

# CodeICE™ Emulator

## for Motorola 68060, 68EC060, and 68LC060 Microprocessors

### Highlights

- Full-scale 50 MHz emulator with dedicated probe tips for 68060, EC060 and LC060
- Powerful, multi-windowed debugger with C and C++ support on SUN 4, PC and HP 9000 hosts
- MRI, DIAB, GNU, Intermetrics, SDS and Greenhills compiler support
- Unique intelligent trace disassembler tracks code execution including register state and data access information
- RTOS-Link™ supports real-time kernels with real-time task and kernel profiling, system error detection, and unprecedented system visibility
- Integrated support for 68360 companion mode for targets using both 68060 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 168 bits of information about each bus cycle with a depth of 32 K frames
- Multi-threaded event system provides mechanism to track task-based, variable based or register-based bugs
- 1 MB to 16 MB overlay memory for replacing target ROM or RAM during boot code or early product development
- Fully isolated probe-tip, diagnostic scope loops, trace memory help verify hardware design and diagnose problems
- CodeICE emulators can be easily reconfigured for other 68K family processors including 68040, 68030 and 68020

### Companion Products

- CodeTEST™ embedded software verification tools for 68060 offer developers and testers comprehensive software performance analysis, code coverage analysis memory allocation analysis and software trace



Applied  
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*CodeICE 060—Minimize risks with tools that will make your day.*



### Sieze the Day

The Motorola 68060 offers a great opportunity to quickly get a market advantage. The CodeICE 060 is designed to help with a feature set that has been crafted to the unique needs of the 060 developer. It's a tool for the developer trying to debug software and hardware problems or integrate the two with a real-time operating system. Today's market offers both rewards and risks. Minimize your risks with good tools. *Carpe Diem.*

### 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 68060 supports your team—not just during the critical-path integration phase, but right from concept through manufacture of the finished product. Prior to integration, a powerful trace, event and overlay system help verify code and algorithms. Hardware verification and manufacturing go faster thanks to a fully buffered probe-tip and diagnostic scope loops. The bottom line? In today's market, CodeICE makes emulation make perfect sense.

*We also offer tools to support these Motorola products:  
68000, 68020, 68030, 68040/040V, ColdFire MCF5102,  
68302, 68330/340, 68331/332, 68360/EN/MH, 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 060 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 68060, 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 060 is the tool that makes it easy to do more. And that makes sense.

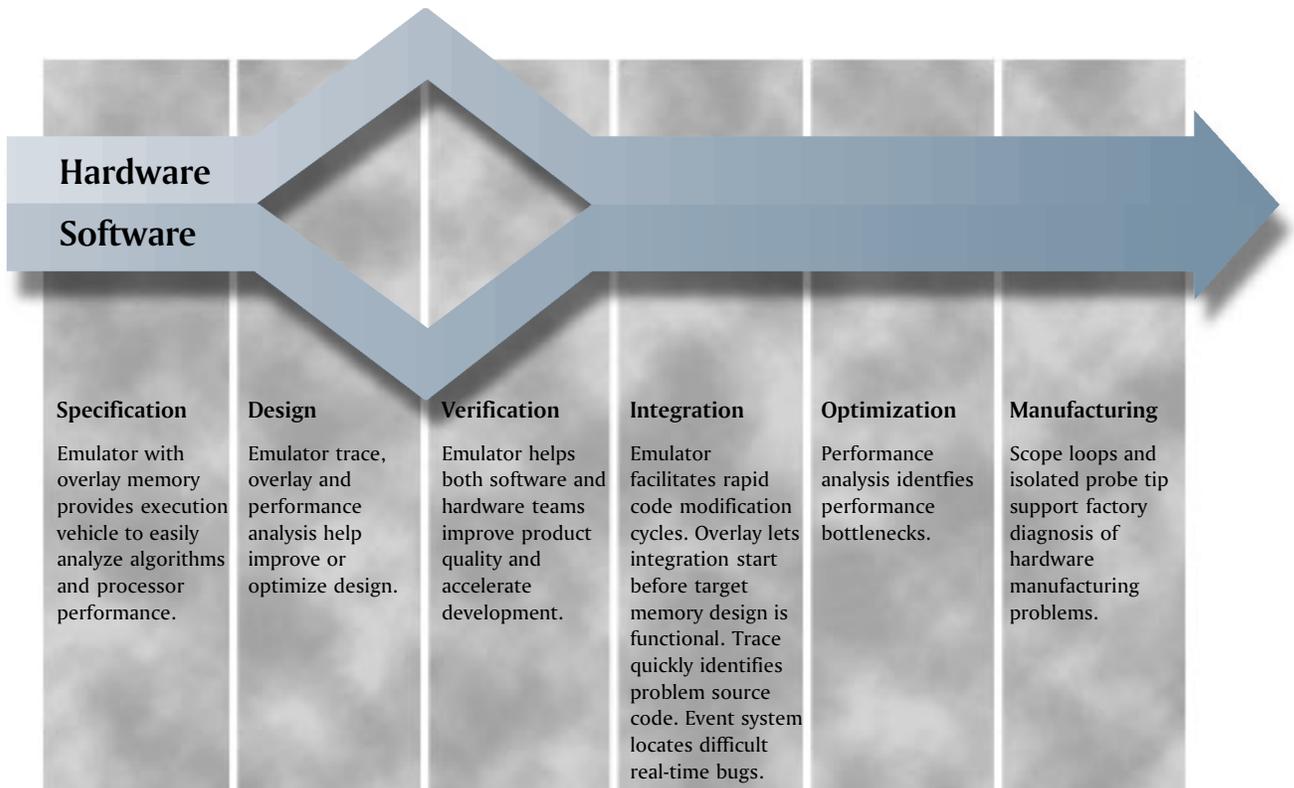
### **Debugging for the Rest of Us**

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.

Even when you have a target that can't be stopped for troubleshooting, you can still debug using dynamic run



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



*The multi-windowed MWX-ICE debugger speeds development with simultaneous display including (clockwise from upper left): symbolic representation of structure elements; stack values; call tracing; register values; interleaved source and assembly; and pure source code.*

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 68060 and 68360 registers. For products using the 060 in tandem with the 68360, you also get full support for the companion 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 168 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 and data accesses during code execution. This helps you detect errant register-based variables. It also helps you understand stacking operations as a result of interrupts and exceptions.

### **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. Its access speed supports zero-wait states for 50 MHz half-speed bus accesses (25 MHz single-clock bus cycle) or 1 wait-state for 50 MHz half-speed bus accesses (33 MHz single-clock bus cycle).

### Dedicated Support for 68060, EC060 and LC060

Because there are significant differences between the 68060 and its two variants, three separate probe tips are available to ensure accurate emulation for each processor. Unlike an emulator that only supports the 68060, the CodeICE EC060 and LC060 probe tips support debugging of floating point libraries.

### 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.

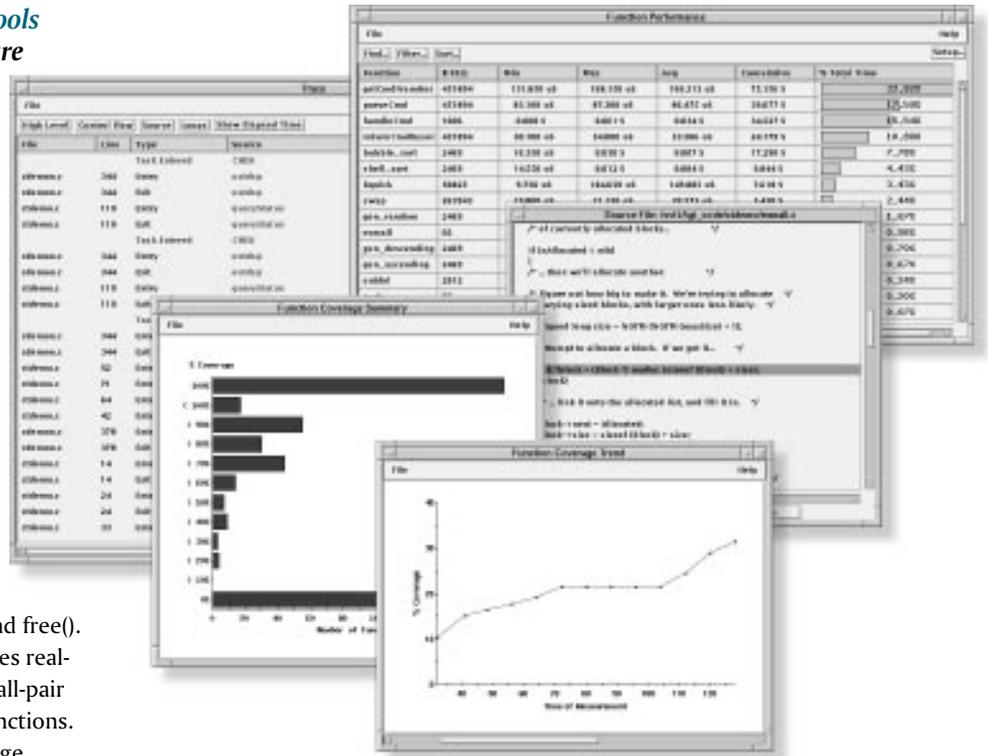
The event system is specifically designed to help isolate problems in multi-threaded software systems found in kernel applications. The system is organized in a four-state-by-four-group structure. Each group can be applied to a software thread and the four states can be used to isolate deeply nested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



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

**CodeTEST Companion Tools**  
**Test, Analyze and Measure**  
**Code Performance**

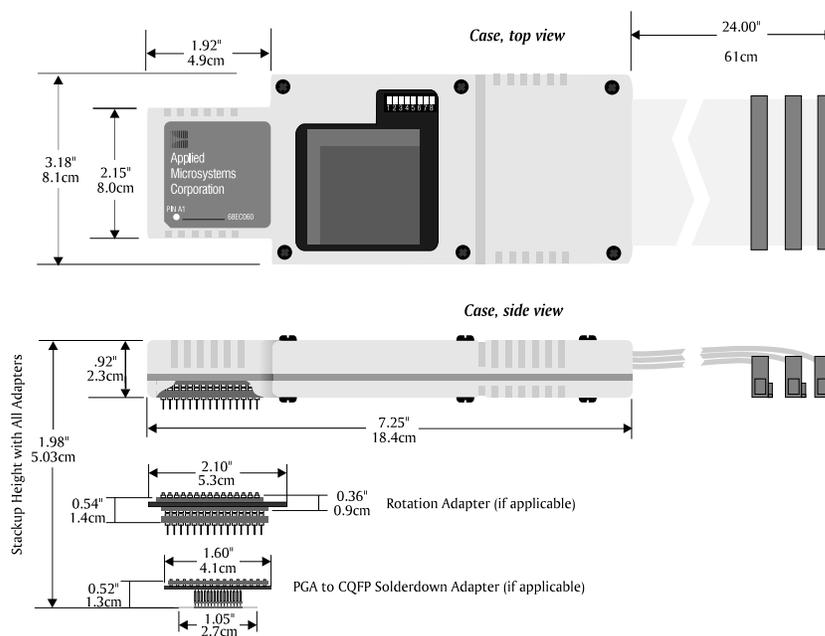
Software development is made from equal parts of debugging and testing code. The CodeICE provides an exceptional set of tools to debug code; CodeTEST offers the same for testing code. In fact, CodeTEST is the first software verification tool suite crafted specifically for embedded software. It offers 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 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.



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

**Get The Advantage of 68060 Emulation**

To see how the new CodeICE emulator can help you make sense of your 68060 project, call 1-800-426-3925 today for information or a product demonstration.



*The CodeICE 060 probe tip. Dimensions are in inches.*

# CodeICE Emulator for 68060, 68EC060 and 68LC060

## Microprocessors Supported

Motorola 68060, 68EC060 and 68LC060 to 50 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, 20 MB swap Solaris 2.2 or above HP 9000, HP-UX 9.0 or above, 20 MB swap

## Communications

### PC Environment

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

High-speed parallel (ISA or EISA bus required, effective download speed 5.0 MB/min)

### Sun and HP9000 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 frequency to 25 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

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

Timestamp resolution from to 50 ns to 100 ms

Includes up to 16 user-specified target signals via optional LSA pod

### 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

256 software execution breakpoints

1 asynchronous breakpoint from keyboard

1 BNC input to support break request from external instrument

## Overlay Memory

1, 4 or 16 MB, zero wait state to 25 MHz

Supports burst by 68060

Map anywhere with 256 byte resolution

## Multi-Processor Support

Supports cache coherency and bus-snooping (required in multi-68060 systems) even while emulator is paused

Supports 68360 register interrogation and modification for targets using 68060 and 68360

## Target Hardware Debug Support

Fully buffered probe-tip permits debug of dysfunctional target hardware

Target diagnostic routines offer a suite of tools 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"



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