both burst and normal accesses to 25 MHz with zero wait states
- Fully isolated probe-tip, diagnostic scope loops, trace memory help verify hardware design and diagnose problems
- CodeICE emulators can be reconfigured for other processors including 68020, 68030, 68060, and ColdFire MCF5102

### Companion Products

- CodeTEST™ embedded software verification tools for 68040 offer developers and testers comprehensive software performance analysis, code coverage analysis memory allocation analysis and software trace



Applied  
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Corporation

*CodeICE 040—Making emulation make sense.*



### Under Budget and On Schedule

No project has enough time or money. That's why the new CodeICE™ 040 emulator is designed to help you work as efficiently as possible to meet critical deadlines. An optimized platform for debugging 68040-based products, this cost-effective solution offers a rich and complete feature set tailored to the real needs of embedded developers.

### A Development Tool for Today

In today's market, products are getting more complex, while developers face shrinking schedules and tighter budgets. Making a product happen takes a streamlined development process, and CodeICE helps you get there with productivity-boosting features and utility that spans the entire development cycle.

The new CodeICE emulator for the 68040 supports your team—not just during the critical-path integration phase, but right from concept through manufacture of the finished product. During specification, memory overlay and isolation mode help analyze code algorithms in real time. Prior to integration, a powerful trace and event system helps verify code. And hardware verification and debug go faster thanks to a fully buffered probe-tip and diagnostic scope loops. With its ability to accept regression scripts and isolate production problems, CodeICE also offers value when the product is in manufacturing. The bottom line? In today's market, CodeICE makes emulation make perfect sense.

*We also offer tools to support these Motorola products:  
68000, 68EC/HC000, 68020/EC020, 68030/EC030, ColdFire  
MCF5102, 68302, 68330/340, 68331/332, 68360/EN360, CPU32*

## *CodeICE—the Tool that Makes Sense*

### **Productivity**

That's what your tools are all about. And while any development team gets value from logic analyzers and monitors, a well-designed emulator gives you the breadth and depth that can make all the difference in your project.

CodeICE 040 is designed to maximize productivity for the whole team, and from start to finish. From software or hardware engineers to manufacturing technicians, CodeICE delivers information about your product that you can't get as easily—or at all—with any other tool. And because it's designed just for the 68040, the emulator offers complete visibility of even the most esoteric processor activity, but doesn't intrude on the operation of your application.

### **Simplicity**

That's the difference between a tool you use, and one that sits on the bench. CodeICE makes the capabilities of a full-scale emulator so accessible that you'll actually get to use all that power.

CodeICE makes it simple right from the start. Just plug in the probe tip; no need for special adaptors or complicated wiring. And because no target hardware resources are used, you don't have to worry about compensating for the emulator or compromising accurate emulation.

Working with CodeICE is simple, too. The graphical windowed interface puts you in control, with shortcuts for experienced users and intuitive operation and help for new or occasional users. And full network support lets you work where you want.

### **That Makes Sense**

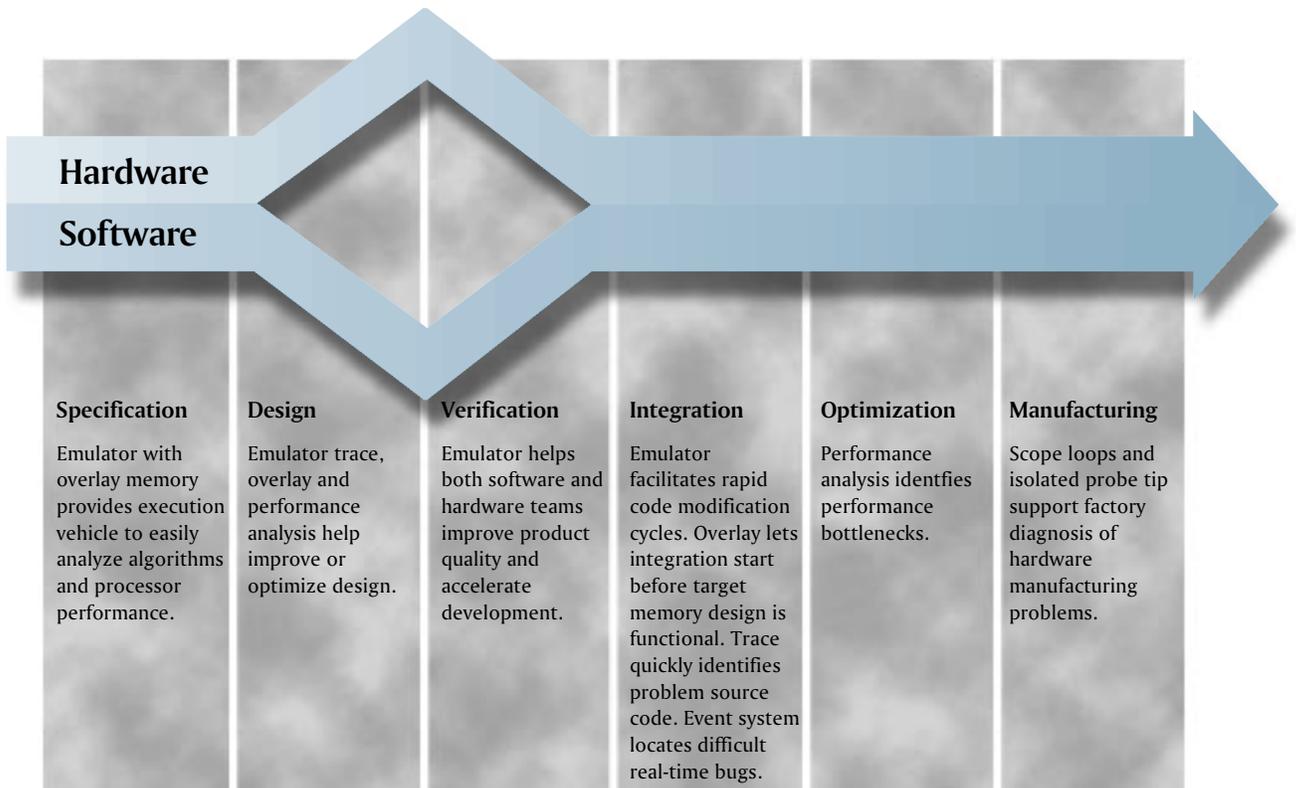
CodeICE 040 is the tool that makes it easy to do more. And that makes sense.

### **Debugging for the Rest of Us**

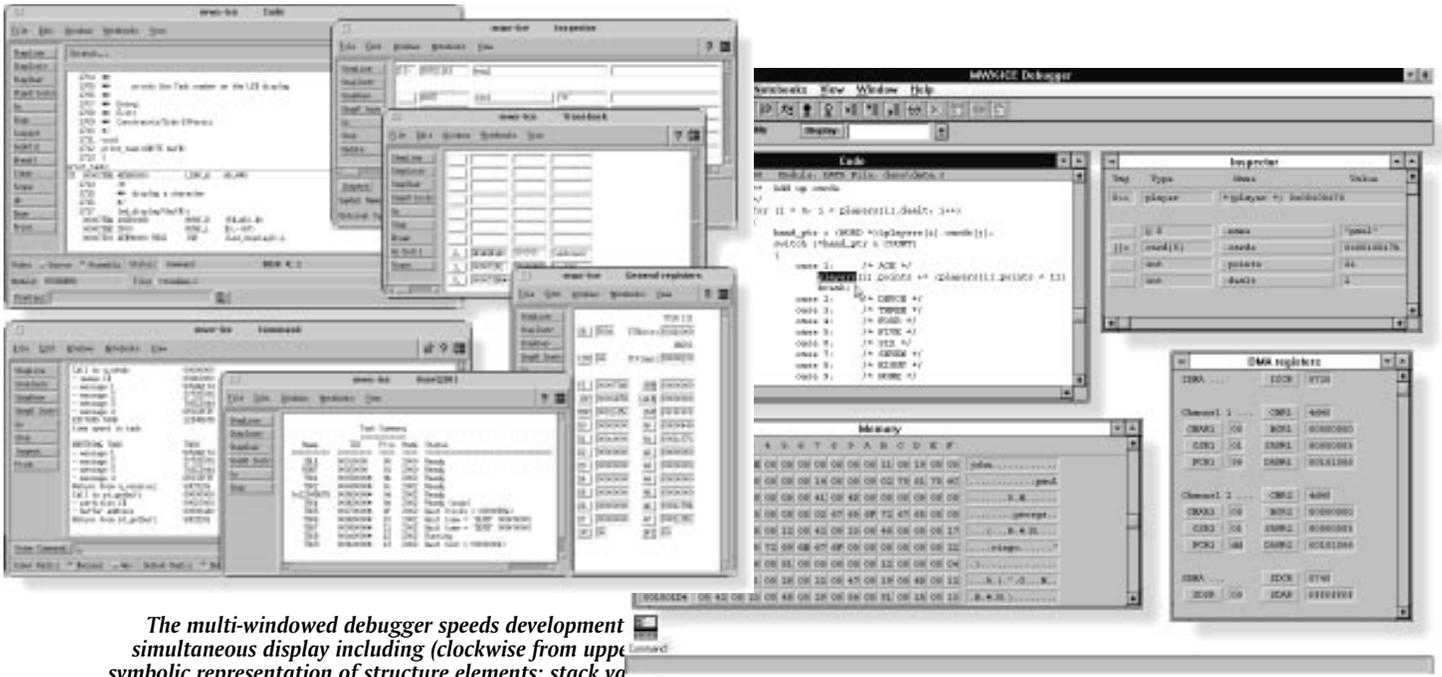
Whether you use a debugger every day or just every so often, you can easily be comfortable and productive with this function-rich, Sun 4-, HP 9000-, or PC-hosted source- and assembly-level debugger.

The notebook feature eliminates the need to remember debugger command language—you can just point and click. And the context-sensitive hypertext help system saves time spent hunting through manuals.

The windowed graphical interface lets you visually organize your approach to solving a problem. You don't have to grapple with complex modes and functions to fully exploit the power of the emulator. And whether you prefer to work with a mouse or from the command line, you get simple, straightforward control of your target and the emulator.



*The utility of the CodeICE emulator spans the entire development cycle.*



The multi-windowed debugger speeds development simultaneous display including (clockwise from upper left) symbolic representation of structure elements; stack tracing; interleaved source and assembly; and pure source code.

MWX-ICE for Microsoft Windows offers the same intuitive control and ease-of-use as the workstation version.

Even when you have a target that can't be stopped for troubleshooting, you can still debug using dynamic run mode. You can also display source code together with the corresponding assembly language to clarify the relationship between them and verify compiler performance.

The register decoding utility gives you access to the meanings of both 68040 and 68360 registers. For products using the 040 in tandem with the 68360, you also get full support for the peripheral mode of the 68360. You can configure, decode and examine all of the 68360 SIMM registers.

### Trace System Simplifies Problem Analysis

The last thing you want to do is spend your time figuring out the relationship between your application's execution history and your source code. CodeICE handles all of that for you with its highly approachable trace system.

Four trace display modes let you see information in the format most

useful to you. High-Level Mode supports application developers using C or C++. Low-Level Mode supports team members writing speed-critical device drivers. Combined High/Low-Level mode supports anyone interested in the relationship between source and compiler-generated assembly language. Raw Trace Mode permits analysis of hardware activity on a bus cycle or clock cycle basis.

For complete capture of execution history, the system provides 136 bits of width and 32K frames of depth. The Event System can qualify trace to capture the context of a problem, not just the effect. For targets that can't be stopped to debug a problem, you can examine trace while the emulator runs the target. To quickly find the information you want, you can scroll trace frames and search for any combination of address, data, and status information.

### Register-Tracking Disassembler

This unique tool helps boost productivity by providing insight into

the operation of the processor. The disassembler tracks the state of processor registers during code execution. That lets you easily see how data is passed between code modules.

### Intuitive Event System

The CodeICE Event System lets you readily determine the execution trail of code without having to modify your code with printf statements or semaphores. You can quickly and easily place transparent breakpoints anywhere in code.

The Event system can be configured using familiar names and symbol references. The system supports address, data or status qualification, or any combination of the three.

The "When Event /Then Action" event statement format is both simple to understand and powerful. With a full complement of event system actions, you have a complete tool kit for isolating a problem. Available actions include stop emulation, turn-on trace, turn-off

trace, enable timestamp, disable timestamp, change event state or group, and generate an external trigger for operations such as synching an oscilloscope.

### Versatile Overlay Memory

CodeICE overlay memory helps extend the utility of the emulator to early stages of the development cycle. Before target hardware is available, the emulator probe tip and overlay memory provide an execution vehicle without the need for an evaluation board.

Mapping overlay as target memory also eliminates time wasted burning ROMs to verify a code fix. And overlay simplifies and accelerates hardware-software integration by letting you gradually implement target memory. Simply use overlay until the target hardware is debugged.

Both normal and burst bus cycles are supported, and overlay can be mapped on 256 byte boundaries anywhere in memory. Two speed grades let you match overlay to the requirements of your target and your budget: fast overlay supports zero wait-states at 25 MHz and one wait-state at 40 MHz; Normal overlay supports zero wait-states at 20 MHz, one wait-state at 33 MHz and two wait-states at 40 MHz.

### Dedicated Support for 68040/EC040/LC040 and 3-Volt 68040V

Because there are significant differences between the 68040 and its two variants, three separate probe tips are available to ensure accurate emulation for each processor. Unlike an emulator that only supports the 68040, the CodeICE EC040/LC040 probe tips support debugging of floating point libraries. And the full 3-volt probe tip for 68040V helps prevent electrical damage to your 3-volt target or 68360 companion processor.

### Non-Intrusive Performance Analysis

The CodeICE Performance Analysis system places no demands on target operation or resources, so you get an accurate view of where your code spends its time.

The system monitors an unlimited number of modules, address ranges or data variables at the full bus cycle frequency of the processor.

The Performance Analysis System is easy to use: it is automatically configured and can quickly be re-configured from the command line. The system gathers performance data to describe execution activity, code timing, interrupt timing and fault detection. Data is presented in an easily understood histogram format, and the system generates reports help to document software and product performance.

### RTOS-Link Real-Time Kernel Support

CodeICE engineers work closely with industry-leading commercial kernel developers to provide comprehensive support packages for Real-Time Operating Systems (RTOS). RTOS visibility at the CodeICE level shows how the target, application, and RTOS interact with one another during execution in a thoroughly integrated, real-time environment.

Applied's RTOS-Link feature provides several broad categories of support, including: real-time trace of RTOS activity, display of individual task context and other system structures, task-qualified breakpoints, task stack overflow detection, and task profiling support. The benefit of integrated RTOS support is a substantial reduction in the time



RTOS-Link reveals target, application, and RTOS interaction.

required to debug and optimize your application as it runs in your target.

The event system is specifically designed to help isolate problems in multi-threaded software systems found in kernel applications. The system is organized in a four-state-by-four-group structure. Each group can be applied to a software thread and the four states can be used to isolate deeply nested bugs.

### Keeping You Satisfied

Because our success depends on your success, we take product support very seriously. In fact, at Applied Microsystems we call our program Customer Satisfaction.

Keeping you satisfied means more than just answering your questions. Our on-site training and engineering assistance, technical guidance on emulation issues, and expedited product service can help you get your product to market on time and on budget.

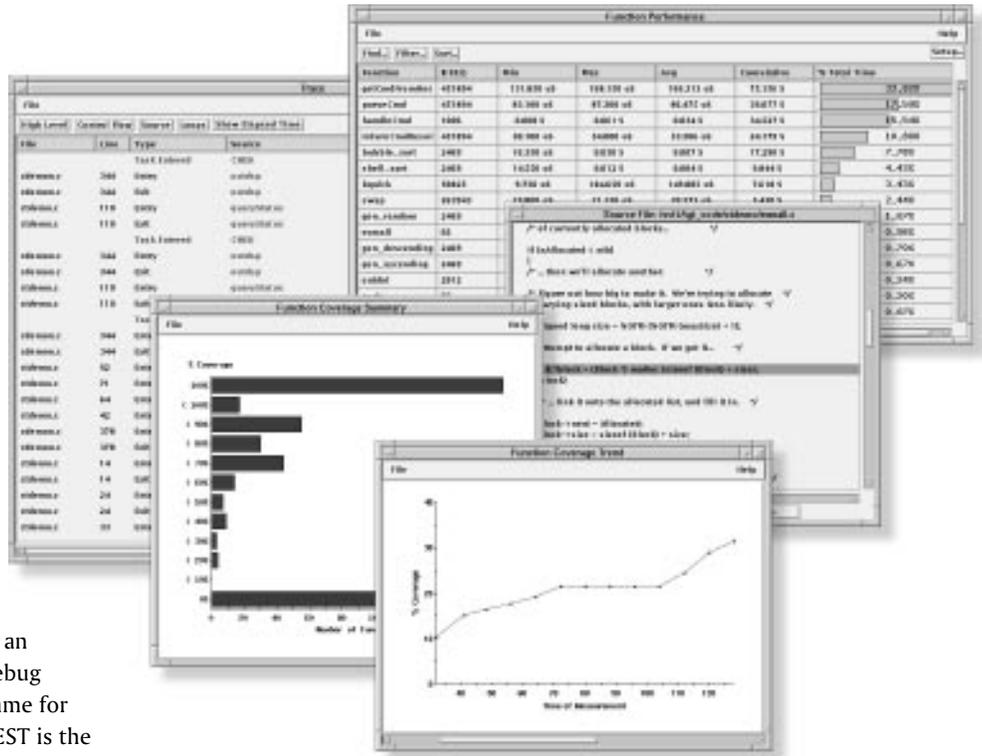
Our Applications Engineering Group is backed by a network of experienced Field Application Engineers, our own design teams, and the commitment of the entire company. And with over 15,000 installed solutions and more than

fourteen years of leadership in embedded hardware and software development tools, our team is an important asset to have on your team.

### CodeTEST Companion Tools

### Test, Analyze and Measure Code Performance

Software development is made from equal parts of debugging and testing code. The CodeICE provides an exceptional set of tools to debug code; CodeTEST offers the same for testing code. In fact, CodeTEST is the first software verification tool suite crafted specifically for embedded software. It offers memory allocation analysis to help you locate memory leaks and detect improper uses of malloc() and free(). Performance analysis provides real-time module duration and call-pair linkages for up to 32,000 functions. The coverage analysis package clarifies the effectiveness of your test suite to

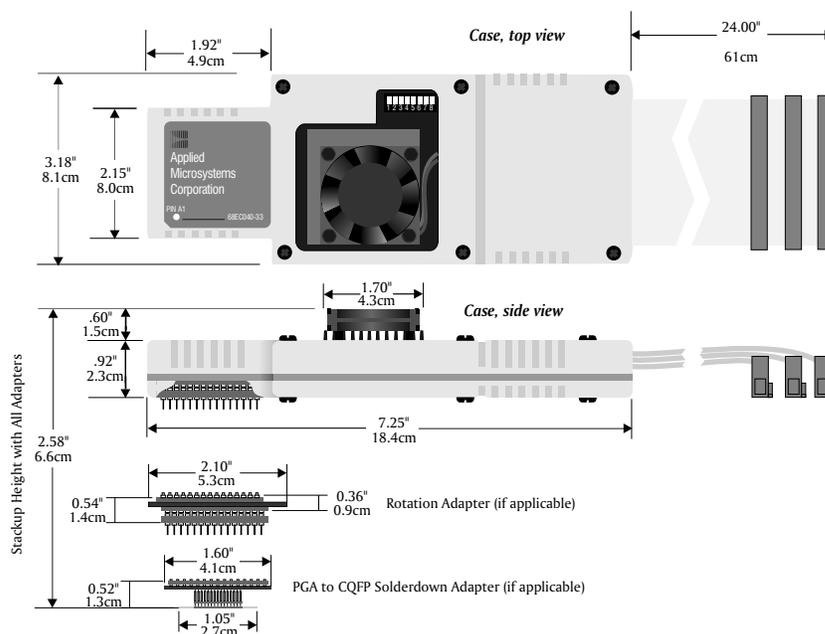


*CodeTEST is a new family of tools for embedded software developers and testers.*

help you develop higher quality code. Finally, the trace analysis package offers multiple ways to view the execution history of your program and, thereby, see the “big picture” about the operation of your software.

### Get Sensible About 68040 Emulation

To see how the new CodeICE emulator can help you make sense of your 68040 project, call 1-800-426-3925 today for information or a product demonstration.



The CodeICE 040 probe tip. Dimensions are in inches.

# CodeICE Emulator for 68040, 68EC040, 68LC040, and 3-volt 68040V

## Microprocessors Supported

Motorola 68040, TO 40 MHz,  
68EC040, 68LC040 to 33 MHz,  
3-volt 68040V to 33 MHz

## Packages Supported

PGA, CQFP

## Minimum Host Requirements

PC386, Microsoft Windows 3.0 or  
higher, 16 MB RAM, ISA or EISA slot  
Sun SPARC, Sun OS 4.1, Solaris 2.2 or  
above  
HP 9000, HP-UX 9.0 or above, 20 MB RAM

## Communications

### PC Environment

IEEE 802.3 10base2, 10base5,  
10baseT (effective download speed  
4.0 MB/min)

### Sun Environment

IEEE 802.3 10base2, 10base5,  
10baseT (effective download speed  
4.0 MB/min)

## Source Level Debugger

### Integrated Source Level Debugger

Multi-Windowed interface (X-window  
on Sun and HP 9000, Microsoft  
Windows on PC)

Runs stand-alone or as an integrated  
element of the MRI MasterWorks  
environment

Support for C, C++ and assembler  
Access to source code variables  
by name

Access to all global, local, stack-based  
and register-based symbols

Full C-typing features

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### Execution control and full access to the emulator

Debug code without stopping target  
system with Dynamic Run, Stop  
and Update

Execution breakpoints can be set on  
line numbers, C statements, program  
labels and memory addresses

Display trace interlaced with source  
code and assembly language in one  
window

Display trace in raw, assembly or  
high-level formats

Monitor real and simulated I/O

High-level control of the trace, event,  
and overlay sub-systems

### Performance Analysis

Automatically configured at invoca-  
tion or custom-tailored from the  
keyboard or a configuration file

Gathers Performance Analysis data at  
the full processor bus cycle  
frequency to 40 MHz

Monitor an unlimited number of modules  
Time code execution and interrupt  
service response

Fault detection capability for memory  
management problems

### Real-Time Operating System Support

Real-time trace of kernel and tasks

Real-time task profiling

Tracks return codes and error messages

Provides text description of kernel  
resource requests

Tracks allocation/de-allocation of  
memory and related errors

### Intelligent Trace Disassembler

Display instructions and register  
contents correlated with data

### Advanced testing and setup capabilities

Construct complex macros containing  
C-like statements and debugger  
commands

Record and play back debugging  
sessions

### File Format Capability

Supports toolchains from MRI, DIAB,  
Intermetrics, and Greenhills

Supports GNU toolchain for  
A.OUT format

## Trace and Event System

### Trace System

136 bits of information captured on  
every bus cycle, with a depth of  
32 K frames

Timestamp resolution from to 50 ns  
to 100 ms

### Event System

4 independent groups

10 counters

Up to 16 conditional statements per  
group for a total of 48 When/Then  
statements

Supports qualification of event by  
value of variable, value of register,  
address, data, status, or counter

2 BNC connectors: 1 trigger-out,  
1 trigger-in

### Event Actions

Break asynchronously

Break synchronously

Trace on/off/trace-one

Timestamp enable/clear

Change group      Change state

Cache enable/disable      Trigger output

## Breakpoint System

100 software execution breakpoints

1 asynchronous breakpoint from  
keyboard

1 BNC input to support break request  
from external instrument

## Overlay Memory

1, 2, or 16 MB, zero wait state  
to 25 MHz

Supports burst by 68040

Map anywhere with 256 byte resolu-  
tion

## Multi-Processor Support

Supports cache coherency and bus-  
snooping (required in multi-68040  
systems) even while emulator is  
paused

Supports 68360 register interrogation  
and modification for targets using  
68040 and 68360

## Target Hardware Debug Support

Fully buffered probe-tip permits  
debug of dysfunctional target  
hardware

Diagnostic scope loops offer a suite  
of routines to quickly isolate  
defective hardware

## Physical Specifications

Chassis: 16" X 13" X 5" (L x W x H)

Chassis weight: 14 lbs.

Probe Tip: 7.25" X 3.18" X 0.81"  
(L x W x H)

Probe-tip cable length: 24"

**For more information, call 1-800-426-3925,  
e-mail [info@amc.com](mailto:info@amc.com), or browse <http://www.amc.com>**

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