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

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.

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<td>Emulator with overlay memory provides execution vehicle to easily analyze algorithms and processor performance.</td>
<td>Emulator trace, overlay and performance analysis help improve or optimize design.</td>
<td>Emulator helps both software and hardware teams improve product quality and accelerate development.</td>
<td>Emulator facilitates rapid code modification cycles. Overlay lets integration start before target memory design is functional. Trace quickly identifies problem source code. Event system locates difficult real-time bugs.</td>
<td>Performance analysis identifies performance bottlenecks.</td>
<td>Scope loops and isolated probe tip support factory diagnosis of hardware manufacturing problems.</td>
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The multi-windowed debugger speeds development with simultaneous display including (clockwise from upper left): symbolic representation of structure elements; stack tracing; register values; 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.

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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.

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 emulation, and more.

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.
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.

**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 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

**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.

**RTOS-Link reveals target, application, and RTOS interaction.**
CodeTEST is a new family of tools for embedded software developers and testers.

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.
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
PC/AT, 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-UUX 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

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 invocation
or custom-tailored from the
keyboard or a configuration file
Gathers Performance Analysis data at
the full processor bus cycle
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”
Probe-tip cable length: 24”

For more information, call 1-800-426-3925,
e-mail info@amc.com, or browse http://www.amc.com

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