# Agilent Emulation and Analysis Solutions for the Motorola CPU32 Microcontrollers

Product Overview

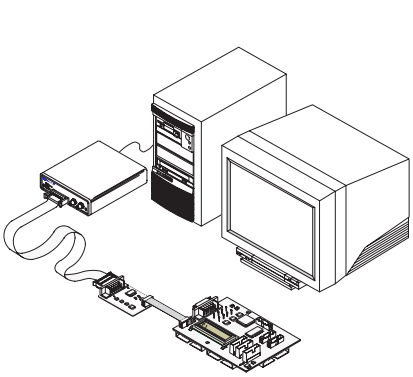
## Debug and Integrate Real-Time Embedded Systems

Quickly and accurately determine the root cause of many difficult hardware, software, and system integration problems with Agilent Technologies' powerful emulation and logic analysis solutions.

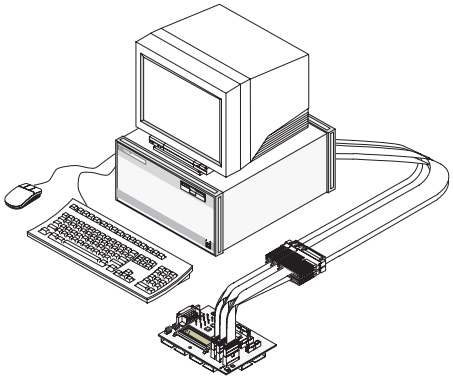
Agilent's emulation and analysis solutions for the Motorola CPU32 microcontrollers combine the powerful tools of run control, code download, integrated debugger connections, and logic analysis for a comprehensive, scalable system development environment.

With a scalable solution from Agilent, your design team members can customize product offerings to meet unique requirements. Solutions range from emulation probes combined with the industry's leading debuggers to emulation with real-time trace to help solve today's most complex design problems. Agilent's solutions are designed to meet your needs today and help protect your investment as your needs change in the future.

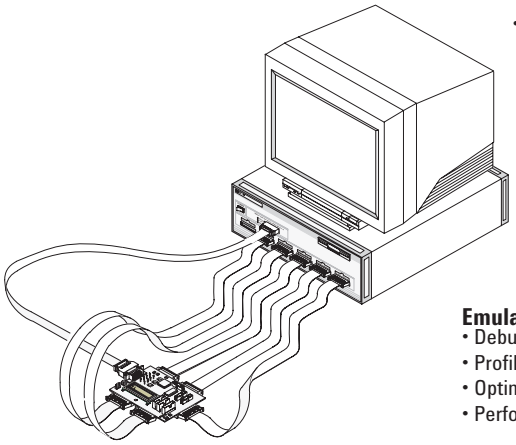
With logic analysis providing timing and state analysis, you can monitor microcontroller activity in relation to other important system signals such as a PCI bus, other microcontrollers, or I/O devices. Most traditional emulation systems don't allow you to time-correlate events across your entire system using timing, analog, and state analysis for your most difficult integration problems.



**Emulation Solution**
- Verify Interrupt Routines
- Debug Assembly Code
- Optimize Code



**Logic Analysis Solution**
- Perform Basic Signal Measurements
- Profile Hardware Operation
- Verify Signal Integrity
- Verify Conformance to Specifications
- Exercise Microcontroller and Other Hardware
- Debug Boot Code



**Emulation with Real-Time Trace Solution**
- Debug Hardware/Software Interaction
- Profile Hardware/Software Interaction
- Optimize System Performance
- Perform System Test

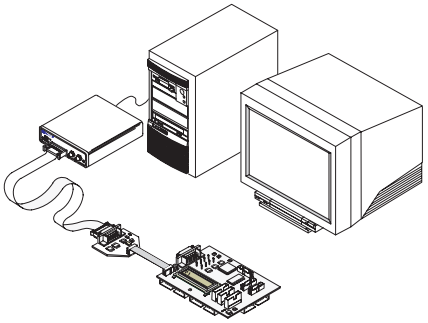
The logic analyzer is nonintrusive, allowing you to run your target system at full speed. A system trace, up to 2 M deep, can be combined with complex triggering to find the toughest problems. The microcontroller instruction set execution can be correlated to the high-level source code with the Agilent source correlation tool set.

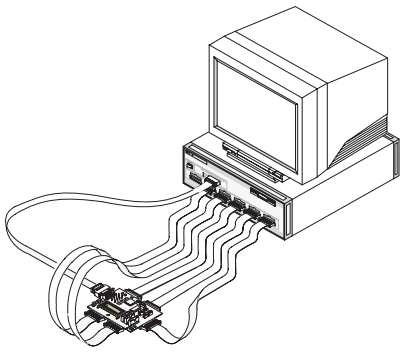
**Agilent Technologies**

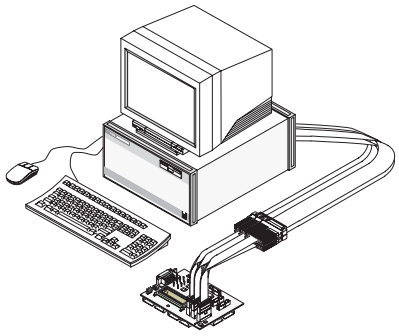
Innovating the HP Way

## Agilent Scalable Solutions

Agilent emulation and logic analysis solutions are scalable for each member of the digital design team. The following are three typical configurations for firmware/software debug, hardware debug, and system integration.







Components of these solutions include a logic analyzer, emulation probe or module, analysis probe, inverse assembler, source correlation tool set, and system performance analysis tool set.

Information on each of these components is included in this document.

| System Features | System Components and Functionality |
|---|---|
| **Emulation Solution** | |
| Microprocessor run control on your target system | Emulation Probe: (see p. 3)<br>• Download code, view and modify memory, and view registers on your target system or evaluation board from the debugger interface |
| Debugger connection | Connection to industry-leading debuggers from Green Hills, Microtec, and SDS |
| **Emulation with Real-Time Trace Solution** | |
| Microprocessor run control on your target system<br><br>Debugger connection<br><br>Real-time logic analysis trace solution:<br>• Assembly level trace<br>• Source code trace devices<br><br>QEP or PGA probing solution | 16600A or 16700A Series Logic Analysis System:<br>• Capture and analyze code flow and data flow without halting the target system<br>• Time-correlate analog, timing, and state events across your entire system<br>• Monitor microprocessor activity in rela tion to system buses, other microproces-sors, or I/O devices<br>Analysis Probe: (see p. 8)<br>• Choose from 132, 144, 160, 240 pin QFP probing solution, or 241 pin PGA probing solution<br>• Disassemble trace listing into CPU32 mnemonics<br>Integrated Emulation Module: (see p. 3)<br>• Download code, view and modify memory, and view registers on your target system or evaluation board from the debugger interface<br>• Connect to industry-leading debuggers from Green Hills, Microtec, and SDS<br>Source Correlation Tool Set: (see p. 9)<br>• Time-correlate acquired logic analysis trace to high-level source code<br>• Step through trace in assembly or high-level source code |
| **Logic Analysis Solution** | |
| Real-time logic analysis trace solution:<br>• Assembly level trace<br>• Optional source code trace<br><br>QFP or PGA probing solution | 16600A or 16700A Series Logic Analysis System:<br>• Capture and analyze code flow and data flow without halting the target system<br>• Time-correlate analog, timing, and state events across your entire system<br>• Monitor microprocessor activity in relation to system buses, other microproces sors, or I/O devices<br>Analysis Probe: (see p. 8)<br>• Choose from 132, 144, 160, or 240 pin QFP probing solution or 241 pin PGA probing solution<br>• Disassemble trace listing into CPU32 mnemonics |

| Microcontroller | Package Type | Microcontroller Clock Speed | Emulation Solution | Emulation with Real-Time Trace Solution | Logic Analysis Solution |
|---|---|---|---|---|---|
| 68330/L331/L332 | | | X | | |
| 68331/32/34/35 | 132 PQFP | Up to 25 MHz | X | X | X |
| | 144 TQFP | | | | |
| 68F333 | | | X | | |
| 68336/76 | 160 PQFP | Up to 25 MHz | X | X | X |
| 68338/39 | | | X | | |
| 68340 | 240 PQFP | | X | | |
| | 241 PGA | Up to 25 MHz | X | Agilent & Corelis | Corelis |
| 68341/49 | | | X | | |
| 68360/EN360/PM360/ | 240 PQFP | Up to 33 MHz | X | X | X |
| MH360/MH360V | 241 PGA | | | | |
| 68370/71 | | | X | | |

**Table 1: Emulation and Analysis Solutions for Motorola CPU32 Microcontrollers**

## Emulation Probe and Module

**Figure 1a: Standalone Agilent Emulation Probe**

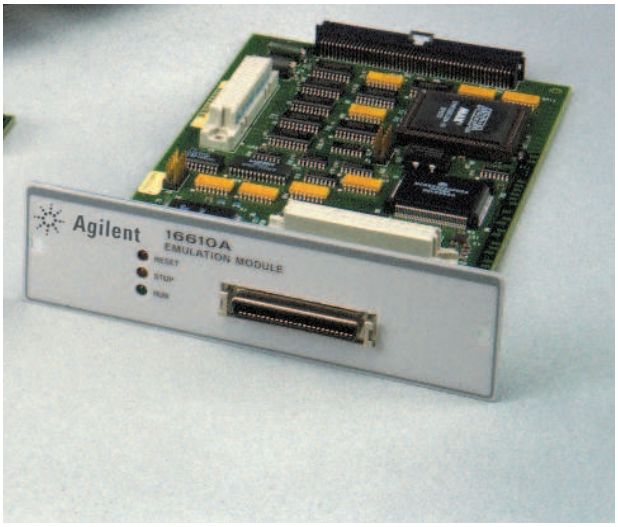



**Figure 1b: Emulation Module for Integration with Agilent 16600A and 16700A series**

The emulation probe and emulation module provide the same functionality. The emulation probe is a standalone product, as shown in figure 1a. The emulation module is an integrated plug-in for the Agilent 16600A and 16700A Series logic analysis systems as shown in figure 1b.

Both solutions help you debug your code by providing run control, code download, and memory/register display and modification. You can control program execution through single stepping, start/stop, run/break, and-set/modify breakpoints. You can also run code at full speed in the target.

The emulation probe can be controlled by an industry-leading debugger. The emulation module can either be controlled by a debugger or the emulation control interface provided with the logic analyzer.

The emulation probe and module can be controlled over your local area network (LAN) by the debugger and can connect directly to your target through the Motorola standard 8- or 10-pin dedicated connector. They also can be connected through the analysis probe, as shown in figure 2.

Unlike traditional emulators, the emulation probes and modules provide more stable operation by accessing only the debug pins of

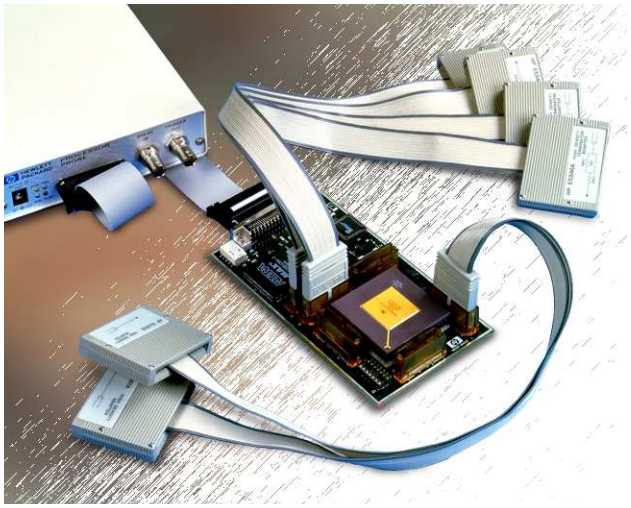


**Figure 2: Agilent Emulation Probe connecting to the CPU32 Analysis Probe.**

the microcontroller and affect no other signals. You don't need a serial port on your target system to download code. Unlike ROM monitors, they don't require user memory.

### Debugger Interface

Industry-leading debuggers can control the emulation probe or module. You can set breakpoints, single-step through code, examine variables, and modify source code variables from your high-level source code debugger interface.

Debugger interfaces must be ordered directly from the debugger vendor.

### Debugger Connections

Green Hills Software, Inc.
30 West Sola Street
Santa Barbara, CA 93101 USA
Phone: (805) 965-6044
www.ghs.com

Microtec, A Mentor Graphics Company
880 Ridder Park Drive
San Jose, CA 95131 USA
Phone: (800) 950-5554
Phone: (408) 487-7000
www.mri.com

Software Development Systems, Inc.
815 Commerce Drive, Suite 100
Oak Brook, Illinois 60523 USA
Phone: (630) 368-0400
www.sdsi.com

Please check with your local Agilent Test and Measurement sales office or visit our web site at www.agilent.com/find/las-data for the current list of debugger connections.

### Emulation Control Interface

The emulation module integrated into the logic analysis system can be controlled directly by the emulation control interface. You can easily display and modify contents of microcontroller registers, system memory, and I/O. You can also view memory code segments disassembled into familiar Motorola CPU32 assembly instructions.

From the emulation control window you can instruct the microcontroller to run, break, reset, or single-step. You can also set and verify memory, I/O, and register values.

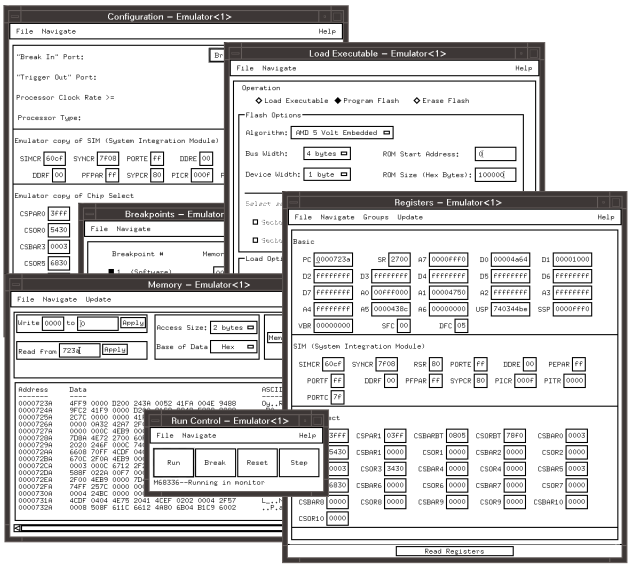



**Figure 3: Emulation Control Interface**

Writing command files that set up registers, memory, and I/O in your system is easy with the command language. Once the command file is written, save it on the logic analyzer hard disk. When you want to initialize your hardware system to a particular state, simply recall and execute the command file. Unlike the debugger interface, the emulation control interface does not reference back to the high-level source code.

**Flash Support**
Agilent emulation modules and probes support flash download. AMD 12V, AMD 5V, Intel Auto, and Intel Quickpulse (AMD Flashwrite) are supported.

Contact Green Hills, Microtec, or SDS for flash algorithms supported from their debugger interface.

**Emulation Module and Probe Migration**
Agilent helps protect your current investment by providing a migration path for the emulation modules and probes as your needs change. To move from one processor family to another, simply order a migration kit for the emulation module or probe, which will provide all the necessary hardware, firmware, and cables to support your new processor at a fraction of cost of a new probe or module.

This migration path is the same for emulation probes and emulation modules.

**Emulation Module Triggering Integration with Logic Analyzer**
With the emulation module, you can use the powerful triggering of the 16600A and 16700A Series logic analysis systems to halt on events such as microcontroller activity, system buses, or other external events. The emulation module will also trigger the logic analyzer when a breakpoint is hit. This provides powerful correlation between the debugger interface environment and the logic analyzer.

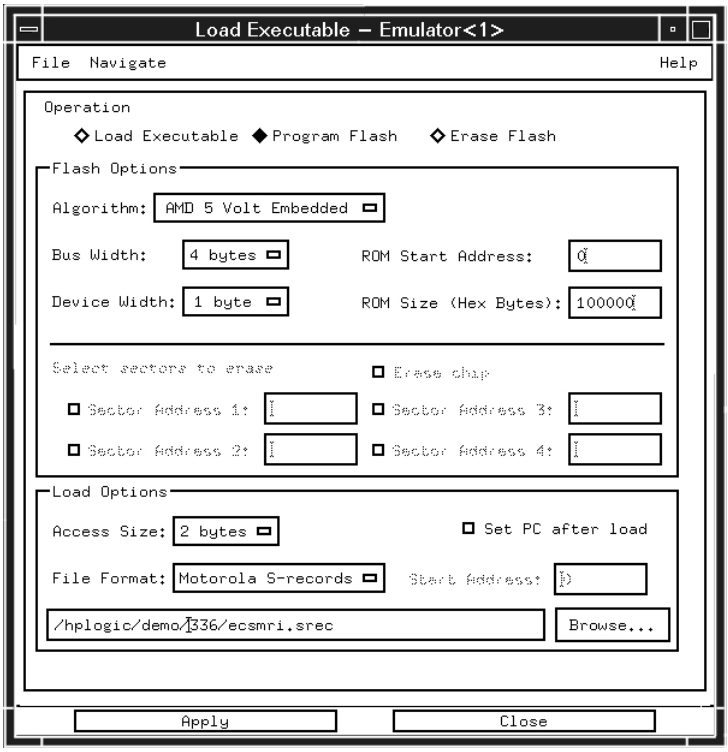



**Figure 4: Flash Programming from the Emulation Control Interface**

The emulation probe provides similar capability on two BNC connectors for "trigger in" and "trigger out" to be used with non-integrated test equipment.

**Emulation Probe and Module Target Connection Information**
The emulation probe and module can be used directly with the analysis probe, as shown in figure 2. When used together, the 10-pin connector is not necessary because the debug port pins are accessed directly through the analysis probe.

If the analysis probe is not being used, access to the target system is made through the Motorola standard 8- or 10-pin connector. If your target system does not incorporate the connector, you can access the BDM pins on the microcontroller directly using the flying lead probes that are provided.

To improve accessibility to the target microcontroller, the cable between the emulation probe or emulation module and the target microcontroller is three feet long. This cable is terminated by a TIM (Target Interface Module) for signal adaptation.

| | |
|---|---|
| **Voltages** | Both 3.3 V and 5 V are supported |
| **Download Rate** | Four megabytes per minute when the target is running at full speed. |
| **FlashProgramming** | The emulation probe and module can program your target system flash during product development or manufacturing. There is no size limitation on the flash image because the image is copied directly from the host computer to your target system.<br>**AMD 12V Embedded**<br>**AMD 5V Embedded**<br>**AMD Flashwrite**<br>**Intel Auto**<br>**Intel Quickpulse** |
| **Electrical Loading on Target System**<br>Pin 1,2,4,6,7,8,9,10<br>Pin 9 | <br>:40pF, 7.5K to Vdd<br>Idd<10mA at 5V |
| **RS-232-C** | 1200 through 115200 baud rate supported |
| **Temperature** | Operating 0°C to +55°C<br>(+32°F to +131°F)<br>Non operating<br>- 40 °C to + 70°C<br>(-40°F to +158 °F) |
| **Altitude** | Operating : 4600m (15000 ft)<br>Nonoperating: 15300m (50000 ft) |
| **Humidity** | 15% to 95% Relative |
| **Safety Approvals** | IEC1010-1:1990<br>AMD 1:1992<br>UL 1244<br>CSA-C22.2 No 231<br>(series M-89) |

**Table 2: Emulation Probe and Module Specifications**

## Real-Time Trace Analysis

Real-time trace analysis consists of a physical connection to signals on the Motorola CPU32 microcontroller, acquisition of relevant data, and analysis of the real-time captured bus information.

Physical connection to the microcontroller is provided by the probing solutions listed below.

Real-time trace analysis solutions are available for probing alternatives. These include inverse assembly, source correlation, and system performance analysis.

For information on the data acquisition modules for the 16600A and 16700A Series logic analyzers, please refer to related Agilent literature on page 16.

| CPU32 Microcontroller | Supported Speed and Voltage | Probing Solutions | Real-Time Trace Solutions |
|---|---|---|---|
| 68331/32/34/35<br>68336/76 | Up to 25 MHz<br>3.3 and 5 Volt | Analysis Probe<br>• 132-, 144-, 160-Pin QFP probing<br>• Inverse assembler included<br>• Access to all microcontroller signals for logic analysis, | Inverse Assembly<br>• Disassembly of bus information into CPU32 microcontroller mnemonics<br>• CPU32 configuration files for logic analyzer<br><br>Source Correlation<br>• Time-correlation of acquired trace to high-level source code<br>• Trigger and search through trace in high-level source code<br><br>System Performance Analysis<br>• Statisical performance measurements on trace data<br>• State overview, state interval, time interval, and time overview measurements |
| 68340 | Up to 25 MHz<br>3.3 and 5 Volt | Analysis Probe from Corelis*<br>• 241-Pin PGA<br>• Inverse assembler included<br>• Access to all microcontroller signals for logic analysis<br><br>* Not validated with the Agilent source correlation tool set and 3rd Party debugger solutions | |
| 68360/EN360/<br>PM360/MH360/<br>MH360V | Up to 33 MHz<br>3.3 and 5 Volt | Analysis Probe<br>• 240-Pin QFP probing<br>• 241-Pin PGA probing<br>• Inverse assembler included<br>• Access to all microcontroller signals for logic analysis | |

**Table 3: Real-Time Trace and Probing Alternatives**

## Analysis Probe

The analysis probe allows easy connection of an Agilent logic analyzer to your Motorola CPU32 QFP target system for real-time analysis. With the analysis probe solution, you don't need to design special debug connectors into your target system.

The analysis probe connects to the microcontroller by a QFP probe or PGA connector. Mechanical dimensions are included in figures 9 thru 12.

## Modes of Operation

### State-Per-Clock

In state-per-clock mode, every clock cycle is captured by the logic analyzer, including idle and wait states. Address, data, status, and I/O ports are captured on each CPU clock. This mode is useful in hardware validation and when debugging system crashes.

### State-Per-Bus Cycle

In the state-per-bus cycle mode, the analyzer samples address, data, status, and I/O ports once per bus cycle. This mode is useful in software debugging because it increases the readability of the executed code and stores more instructions in the logic analyzer's trace memory.

### Timing Mode

Timing analysis is supported. The analysis probe provides unbuffered timing analysis for all signals.

### Pods Required

Each analysis probe includes high-density cables for connection to analyzer pods and configuration software to set up the Agilent logic analyzer for compatibility with the analysis probe interface.

See table 4 for the number of analysis pods for each analysis probe solution.

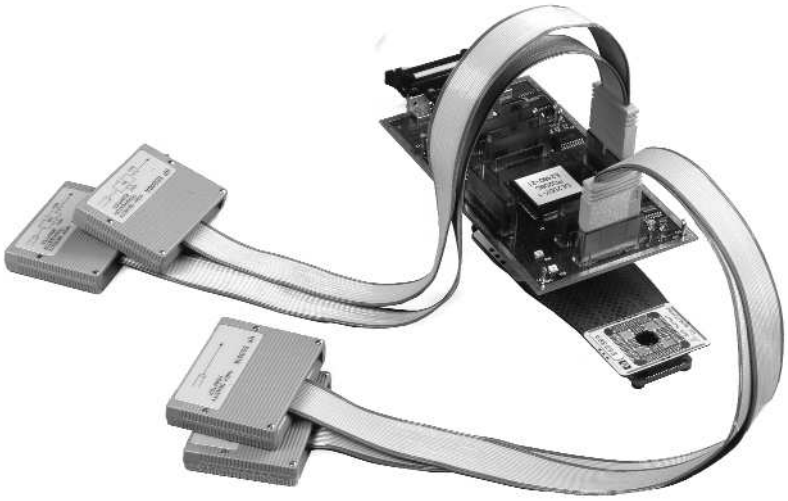


**Figure 5: Agilent Analysis Probe for Motorola CPU32 QFP Target Systems**

| CPU32 Models | State, timing analysis, of I/O ports | State analysis of reconstructed address, inverse assembly, source level analysis | Timing analysis of address, data, status busses |
|---|---|---|---|
| 68331/32/34/35 68336/76 | 4 analyzer pods required | 4 analyzer pods required | 4 analyzer pods required |
| 68360/EN360/ PM360/MH360/ MH360V | 6 analyzer pods required | 6 analyzer pods required | |

**Table 4: Analyzer Pods Required for State and Timing Analysis**

## Inverse Assembler

Software provided with the analysis probe quickly configures the logic analyzer by labeling address, data, and status signals for the CPU32. The software includes an inverse assembler, which gives you CPU32 mnemonics in the trace listing for easy correlation between captured data and target code. Instructions that are prefetched but not executed are marked in the trace display. Coprocessor operations can also be displayed or removed from the trace. Additionally, when the target microcontroller is configured in show mode, the analysis probe will capture and disassemble internal cycles.

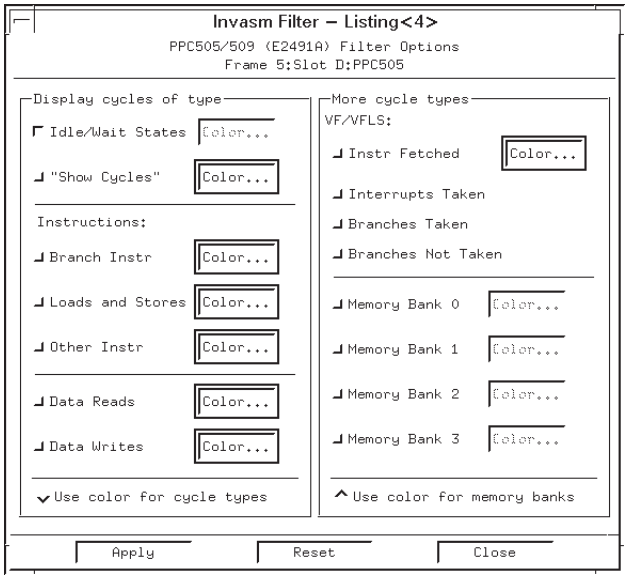



**Figure 6: Inverse Assembler Filter Options**

## Agilent B4620B Source Correlation Tool Set

The Agilent B4620B source correlation tool set allows you to time-correlate an acquired trace to written code. The source correlation tool set uses the symbolic information provided in your object file to build a database of source files, line numbers, and symbol information.

After the logic analyzer acquires the real-time trace, you can step through the trace at assembly-code level or source-code level. You can more easily locate the cause of a problem by stepping backward to the root cause. With time-correlated analysis in both the digital and analog domains, Agilent Technologies provides powerful solutions for your most difficult hardware/software integration problems. IEEE 695, OMF X86, Elf/Dwarf, ASCII, and TI COFF symbol files are supported.

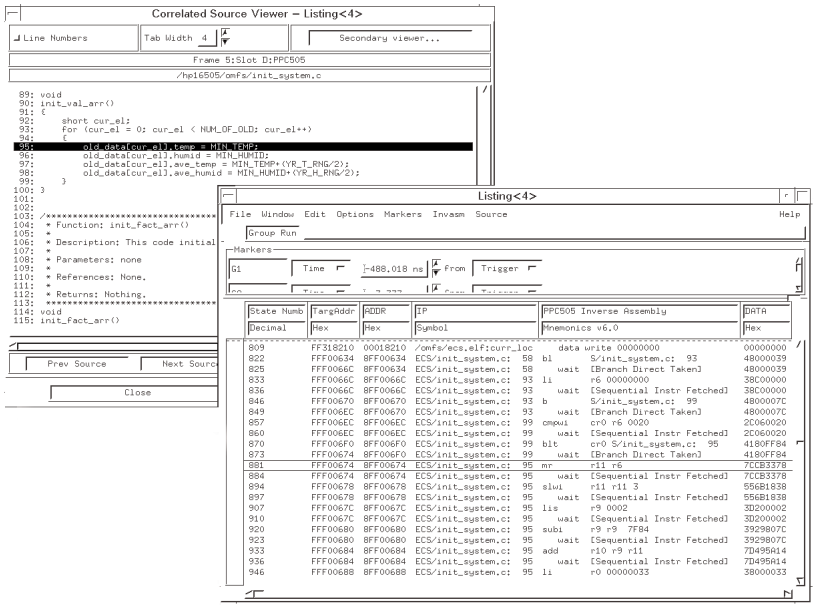



**Figure 7: Inverse Assembled Trace Time-Correlated to Source Code Using the Agilent Source Correlation Tool Set**

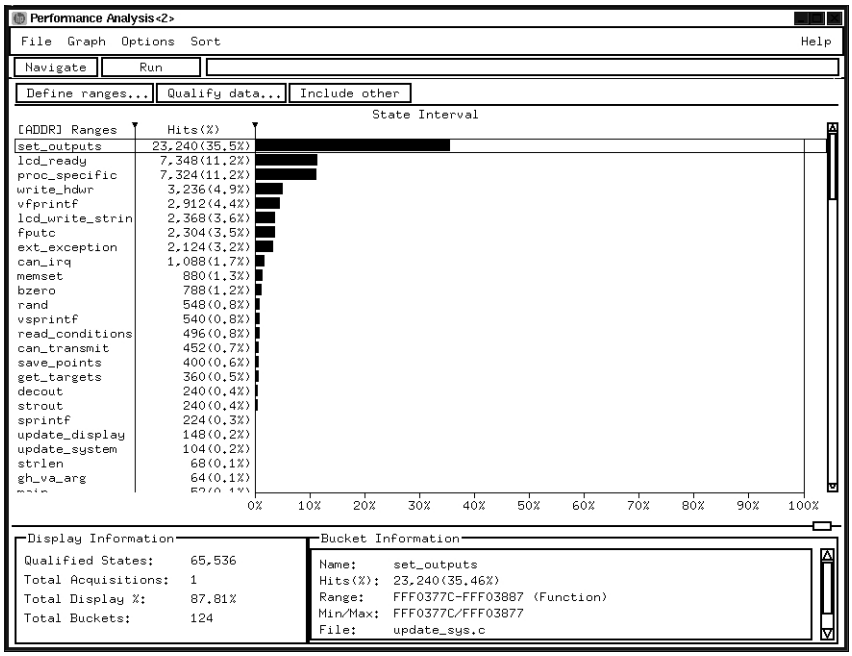



**Figure 8: Statistical Performance Information from the Agilent System Performance Analysis Tool Set**

### System Correlation

With the Agilent logic analysis systems, you can time-correlate bus information from many other microcontrollers or bus interfaces in your target system, such as a PCI bus, with the CPU32. Analysis probes are available for other microcontrollers and buses in your system. (Contact your local Agilent Test and Measurement sales office or visit our web site at www.agilent.com/find/las-data for more information.)

## Agilent B4600B System Performance Analysis Tool Set

The system performance analysis tool set (SPA) is an optional software package* for the 16600A and 16700A Series logic analysis systems. The SPA tool set provides statistical performance measurements on your system such as state overview, state interval, time interval, and time overview. The same symbol file used with the source correlation tool set provides symbolic support for the system performance analysis tool set, as shown in figure 8.

* Available for an additional charge.

## Analysis Probe Connections

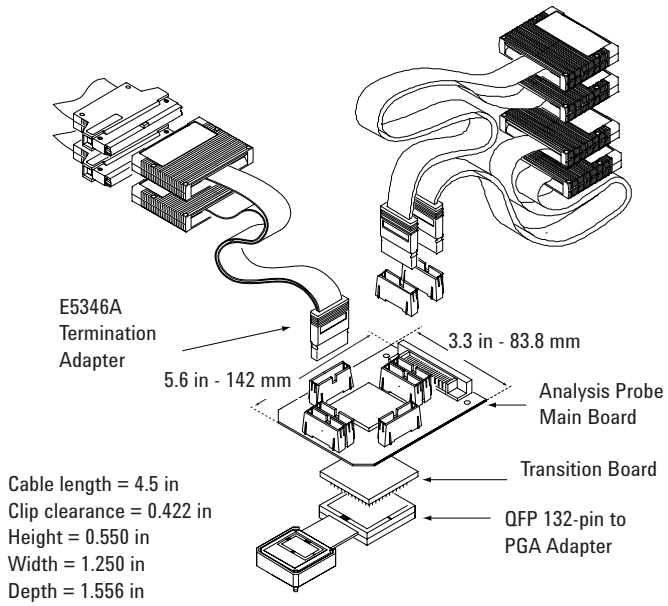



**Figure 9: 132-Pin PQFP Analysis Probe**

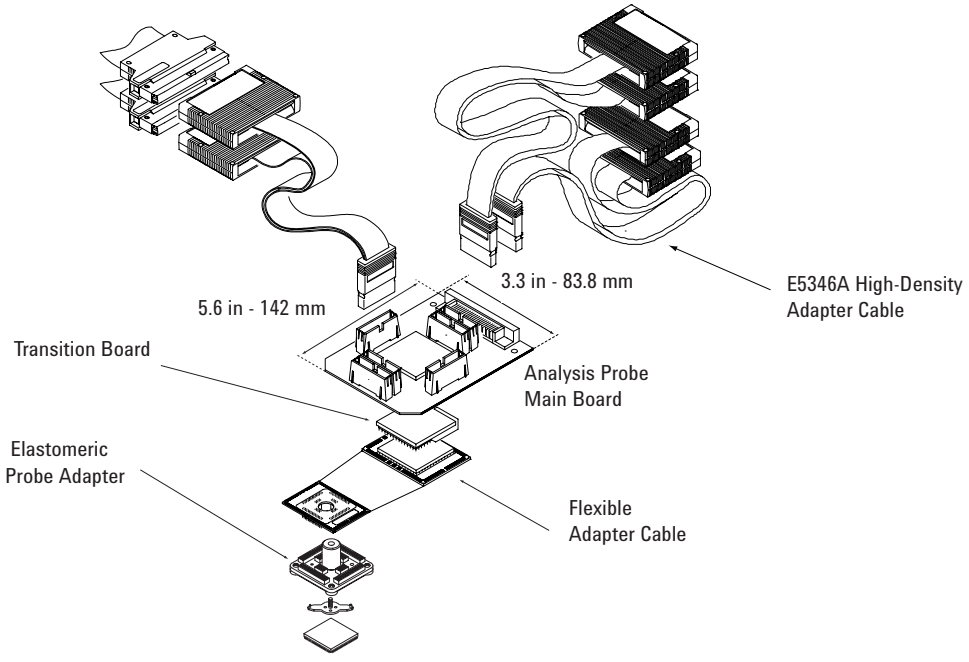



**Figure 10: 144-Pin TQFP Analysis Probe**

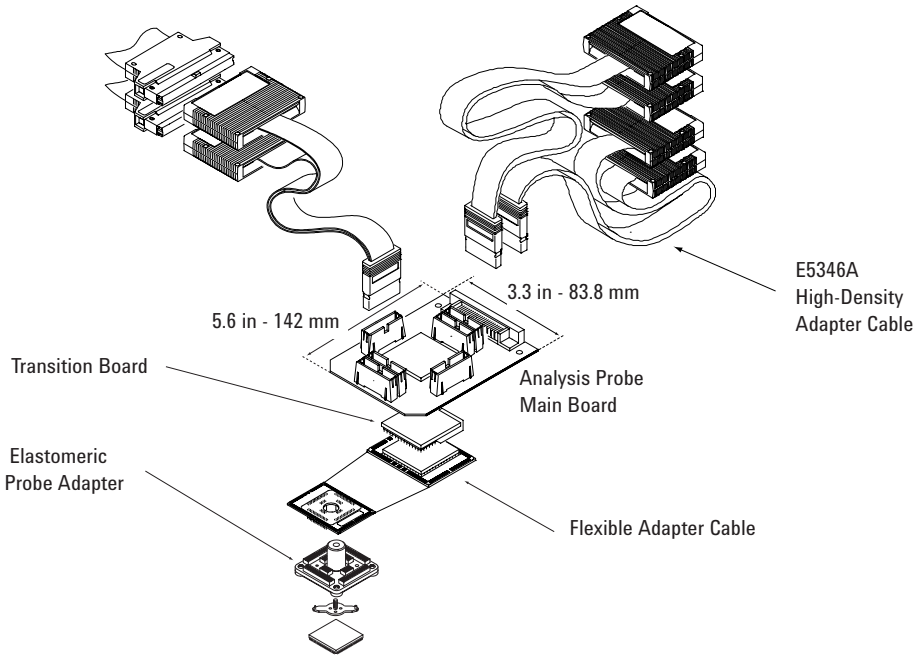



**Figure 11: 160-Pin TQFP Analysis Probe**

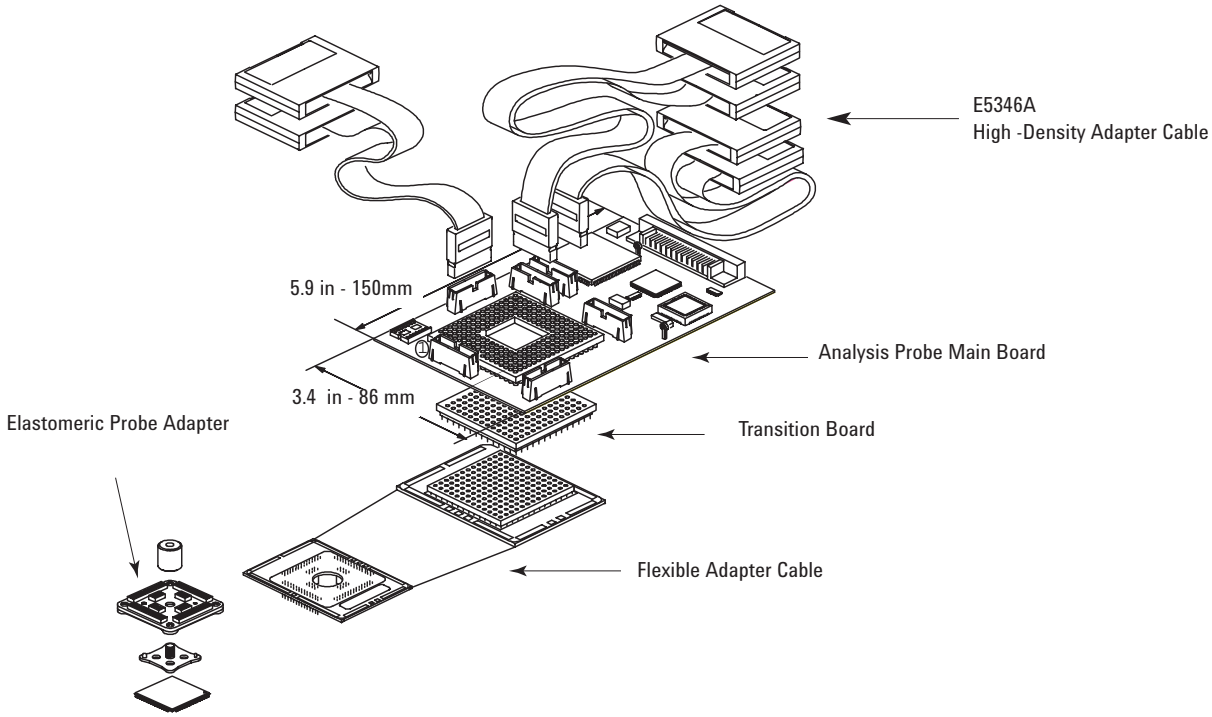
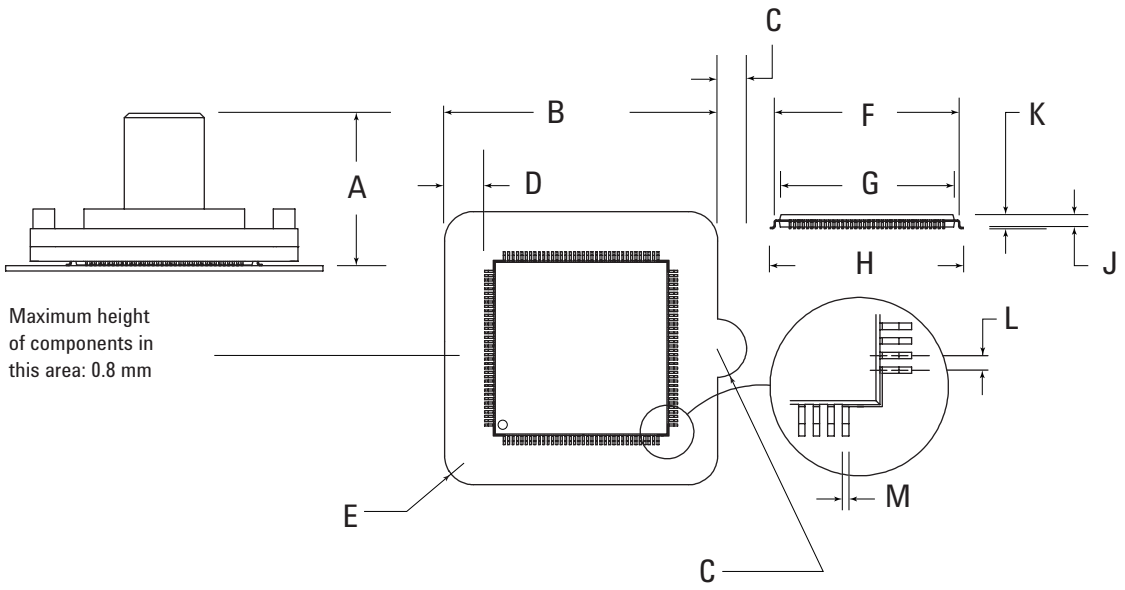



**Figure 12: 240-Pin PQFP Analysis Probe**

## Analysis Probe Mechanical Specifications

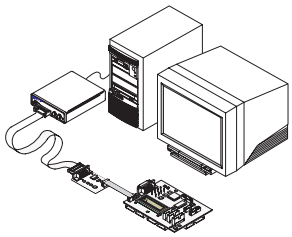



| Adapter | A | B | C | D | E | F | G | H | J | K | L | M |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| **144-Pin TQFP** | | | | | | | | | | | | |
| (inches) | 0.67 | 1.24 | 0 | .06 | 0.14 | 0.827 (min) | 0.795 (max) | 0.866 +/- 0.008 | 0.053 to 0.057 | 0.057 to 0.063 | 0.020 +/- 0.02 | 0.009 +/- 0.02 |
| (milli-meters) | 17.13 to 22.00 | 31.5 | 0 | 1.4 | 3.5 | 21.00 (min) | 20.20 (max) | 22.00 +/- 0.20 | 1.35 to 1.45 | 1.45 to 1.60 | 0.50 +/-0.03 | 0.22 +/-0.05 |
| **160-PIN PQFP** | | | | | | | | | | | | |
| (inches) | 0.76 | 1.58 | 0.16 | NA | 0.15 | 1.154 (min) | 1.106 (max) | 1.266 (max) | 0.126 to 0.146 | 0.136 to 0.161 | 0.03 | 0.087 to 0.015 |
| (milli-meters) | 19.2 | 40.21 | 4 | NA | 3.8 | 29.32 (min) | 28.10 (max) | 32.15 (max) | 3.20 to 3.70 | 3.45 to 4.10 | 0.65 | 0.22 to 0.38 |
| **240-Pin PQFP** | | | | | | | | | | | | |
| (inches) | 0.76 | 1.740 | 0.16 | .19 | 0.15 | 1.293 (min) | 1.268 (max) | 1.362 +/- 0.008 | 0.136to 0.161 | 0.126 to 0.142 | 0.0197 | 0.0067 to 0.0106 |
| (milli-meters) | 19.2 | 44.2 | 4 | 4.9 | 3.8 | 32.85 (min) | 32.20 (max) | 34.60 +/- 0.20 | 3.45 to 4.10 | 3.20 to 3.60 | 0.5 | 0.17 to 0.27 |

## System Configuration and Ordering Information

Agilent makes it easier and more economical to configure and order your emulation or analysis solution by providing solution product numbers. The table below shows the system components you need to order and what is included in each one. Several solutions are available, depending on the probing solution that best fits your needs. The solution product numbers do not include logic analysis systems. The Agilent 16600A and 16700A Series logic analysis systems need to be ordered separately.

If you want to configure or upgrade your system with individual products, see page 15 for individual product number information.



| Solution | Products to Order | Included Components |
|---|---|---|
| **Emulation Solution** | | |
| • Emulation Probe | • E5900A #030 | |
| • Debugger Connection | • Order directly from Green Hills, Microtec, or SDS | |
| **Emulation Solution with Real-Time Trace** | | |
| • 16600A or 16700A Series Logic Analysis System | • Refer to publication 5966-3148E for state/timing modules overview<br>• Supported logic analyzers: 16600A, 16601A, 16602A, 16700A, 16550/555/556 A/D | • Analysis Probe<br>• Inverse Assembler<br>• Emulation Module<br>• Source Correlation Tool Set<br>• Appropriate Adapters<br>• Two E5346A High-Density Termination Adapters (6833x)<br>• Three 5346A High-Density Termination Adapters (68x360) |
| • Emulation/ Real-Time Trace Solutions | • E9489A #002 - 68331/32/34/35 132-Pin PQFP<br>• E9489A #003 - 68331/32/34/35 144-Pin TQFP<br>• E9496A #002 - 68336/76 160-Pin PQFP<br>• E9490A #002 - 68360/EN/PM/MH/MH360V 241-Pin PGA<br>• E9490A #003 - 68360/EN/PM/MH/MH360V 240-Pin PQFP | |
| • Debugger Connection | • Order directly from Green Hills, Microtec, or SDS | |
| • Optional System Performance Analysis Tool Set | • B4600B | |
| **Logic Analysis Solution** | | |
| • 16600A or 16700A Series Logic Analysis System | • Refer to publication 5966-3148E for state/timing modules overview<br>• Supported logic analyzers: 16600A, 16601A, 16602A, 16550/555/556 A/D | |
| • Logic Analysis Solutions | • E9589A #002 - 68331/32/34/35 132-Pin PQFP<br>• E9589A #003 - 68331/32/34/35 144-Pin TQFP<br>• E9596A #002 - 68336/76 160-Pin PQFP<br>• E9590A #002 - 68360/EN/PM/MH/MH360V 241-Pin PGA<br>• E9490A #003 - 68360/EN/PM/MH/MH360V 240-Pin PQFP | • Analysis Probe<br>• Inverse Assembler<br>• Appropriate Adapters:<br>• Two E5346A High-Density Termination Adapters (6833x)<br>• Three 5346A High-Density Termination Adapters (68x360) |
| • Optional Source Correlation Tool Set | • B4620B | |
| • Optional System Performance Analysis Tool Set | • B4600B | |
| • Optional Emulation Module | • E5901A #030 | |

## Individual Components Ordering Information

| Description | Agilent Product |
|---|---|
| Emulation Probe | E5900A #030 |
| Emulation Module | E5901A #030 |
| 68331/32/34/35 132-Pin Analysis Probe | E9589A #002 |
| 68331/32/34/35 144-Pin TQFP Analysis Probe | E9589A #003 |
| 68336/76 160-Pin Analysis Probe | E9596A #002 |
| 68360/EN/PM/MH/MH360V 241-Pin Analysis Probe | E9590A #002 |
| 68360/EN/PM/MH/MH360V 240-Pin PQFP Analysis Probe | E9590A #003 |
| Source Correlation Tool Set | B4620B |
| System Performance Analysis Tool Set | B4600B |
| High Density Termination Adapter | E5346A |

## Training and Consulting

Agilent Digital Systems Consultants can help you maximize your emulation and analysis system through training and consulting. Digital Systems Consultants are experienced in debugging complex digital hardware, software problems, and hardware/software integration.

Agilent training may be delivered through scheduled courses, on-site classes, or one-on-one consulting. Agilent Technologies has courses for the beginner as well as advanced users migrating from the 16500 Series system. Call 1-800-593-6632 in the U.S. for information about training schedules and location or to register. For training offered in other geographies and languages, consult the Agilent Test and Measurement education web site:

www.agilent.com/find/tmeducation

For consulting services, contact your local Agilent Test and Measurement sales office. An Agilent Digital Systems Consultant can help you solve tough digital debug problems by showing you how to apply Agilent tools and debugging best practices. Topics covered can include:

- System Installation
- Complex Triggering
- Multiple Bus Analysis
- Source-Line Referencing
- System Performance Analysis
- Instrumenting Code to Solve Specific Issues
- Bus Signal Timing Analysis
- Signal Integrity Analysis
- 16700A/16600A Networking

| Related Literature | Pub. Number |
|---|---|
| *Agilent 16600A and 16700A Series Logic Analysis System Mainframes* | 5966-3107E |

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**Agilent Technologies' Test and Measurement Support, Services, and Assistance**

Agilent Technologies aims to maximize the value you receive, while minimizing your risk and problems. We strive to ensure that you get the test and measurement capabilities you paid for and obtain the support you need. Our extensive support resources and services can help you choose the right Agilent products for your applications and apply them successfully. Every instrument and system we sell has a global warranty. Support is available for at least five years beyond the production life of the product. Two concepts underlay Agilent's overall support policy: "Our Promise" and "Your Advantage."

**Our Promise**

"Our Promise" means your Agilent test and measurement equipment will meet its advertised performance and functionality. When you are choosing new equipment, we will help you with product information, including realistic performance specifications and practical recommendations from experienced test engineers. When you use Agilent equipment, we can verify that it works properly, help with product operation, and provide basic measurement assistance for the use of specified capabilities, at no extra cost upon request. Many self-help tools are available.

**Your Advantage**

"Your Advantage" means that Agilent offers a wide range of additional expert test and measurement services, which you can purchase according to your unique technical and business needs. Solve problems efficiently and gain a competitive edge by contracting with us for calibration, extra-cost upgrades, out-of-warranty repairs, and on-site education and training, as well as design, system integration, project management, and other professional services. Experienced Agilent engineers and technicians worldwide can help you maximize your productivity, optimize the return on investment of your Agilent instruments and systems, and obtain dependable measurement accuracy for the life of those products.

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