

# EL 1600 Development System

## For Motorola 68302 and 68LC302

### Highlights

- Full 25 MHz support for PGA, TQFP and PQFP packages
- Powerful, multi-windowed C/C++ debugger runs on Sun SPARC, HP 9000, and PC hosts
- Debugger operates stand-alone or in MRI MasterWorks environment
- Compatible with MRI, GNU, DIAB Data and Intermetrics compilers (IEEE695 and a.out OMF)
- Installs no monitor in target memory; all 68302 features available
- Auto-configured Performance Analysis System runs at full bus-cycle frequency, monitors unlimited modules
- RTOS-Link™/KA option provides high-level view of RTOS data structures and allows task qualification for breakpoints from within MWX-ICE
- Trace memory with timestamp or LSA captures 72 bits of information about each bus cycle with depth of 8K frames
- Monitor up to 8 parallel events at once or use 4 event system groups to find deeply nested bugs
- Overlay memory (1 MB and 2 MB) supports DMA access to effectively replace target memory
- Single-window correlated assembly-to-source trace display clearly describes effect of compiler optimizations
- Fully isolated probe-tip, diagnostic scope loops, and trace memory help verify hardware design and diagnose problems
- Probe-tip has exceptional AC timing performance for accurate emulation
- Compact probe-tip simplifies target connection
- Ethernet LAN connection for high throughput

*Helping you build it easier,  
faster, and better.*



### Do it Better

The EL 1600 Emulator from Applied Microsystems is customized to the unique needs of 68302 and 68LC302 developers. And it offers utility that spans the entire product development process. Whether you're working on high-level software or debugging production hardware, the EL 1600 makes developing 68302 products easier, faster, and better.

During specification, EL 1600 overlay memory helps your team analyze algorithms in real-time. A powerful trace and event system tracks the movement of data through your software, while the fully-buffered probe tip and diagnostic scope loops accelerate hardware verification and diagnosis. Get through the critical integration phase with non-intrusive emulation and the help of Applied's experienced Application Support Group. And with its ability to accept regression scripts and isolate production problems, the EL 1600 keeps giving value as the product is released to manufacturing.



Applied  
Microsystems  
Corporation

*We also offer tools to support these Motorola products:  
68000, 68020, 68030, 68040/040V, 68060/EC/LC060, ColdFire  
MCF5102, 68330/340, 68331/332, 68360/EN/MH, CPU32*

## Helping You Build It

Easier. That's the difference between a tool you use, and one that sits on the bench. The EL 1600 makes the capabilities of a full-scale emulator so accessible that you'll actually use all that power.

The EL 1600 makes it simple right from the start. Just plug in the probe tip. And because no target hardware resources are used, you don't have to worry about compensating for the emulator or modifying your hardware design.

Best of all, working with the EL 1600 is easy. 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.

Faster. That's what your tools are all about. 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 meeting your schedule.

The EL 1600 is designed to help the whole team get done sooner. From software or hardware engineers to manufacturing technicians, the EL 1600 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 68302, the emulator provides visibility of even the most esoteric processor activity, without intruding on the operation of your application.

Better. The EL 1600 for 68302 makes it easy to do a better job, and that makes a better product. And when you're ready to move to 68360- or 68040-based products, Applied offers tools that use the same interface, so you already know how to get the job done.

## Debugging Made Better

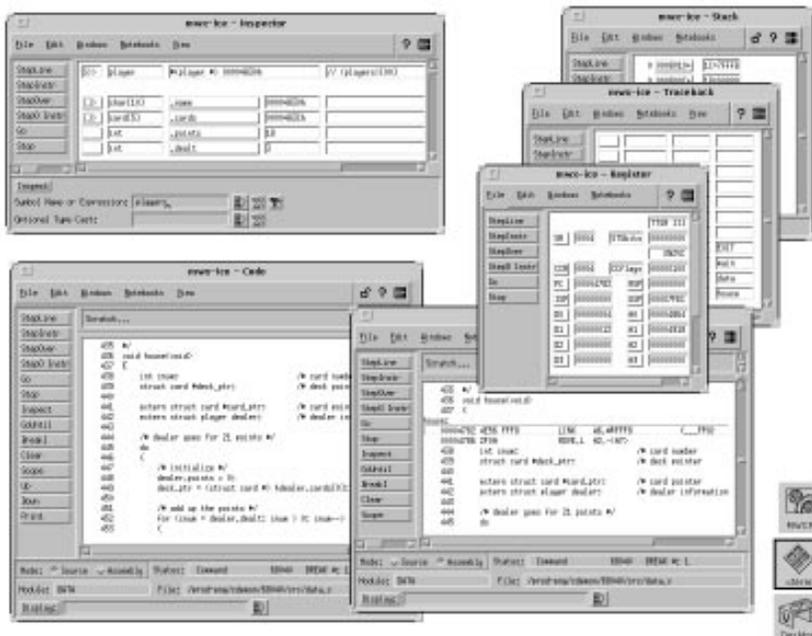
Whether you use a debugger every day or just every so often, you can easily be comfortable and productive with this intuitive, function-rich Sun Sparc, HP 9000 or Windows PC-hosted C/C++ source- and assembly-level debugger.

The notebook feature eliminates the need to remember the 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. 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 mode. You can also display source code together with the corresponding assembly language to clarify the relationship between them and verify compiler performance.

Optional language tools include an ANSI C/C++ optimizing compiler, assembler, and an instruction set simulator. The debugger also fits seamlessly into the MasterWorks environment from Microtec Research, so you can easily enjoy the advantages of integrated graphical development.



*The multi-windowed 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.*

### **Trace System Simplifies Problem Analysis**

The last thing you want to do is spend your time figuring out the relationship between execution history and your source code. The EL 1600 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 physical layer 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 72 bits of width and 8K frames of depth, including internal/external DMA activity. The Event System can qualify trace to help focus your search for a problem. 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.

### **Trace Disassembler Reveals Critical Information**

The custom 68302 trace memory disassembler helps you understand how your code operates and manipulates data. It also provides valuable information about interrupt and stacking activity and function calls.

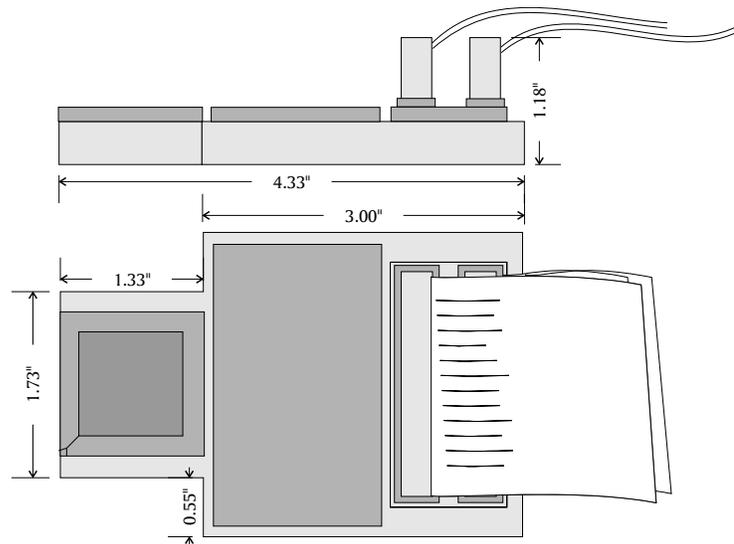
### **Breakpoint System Easily Tracks Code Execution**

The EL 1600 Breakpoint 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 up to 64 transparent breakpoints anywhere in code.

### **Intuitive Event System Pinpoints Problems**

The advanced Event System helps you rapidly track down deeply nested, real-time problems. The system can be easily configured using familiar names and symbol references. It supports address, data, or status qualification, or any combination of the three.

The event system language 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; trace one bus cycle; increment, reset, or toggle a counter; reset timestamp; change event group; jump to a user-specified routine; and generate an external trigger for operations such as synching an oscilloscope.



*EL 1600 for 68302 probe tip dimensions.*

### Versatile Overlay Memory

EL 1600 overlay memory helps extend the utility of the emulator to early stages of the development cycle. Before target hardware is available, overlay memory and the simulated I/O capability provide an execution vehicle without the need for an evaluation board.

Mapping overlay in place of 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.

One of the most important features of the 68302 is its DMA capability; EL 1600 overlay memory fully supports these DMA accesses. Overlay can be mapped on 2 KB boundaries anywhere in memory. Memory sizes of 1 MB or 2 MB let you match overlay to the requirements of your target.

### Non-Intrusive Performance Analysis

The Performance Analysis system puts 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 helps you generate reports to document software and product performance.

### Real Time Kernel Support

The RTOS-Link/KA package allows you to debug your application running with a commercial RTOS without changing tools. RTOS-Link/KA provides a high-level view of OS structures and task status. Using RTOS-Link/KA, you can qualify breakpoints to specific tasks.

### Network Support and Fast Code Downloads

With Ethernet network support for Sun and HP 9000 workstations and Windows PC hosts, the EL 1600 lets you get out of the lab and work where you are most comfortable. Exceptional download speeds help accelerate code modification cycles.

### Keeping You Satisfied

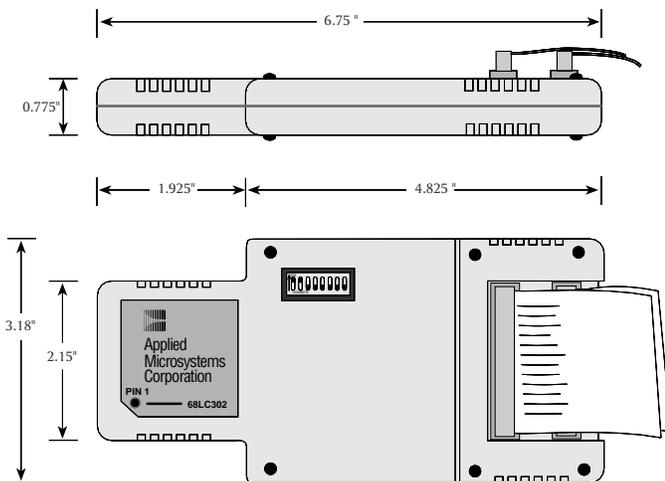
Because our success depends on your success, we take product support very seriously. In fact, at Applied Microsystems we call our program Total Customer Satisfaction.

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 embedded design teams, and the commitment of the entire company. With over 10,000 installed solutions and more than sixteen years of leadership in embedded hardware and software development tools, our team is an important asset on your team.

### Do It Now

To see how the EL 1600 emulator can help build your products, call 1-800-426-3925 today for information or a product demonstration.



EL 1600 for 68LC302 probe tip dimensions.

# EL 1600 Emulator for Motorola 68302 and 68LC302

## Microprocessors Supported

Motorola 68302, 25 MHz, 5-volt  
Motorola 68LC302, 25 MHz, 3.3-  
and 5-volt

## Packages Supported

132-pin PGA  
132-pin PQFP/CQFP via solder-down  
adapter  
144-pin TQFP via solder-down  
adapter (302)  
100-pin TQFP via solder-down  
adapter (LC302)

## 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  
HP 9000, HP-UX 9.0 or above,  
20 MB swap

## Communications

### Windows PC Environment

IEEE 802.3 10base2, 10base5,  
10baseT (effective download speed 4  
MB/min)

### Sun Sparc and HP 9000 Environment

IEEE 802.3 10base2, 10base5,  
10baseT (effective download speed 4  
MB/min)

## Optional Code Generation Tools

ANSI C / C++ cross-compiler  
Cross-assembler  
Embedded linking loader  
Object module librarian

## Source-Level Debugger

### Integrated source level debugger

Window-oriented interface  
(X-Window support on Sun)  
Support for C, C++ and assembler  
Access to source code variables  
Disassembled source view for  
machine-level debug and patch  
Access to all global, local, stack-based  
and register-based symbols  
Full C-typing features

### Execution control and full access to the emulator

Soft switches provide interactive  
instrument control  
Execution breakpoints can be set on  
line numbers, C statements,  
program labels and memory addresses  
Display trace in raw, assembly, and  
high-level formats or disassembled  
Monitor real and simulated I/O  
High-level control of event system  
setup and operation

Perform emulator operations while  
the target is running

### In-line assembler/memory functions

Assemble code in target memory  
using Motorola mnemonics

Display and modify memory

### Performance analysis

Display relative time spent in  
functions or groups of functions

### Advanced testing and setup capabilities

Construct complex macros containing  
C-like statements and debugger  
commands

Record and play back debugging sessions

### File format compatibility

IEEE 695, A.OUT, COFF, S-record

## RTOS Support

ISI pSOS+ via Applied's RTOS-Link™

## Target Diagnostics

Built-in diagnostic routines to debug  
target hardware before running code

## Trace and Event System

### Trace System

72 bits of information captured on  
every bus cycle  
24 bits of address, 16 bits of data, 16  
bits of status,  
16 bits of timestamp or Logic-State  
information  
Depth is 8 K frames  
Optional timestamp with resolution  
from 100 ns to 1 ms

### Event System

4 independent groups  
Up to 8 parallel comparisons per  
group  
1 event counter per group  
Up to 8 conditional statements per  
group  
for a total of 32 event statements  
1 trigger-output via BNC connector

### Event Actions (may be combined)

Break emulation  
Change event group  
Trace on/off/trace-one  
Jump to user-specified routine  
Count one, toggle on/off, reset  
counter  
Trigger output

## Breakpoint System

64 software execution breakpoints  
1 asynchronous breakpoint  
from keyboard

## Overlay Memory

1 MB or 2 MB  
Zero wait-state performance at  
16 MHz; two wait states at 25 MHz  
Supports 68302 DMA  
Mappable anywhere with 2 KB  
resolution

## Multi-Processor Support

Supports target access to internal  
RAM and registers of 68302 even  
while emulator is paused

## 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: 17.5" X 14.75" X 6.5" (L x W x  
H)  
Chassis weight: 25 lbs.  
68302 Probe Tip: 4.33" x 2.83" x  
1.18" (L x W x H)  
68LC302 Probe Tip: 6.75" x 3.18" x  
.775" (L x W x H)  
Probe-tip cable length: 16.5"

# *EL 1600 Emulator for Motorola 68302 and 68LC302*



**Applied  
Microsystems  
Corporation**

**U.S. and Canada**

Applied Microsystems Corporation  
5020 148th Avenue N.E.  
P.O. Box 97002  
Redmond, WA 98073-9702  
Tel: 206-882-2000  
Toll-Free: 1-800-426-3925  
TRT Telex 185196  
Fax: 206-883-3049

**Europe**

Applied Microsystems Corporation Ltd.  
AMC House, South Street  
Wendover, Buckinghamshire, HP22 6EF  
United Kingdom  
Tel: +44 (0)1296-625462  
Fax: +44 (0)1296-623460

**Germany**

Applied Microsystems GmbH  
Stahlgruberring 11a, 81829 Muenchen  
Germany  
Tel: +49 (0)89-427-4030  
Fax: +49 (0)89-427-40333

**Japan**

Applied Microsystems Japan, Ltd.  
Arco Tower 13 F  
1-8-1 Shimomoguro, Meguro-ku  
Tokyo 153  
Japan  
Tel: +81-3-3493-0770  
Fax: +81-3-3493-7270

*For more information, call 1-800-426-3925  
or browse <http://www.amc.com>*

CodeICE is a trademark of Applied Microsystems Corporation. All other brand names, product names or trademarks cited herein belong to their respective holders.

This document may contain preliminary information and is subject to change without notice. Applied Microsystems Corporation assumes no responsibility or liability for any use of the information contained herein. Nothing in this document shall operate as an express or implied license or indemnity under the intellectual property rights of Applied Microsystems Corporation or third parties. NO WARRANTIES OF ANY KIND, INCLUDING BUT NOT LIMITED TO THE IMPLIED WARRANTIES OF MERCHANTABILITY OR FITNESS FOR A PARTICULAR PURPOSE, ARE OFFERED IN THIS DOCUMENT.  
© Applied Microsystems Corporation 1995. All rights reserved.

