

Hardware and Software Debug Tools for the IBM 6x86 Microprocessor



Application Note

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Introduction

Finding and solving problems or "bugs" in software or hardware is primarily a logical process. You start off with a problem, at least with a general symptom, and follow a series of steps to isolate the problem. The key to this debug process is to have the right tool for the right problem. This application note is intended to describe a complete list of debug tools for the IBM 6x86** processor. Most of the software debug tools used in work with 486 class processors are viable when debugging the 6x86 processor. However, the hardware tools used to provide the physical interface between the 6x86 processor and the software must be upgraded. These new hardware tools are required since the PGA package pinout, data width of 64 bits, and bus protocol are different. We will describe some of the various options available in tools in three areas; software, hardware, and hardware systems.

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Software Tools

Since the majority of the problems that a user may have to debug are application software programs, we will first consider the software tools available. We will consider three areas of software system operation: DOS**, Windows** and OS/2*. All of these tools reside in the background and share common features.

Software debug tools take advantage of the breakpoint registers and trace ability of the 386, 486, 586 and 686 classes of processors. The IBM 6x86 microprocessor supports the same debug resources as those of a 486 class processor and therefore all of the 486 class debug

software tools are compatible. The software is invoked by a key press or when a fault in the application software occurs. The software debug tools use a combination of display windows to show the state of the processor and system. They also allow modifications to registers, system memory, and program flow.

The following chart shows some of the tools available for the three operating environments previously listed.

DOS	Soft/ICE/W**	Periscope/EM**
WINDOWS	Soft/ICE/W	Periscope/EM
OS/2	Included in OS/2	Periscope/32** for OS/2

The three tools listed in the above chart are further described in the following paragraphs.

Soft-ICE/W

Soft-ICE/W is used to debug applications under DOS and Windows. It debugs 16 bit and 32 bit code, application programs as well as device drivers. It resides underneath Windows, ready to be activated at a touch of a key or when your Windows system faults.

It takes full advantage of the debugging support features built into 386 and 486 CPUs which lets you set breakpoints without compromising the speed of your programs. This feature is critical for time dependent fails. It also sets up a back trace buffer that keeps the instructions that led to the fail. If you have the source code or if the application was compiled with debug features, then you can use Soft-ICE/W at the source level. Soft-ICE goes wherever your application goes. If the application invokes a system function (i.e. Windows kernel), then Soft-ICE/W will take you there. Soft-ICE/W is activated at the time Windows is being launched in protected mode which provides capability for debug when the Windows kernel is being loaded.

Company: **Nu-Mega Technologies**
PO. Box 7780
Nashua, NH 03060
Phone: (603) 889-2386

Periscope

The core Periscope debuggers product line includes Periscope/EM, Periscope Model 1**, and Periscope Model 4**. The Periscope/EM software, included with all the Periscope products, provides capability to debug DOS applications: TSRs, device drivers, and interrupt driven software. Periscope Model 1 provides a board that has two additional capabilities: first the user can run Periscope from the board's memory leaving 640KB of system memory intact, second the user can debug software before DOS is loaded using the board's ROM-scan feature. Periscope Model 4 requires a CPU specific pod for debugging time-sensitive software, hardware interrupts or programs that exhibit intermittent behaviors your software debugger cannot help you find.

Periscope also has a new product called **Persicope/32 for OS/2** for debugging under an OS/2 environment. It helps in debugging physical, virtual and PM device drivers and other system-level software running in an OS/2 2.x environment.

Company: **The Periscope Company,**
Suite 100
1475 Peachtree Street
Atlanta, GA 30309-9946
Phone: 800-722-7006

OS/2 System Debug Tool

This tool is included with every copy of OS/2 Warp* and a separate kernel program for OS/2. Refer to your OS/2 or OS/2 Warp operating system manuals for further information about this product.

Hardware Tools

Under hardware tools we consider any items that are specific to the IBM 6x86 that might be useful when solving hardware or system BIOS problems. This category includes sockets, breakout boards, and emulation pods. Sockets can be useful when converting system planars from one manufacturer to another. Breakout boards and emulation pods are useful when trying to solve a problem with oscilloscopes or logic analyzers.

Sockets

Under this category we list two types of sockets. A machine pin socket allows easy stacking to physically raise the processor and also allows modification of the pins for electrical reasons. We also consider the Zero-Insertion-Force (ZIF) socket found on most planars. The ZIF socket is not very useful for raising the processor or modification, however, it may be required for fixing a planar or for the design of a new board using the IBM 6x86 microprocessor. Sources for these sockets are listed below.

Augat, Inc.

**452 John Dietsch Blvd.
Attleboro Falls, MA 02763
Phone: (508) 699-7646**

Focus Microsystems

**1735 N. First St.
Suite 307
San Jose, CA 95112
Phone: (408) 436-2336**

Advanced Logic Design

**20111 Stevens Creek Blvd.
Suite 270
Cupertino, CA 95014
Phone: (408) 446-1004**

Breakout Board

A breakout board is a device that is inserted between the processor and the system planar or motherboard. All of the data, address, control, power and ground signals are individually brought out to a pin. These pins can then be attached to an oscilloscope or logic-analyzer in order to debug the problem.

At the current time Emulation Technologies sells a breakout board for Intel's Pentium** processor. This breakout board can be used in lieu of a specific breakout board for the IBM 6x86 microprocessor. The address and phone number of Emulation Technologies is listed below.

Emulation Technologies, Inc.
23344 Walsh Ave.
Bldg F
Santa Clara, CA 95051-1301
Phone: (408) 982-0660

Logic-Analyzer Emulation Pods

The last item under the category of hardware tools is that of logic-analyzer pods. This device sits between the processor and the system planar like the breakout board. However, instead of the signals going to individual pins, they are grouped together onto connectors that plug into the logic-analyzer cables. This allows a logic-analyzer with the required number of cables to plug easily into the processor bus. Usually this emulation pod includes software that sets up the logic-analyzer in the correct configuration and also may accomplish disassembly of the machine code stream.

At the current time there are no emulation pods specifically designed for the IBM 6x86 microprocessor. However, since the IBM 6x86 and Intel's Pentium processors share the same bus architecture, an emulation pod designed for the Intel Pentium processor can be used for debug with the IBM 6x86 processor. Sources for emulation pods for the Intel Pentium processor are listed below for two major logic-analyzer manufacturers.

Hewlett-Packard** 5000 Series

Tektronix **XXXX Series

Hewlett-Packard
1900 Gardens of the Gods Rd.
Colorado Springs, CO 80907
Phone: (719) 590-2081

To Be Determined

Hardware Systems:

In the past, with less complex processors, various hardware debug systems were available. An In-Circuit-Emulation (ICE) tool would replace the system processor with a complete system that would emulate the working of the normal processor. Usually this system would contain a special version of the processor that allowed an external system to view the internal workings of the processor.

These ICE systems were expensive and required a dual development penalty to the micro-processor developer, since two separate processors would have to be manufactured. The

complexity of 586 and 686 class processors and cost of development of such a system has prevented further development of ICE systems.

The debug of BIOS software and hardware systems is still a problem since the software debug tools are not usable until at least DOS boots. The hardware tools previously described can be used but BIOS software problems would require an extensive amount of time to solve. An intermediate tool that does not require the investment of developing an ICE system would be a hardware debug system. This type of tool would allow an outside system to interrogate the processor without requiring any of the hardware or software systems to be functional. This intermediate debug system may be possible with the IBM 6x86 processor, however, since these tools and this processor have only recently been announced, no intermediate debug tool is currently available. Contact your local field application engineer for more information.

Summary

This application note has tried to show the various tools, both software and hardware, that are available to the user for use in the debug of application problems. As the marketplace develops, other items will be added to this note.

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