Agilent Technologies
16700B and 16702B
Logic Analysis Systems
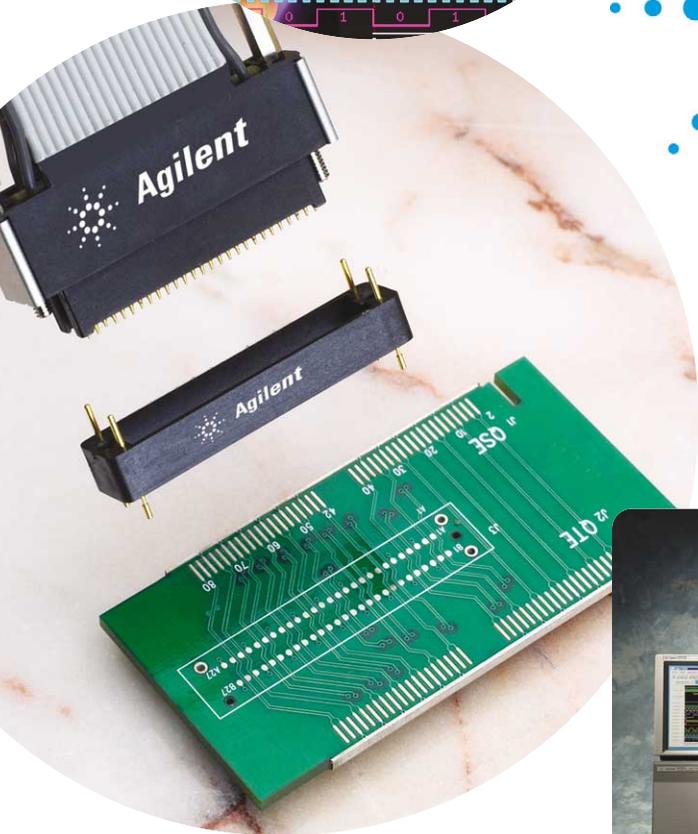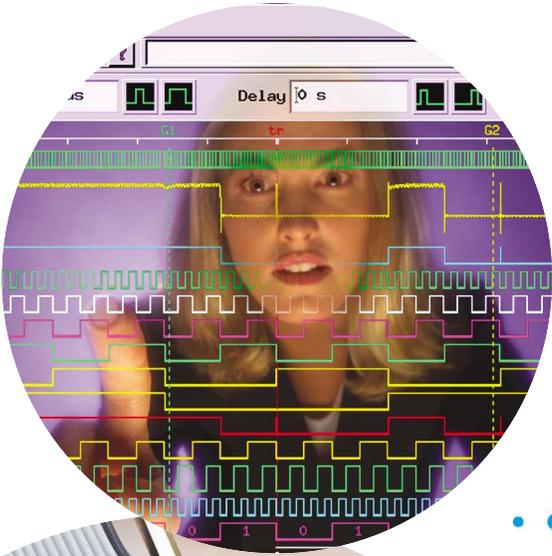
Agilent Technologies

Introduction

From basic board turn-on to signal integrity validation

Agilent Technologies' 16700 Series logic analysis systems help design teams overcome time-to-market obstacles and meet tough engineering challenges—from basic circuit board turn-on to validating signal integrity.

With their wide variety of measurement capabilities, the 16700B and 16702B high-performance modular systems enable you to rapidly consolidate data into meaningful insight while giving you the most complete view of your system's behavior. And since accurate acquisition starts with probing, we also offer reliable, unobtrusive probes that make it easy to connect your Agilent logic analyzer to your system under test.

As the innovator of logic analysis, Agilent (formerly Hewlett-Packard) continues to provide leading-edge solutions that evolve with your changing needs. The modular form factor of the 16700 Series is the key to their long-term value. You purchase only the capability you need now, then expand as your needs evolve.

Configuring these modular systems is as easy as 1, 2, 3. Select your choice of products that will (1) Connect, (2) Acquire, and (3) View/Analyze the data from your system under test. For example, you can choose the timing/state logic analyzer modules, oscilloscope and pattern generator modules and data post-processing and protocol tools that meet your specific needs.
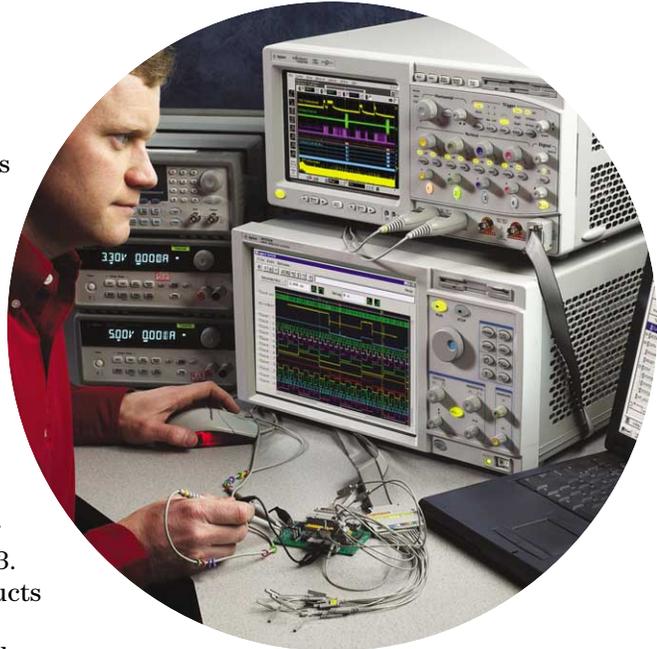
Figure 2. The Agilent Technologies' 16700 Series logic analysis systems help design teams meet tough engineering challenges—from basic circuit board turn-on to validating signal integrity.

Figure 1. The 16700B and 16702B high-performance modular systems enable you to rapidly consolidate data into meaningful insight.

Modular Systems

The power and flexibility to provide the most complete view of system behavior

- Configure a basic or multi-frame system suited to your needs
- Protect your investment with a system that adapts to multiple, current and future projects
- View cross-domain measurements, correlated in time
- Easily master powerful logic analysis capabilities with the 16702B's touch-screen interface

Agilent Technologies' modular logic analysis systems provide the ultimate power and flexibility to match your digital system debug needs. Configure a logic analysis system that provides a complete view of your system's behavior. Select the measurement modules, probing and analysis options suited for your specific application that results in efficient debug and validation.

Agilent Modular 16700 Series Logic Analysis System Mainframes

Model No.	16702B Modular System	16700B Modular System	16701B Expansion Frame
Interface Control	Touch screen, knobs, and dedicated hot keys (mouse, keyboard also provided)	Mouse, keyboard	N/A
Number of Slots	5	5	5
Measurement capability	Timing and state analysis, pattern generation, oscilloscope		
Display Type(s) and Resolution	Internal: 12.1 inch color touch screen, 800 x 600 External: Supports resolutions up to 1600 x 1200 with option 003.	Requires external display. Supports up to 1280 x 1024 standard, 1600 x 1200 requires option 003.	N/A
Data Viewing Types	Standard: Waveform, listing, histogram, chart, compare Module specific: eye diagrams Optional software tool sets: source code, protocol decode, serial analysis, system performance analysis (SPA)		N/A
Connectivity	Time-correlate logic analyzer trace to external Infiniium 54800 Series oscilloscope. Automated de-skew and tracking of markers. Offline analysis, e-mail on trigger, individual user logins for network security Remote programmability via Microsoft ® Active X/COM for PCs and TCP/IP socket based ASCII commands for UNIX ®. Remote access of the analyzer from a web browser (web-enabled). File transfer and storage via mapped shares or mounted drives (Windows® and UNIX)		N/A
16700B and 16702B Options	Option 001 – Add 17-inch 1280 x 1024 monitor Option 003 – 256 MB system RAM, 4 MB video RAM Option 008 – 18 GB external data drive Option 009 – external removable hard drive Option 012 – multiframe module		

Logic Analyzer Probing Solutions

Flexibility and choice in creating quality connections to your target system

- Easily connect with reliable, electrically and mechanically unobtrusive probing solutions

- Achieve low loading (< 0.7 pF), an easy connection and a small footprint with soft touch connectorless probes

- Gain access to individual, widely dispersed signals with Agilent's new differential and single-ended general-purpose lead sets.

Accurate measurements start with reliable probing. Agilent Technologies offers a wide variety of probing accessories that support general-purpose and application-specific measurement needs.

Figure 3. Agilent's soft touch probes combine high-density, low loading and differential capability into a reliable, space-saving package.

Agilent Logic Analyzer Probing Solutions

Probing Method (Application)	Signal Type	Max. Data Rate	Min. Signal Amplitude	Model Number	Channels	Logic Analyzer Compatibility	Equivalent Load Capacitance
Connectorless Probing Quick connection to many signals in a small footprint without requiring a header designed into the target	Differential or single-ended clock, Single-ended data	> 2.5 Gb/s	250 mV p-p	E5390A (Soft touch)	34	90-pin cable connector	< 0.7 pF
	Differential or single-ended clock, Differential or single-ended data		Vmax– Vmin 200 mV	E5387A (Soft touch)	17		< 0.7 pF
	Single-ended clock, Single-ended data		500 mVp-p	E5394A (Soft touch)	34	40-pin cable connector	
Connector Probing Quick connection to many signals in a small footprint, connector is designed into target	Differential or single-ended clock, Single-ended data	1.5 Gb/s	250 mV p-p	E5378A (100-pin Samtec)	34	90-pin cable connector	1.5 pF
	Differential or single-ended clock, Differential or single-ended data		Vmax–Vmin 200 mV	E5379A (100-pin Samtec)	17		
	Single-ended clock, Single-ended data	600 Mb/s	300 mV p-p	E5380A (38-pin Mictor)	34		3 pF
		[1]	500 mV p-p	E5385A (100-pin Samtec)	34	40-pin cable connector	1.5 pF
			500 mV p-p	E5346A (38-pin Mictor)	34		3.0 pF
			250 mV p-p	E5339A (38-pin Mictor)	34		
			500 mV p-p	E5351A [2] (38-pin Mictor)	34		
General-Purpose Flying-Lead Set Flexible connection to individual signals	Differential or single-ended clock, Single-ended data	1.5 Gb/s	250 mV p-p	E5382A	17	90-pin cable connector	1.3 pF
	Differential or single-ended clock, Differential data		Vmax–Vmin 200 mV	E5381A	17		0.9 pF
	Single-ended clock, Single-ended data	[1]	600 mV p-p	E5383A	17	40-pin cable connector	1.5 pF

[1] Equivalent to the data rate of the logic analyzer the probe is attached to.
[2] Requires isolation networks installed on the target.

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Measurement Modules

Configure custom measurement solutions for demanding applications

- Choose from a wide variety of measurement modules

- Acquire differential and single-ended signals with state analysis up to 1.5 Gb/s, 4-GHz timing zoom and memory depths up to 128 M samples

- Quickly validate signal integrity with hundreds of simultaneous eye diagrams

A wide variety of timing and state analysis modules provide the speed and memory depth to isolate and analyze your debug problems. Create a custom solution or expand your existing analysis system by selecting the timing/state analyzer, pattern generator, or oscilloscope modules that meet your debug and validation needs.

Figure 4. Modularity provides configuration flexibility to meet your measurement needs, now and in the future.

Module Ordering Information for Agilent state and timing modules

Model No.	16760A[4]	16753A/54A/55A/56A[4]	16750B/51B/52B	16740A/41A/42A
	←——— 90-pin cable connector ———→		←——— 40-pin cable connector ———→	
Channels/Module (Max. Channels on Single Time Base and Trigger)	34 (170)	68 (340)	68 (340)	68 (340)
High-Speed Timing Zoom[3]	N/A	4 GHz (250 ps) with 64 K depth	2 GHz (500 ps) with 16 K depth	2 GHz (500 ps) with 16 K depth
Max. Timing Sampling Rate (Half/Full Channels)	800 MHz (1.25 ns)	1.2 GHz (833 ps) / 600 MHz (1.67 ns)	800 MHz (1.25 ns) / 400 MHz (2.5 ns)	800 MHz (1.25 ns) / 400 MHz (2.5 ns)
Max. Transitional Timing Rate	400 MHz	600 MHz	400 MHz	400 MHz
Max. State Clock	1.5 Gb/s	600 MHz	400 MHz	200 MHz
Max. Memory Depth (Half/Full Channels)[1]	128M/64M[2]	16753A: 2M/1M 16754A: 8M/4M 16755A: 32M/16M 16756A: 128M/64M	16750B: 8M/4M 16751B: 32M/16M 16752B: 64M/32M	16740A: 2M/1M 16741A: 8M/4M 16742A: 32M/16M
Supported Signal Types	Single-ended, Differential	Single-ended, Differential	Single-ended	Single-ended
Eye Scan	Yes	Yes	N/A	N/A
Setup/Hold Window (With Eye Finder), Adjustment Resolution	500 ps, 10 ps	1 ns (600 ps typical), 80 ps typical	1.25 ns, 100 ps	1.25 ns, 100 ps

[1] Increased memory depth in half-channel timing mode only
[2] 128 M in half-channel 1.25 Gb/s and .5 Gb/s modes only
[3] All channels, all the time, simultaneous state and timing through same probe
[4] Probes ordered separately

NOTE: Probes are ordered separately. Please specify probes when ordering to ensure the correct connection between your logic analyzer and the device under test.

Scopes, Pattern Generator

Agilent Pattern generator module for 16700 Series

16720A	Half channels	Full channels
Maximum clock speed	300 MHz	180 MHz
Memory depth	16 M vectors	8 M vectors
Channels per module	24	48
Maximum number of channels per time base	120	240
Stimulus commands	Initialize, block, repeat, and break macros	
Logic levels supported	5 V TTL, 3 state TTL, 3 state CMOS, 3 state 3.3V, ECL, 5 V PECL, 3.3 V LVPECL, 3 state 2.5 V, 3 state 1.8 V, LVDS	
Ordering information	Order at least one clock pod for each module used as a master and at least one data pod for every 8 output channels	

Pod options for 16720A

Option 011 TTL clock pod & lead set
Option 013 3 state TTL/CMOS data pod & lead set
Option 014 TTL data pod & lead set
Option 015 2.5 V clock pod & lead set
Option 016 2.5 V 3 state data pod & lead set
Option 017 3.3 V clock pod & lead set
Option 018 3.3 V 3 state data pod & lead set
Option 021 ECL clock pod & lead set
Option 022 ECL (terminated) data pod & lead set
Option 023 ECL (unterminated) data pod & lead set
Option 031 5 V PECL clock pod & lead set
Option 032 5 V PECL data pod & lead set
Option 033 3.3 V LVPECL clock pod & lead set
Option 034 3.3 V LVPECL data pod & lead set
Option 041 1.8 V clock pod & lead set
Option 042 1.8 V 3 state data pod & lead set
Option 051 LVDS clock pod & lead set
Option 052 LVDS data pod & lead set

Agilent oscilloscopes for 16700 Series

Model No.	16534A Oscilloscope Module	Infiniium 54800 Series with E5850A Time Correlation Fixture
Oscilloscope Type	Internal Module	External
Maximum Bandwidth	500 MHz	6 GHz
Maximum Sampling Rate	2 GSa/s	20 GSa/s
Maximum Memory Depth	32 K	32 M
Channels Per Oscilloscope	2	2 and 4
Maximum Number of Channels on a Single Time Base and Trigger	8	4
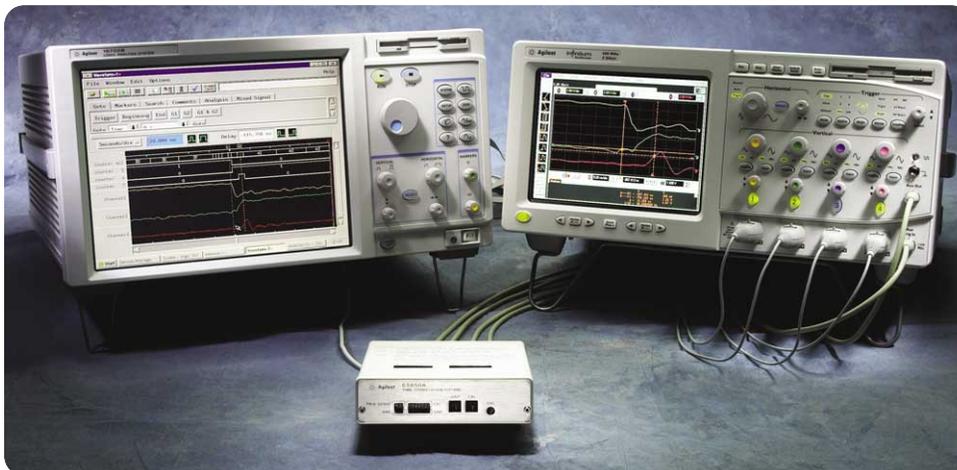
Figure 5. Unleash the synergistic power of a high-performance logic analysis system and oscilloscope with the E5850A time correlation fixture.

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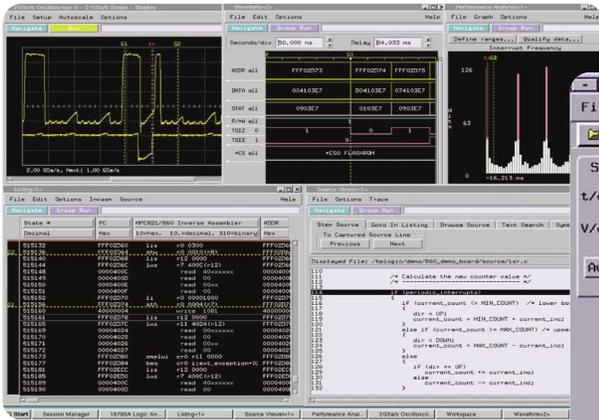
Figure 6. The 16700 Series provides the most complete view of your system's behavior.
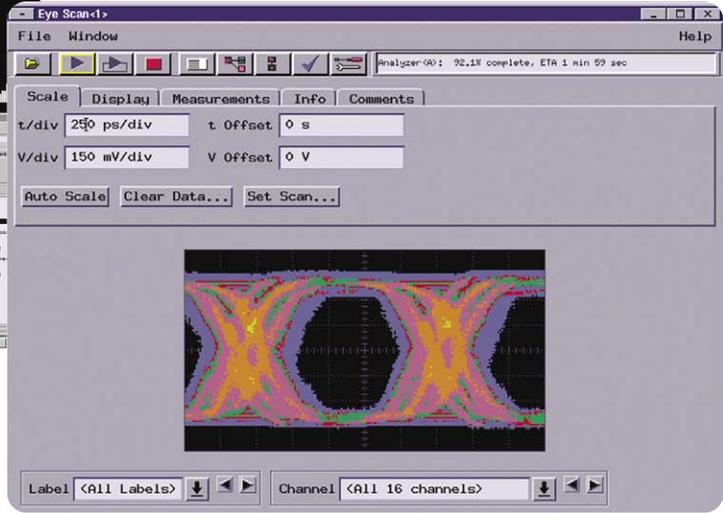
Figure 8. Identify problem signals quickly by using eye scan to make eye diagram measurements on up to hundreds of signals simultaneously.
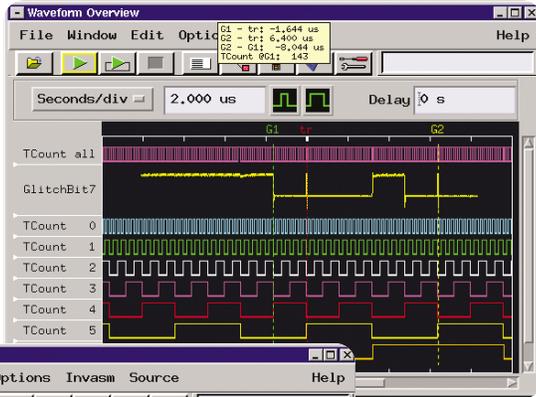

Figure 7. Validate correct hardware operation by viewing timing relationships between multiple buses and signals. Individually color and size the signals/buses to highlight and differentiate areas of interest.
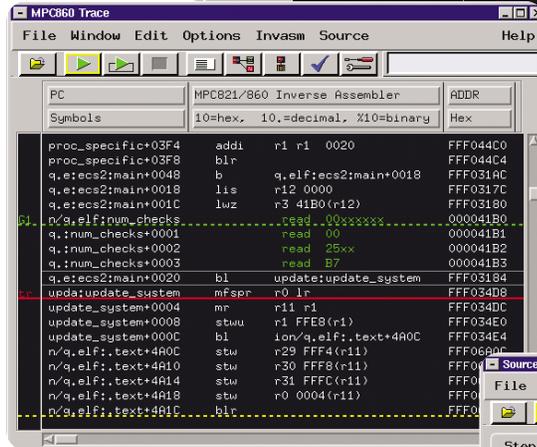
Figure 9. View data patterns and sequences of events from the listing display which presents data in the same order it was captured and placed into memory. The captured binary data can be inverse assembled into processor mnemonics or displayed in multiple formats—binary, hex, decimal, octal, twos complement, ASCII or symbols.
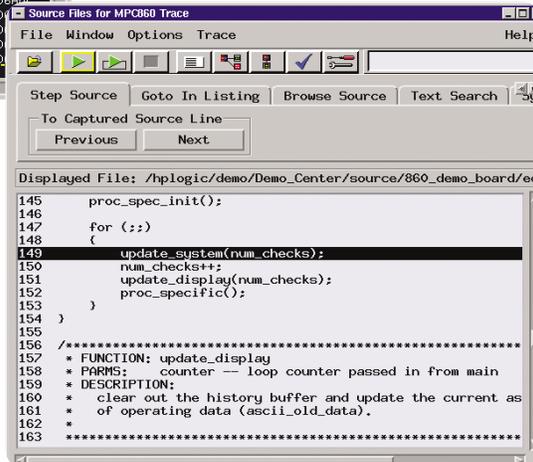
Figure 10. Correlate your logic analyzer trace to the high-level source code that produced it. Easily set up your next logic analyzer trigger by simply pointing and clicking on a line of source code.

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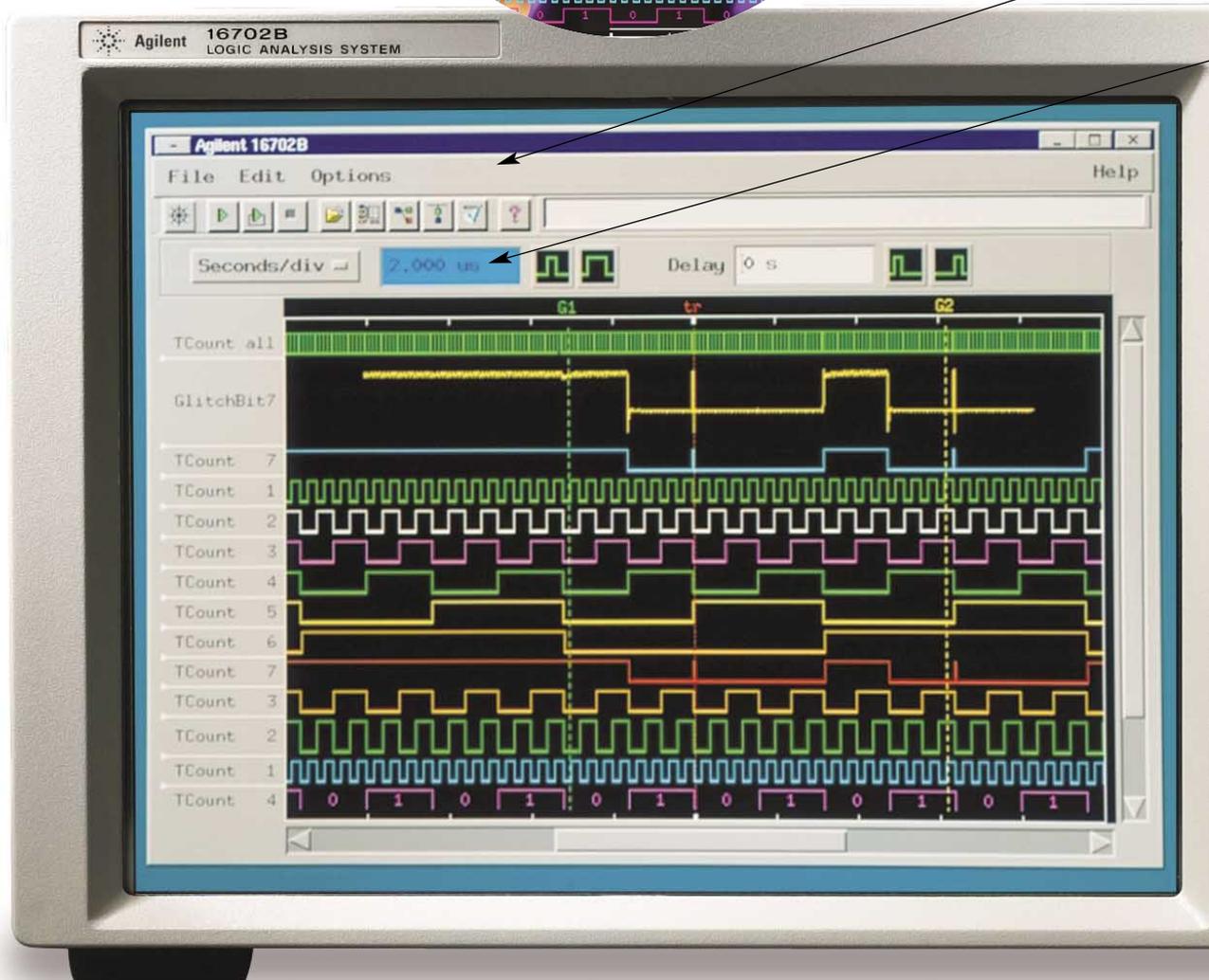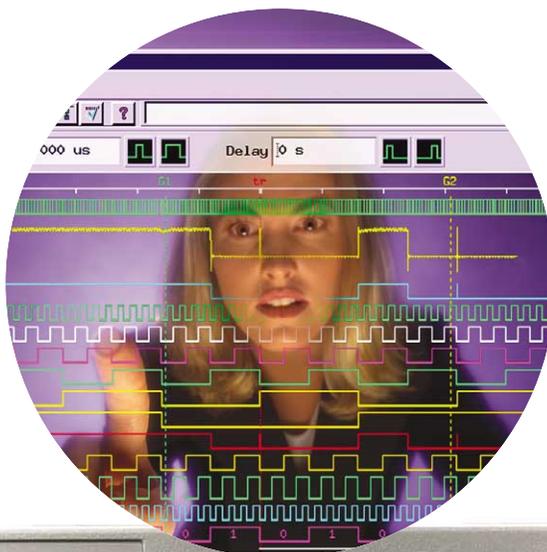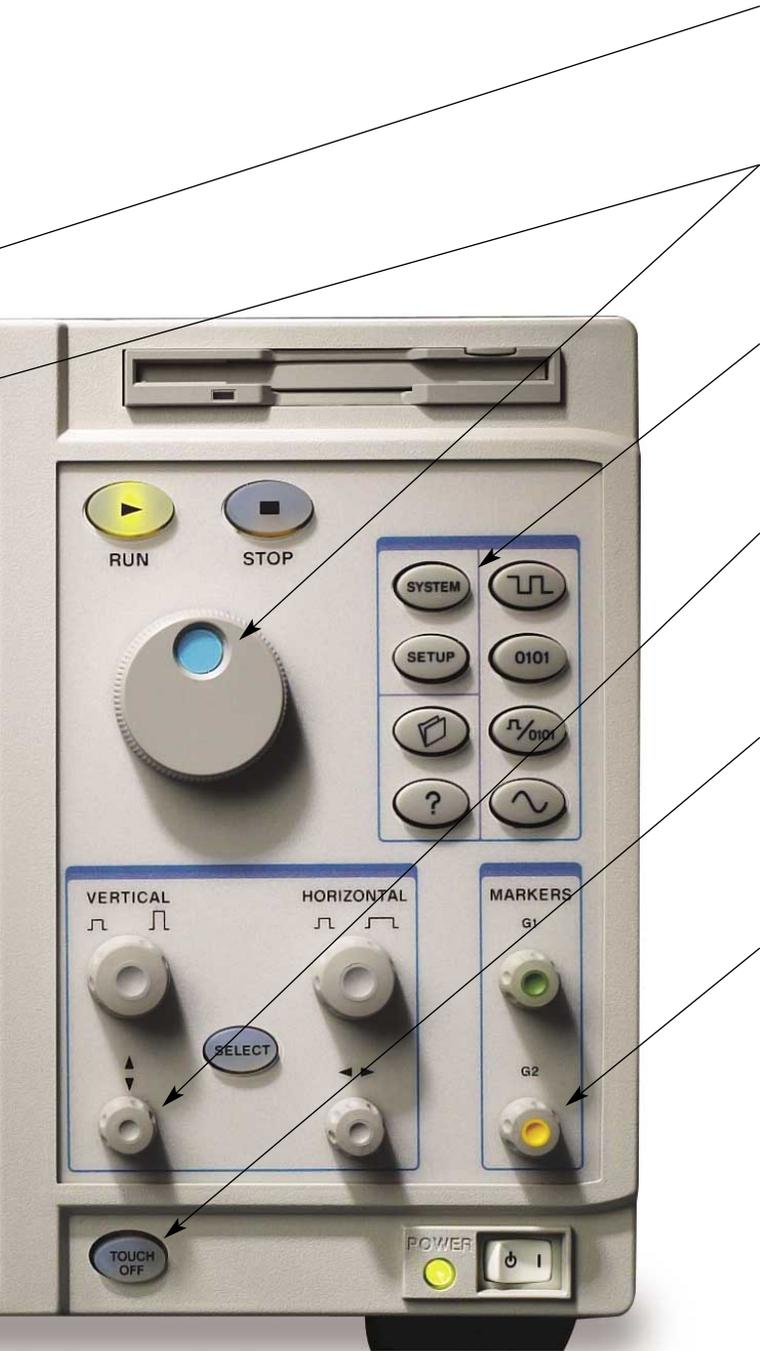
12.1-inch (307.34 mm) LCD display with 16702B touch screen makes it easy to view a large number of waveforms or states.

Select a modifiable variable by touching it, then turn the knob to quickly step through values for the variable.

Dedicated hot keys give instant access to the most frequently used menus, displays, and on-line help.

Dedicated knobs for horizontal and vertical scaling and scrolling. Adjust the display to get just the information you need to solve your problem.

"Touch Off" button disables the touch screen and allows you to point out anomalies to a colleague without altering the display settings.

Dedicated knobs for global markers help track down tough problems. A symptom can be seen in one domain (e.g., timing) tied to its cause in another domain (e.g., analog).

Post-processing Tool Sets

Quickly extract valuable information from your trace data

- Rapidly consolidate large amounts of data into displays that provide insight into your system's behavior

- Correlate a logic analyzer trace with the high-level source code that produced it

- Profile your target system's performance to identify system bottlenecks and isolate areas needing optimization

Logic analyzers with deep memory can generate large amounts of acquired data. Analysis of all this data is a challenge without application-specific analysis tools. Agilent Technologies post-processing tool sets provide powerful data-analysis capabilities that will help you gain insight from your acquired logic-analysis data more quickly and efficiently. These tools expand the power of your Agilent 16700 Series logic analysis system by moving beyond the traditional analysis of timing waveforms and state listings.
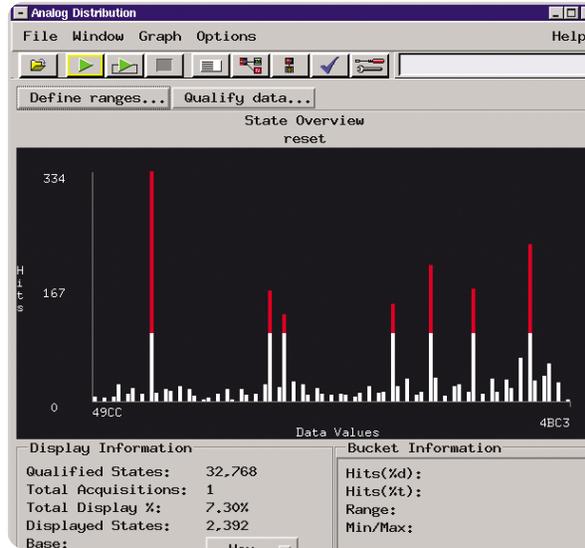
Figure 11. Profile your target system's performance to identify system bottlenecks and areas needing optimization.

Agilent post-processing tool sets

	System Performance Analysis	Serial Analysis	Tool Development Kit	Source Correlation
Model No.	**B4600B**	**B4601B**	**B4605B**	**B4620B**
Application	Optimizing your target system's performance	Solving your serial communication problems	Customizing the display of your acquired data for greater insight	Correlates the logic analyzer trace with the high-level source code that produced it
Capabilities	Generates statistical bar chart and histograms of captured data Shows the amount of time spent in each of the targeted functions or data locations	Converts serial bit streams to parallel format for easy viewing and analysis Supports serial data and protocols that use bit stuffing to maintain clock synchronization	Creates custom tools to analyze your data using C programming language	Provides ability to define the capture event by simply clicking on a line of source code

Protocol Tools

Faster triggering and viewing of protocol data in a standardized form

- Display logic-analyzer trace information at the protocol level
- Easily trigger on standard or custom packet header fields with powerful trigger macros
- Customize the protocol analysis to your specific proprietary protocol using a protocol description language

Agilent Technologies protocol tool sets for the 16700 Series provide customized triggering capabilities and packet decode. This enables rapid analysis and debug of industry-standard and proprietary protocols. You'll gain quick insight into the difficult problems caused by the use of serialized and narrow source synchronous buses in high-speed chip-to-chip and backplane interconnects.
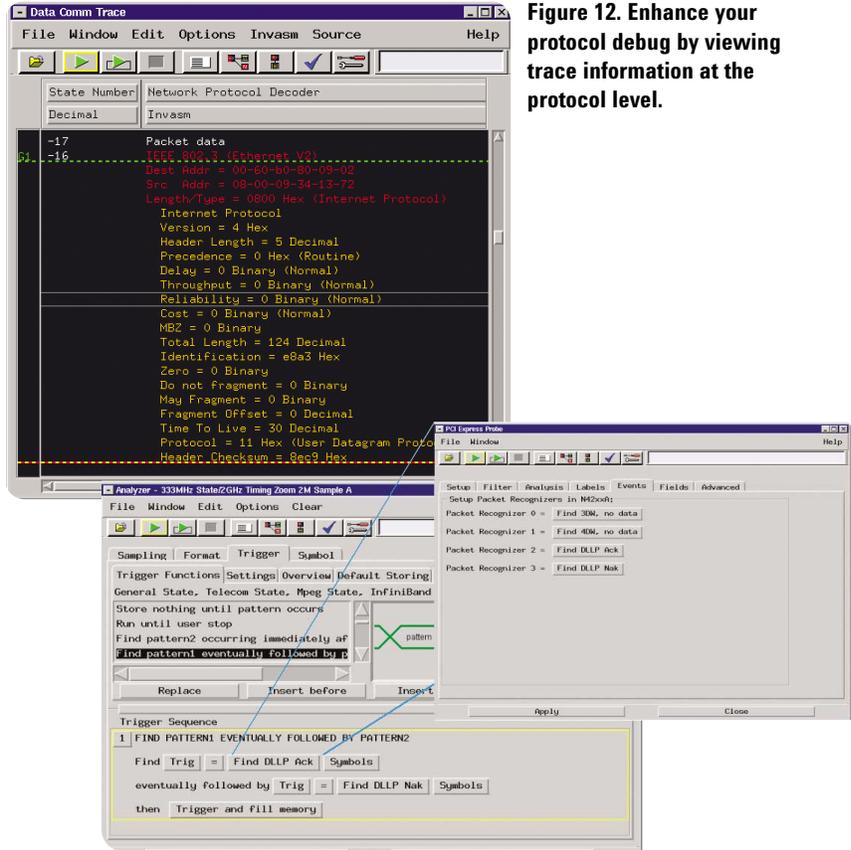
Figure 12. Enhance your protocol debug by viewing trace information at the protocol level.

Agilent protocol analysis tool sets for interconnect standards

	PCI Express V1.0, updated as spec evolves	Serial ATA and ATAPI, OOB signaling (real time) up to 1.5 GHz	RapidIO (8 and 16 bit parallel)	POS PHY L4 (SPI-4.2) (PPP, ATM, Ethernet, etc.)	Gigabit Ethernet TBI	Utopia L1-3 (ATM), POS-PHY L1-3 (PPP), MII/GMII (Ethernet), FlexBus	InfiniBand 1x, 4x, 12x	InfiniBand 1x, 4x, 12x	MPEG-2
Model No.	N4220A	N4219A	N4215A	N4214A	N4212A	B4640B	N4233A	N4206A	B4645B
Packet Trigger	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes
Additional Capabilities	Real time 8b/10b, disparity error, data descrambling	CRC/Disparity checking, data descrambling, 10b capture mode	CRC/ Control word checking, real-time idle filter	Real-time idle filter	Packet CRC check, 8b/10b disparity check		VCRC/ICRC, 8b/ 10b, disparity error, compliance testing.	VCRC, ICRC, 8b/ 10b, disparity error, compliance testing.	Packet length check, packet CRC check

Processor, Bus, and FPGA Support

Save time analyzing your unique design with a turnkey logic analyzer setup

- Save time making bus- and processor-specific measurements with application-specific analysis probes that quickly and reliably connect to your device under test
- Support available for comprehensive list of industry-standard processors and buses
- Display processor mnemonics or bus cycle decode

Agilent Technologies and our partners provide an extensive range of quality tools that offer non-intrusive, full-speed, real-time analysis and processor execution control to accelerate your debugging process.

Agilent and Third-Party Processor Support

- Actel
- Altera
- AMD
- Analog Devices
- ARM®7/9TDMI
- GTE
- IBM PPC
- IDT
- Intel® Pentium®, P4, Xeon Pentium Pro, II, III, & Celeron™
- Motorola
- National
- NEC
- NKK
- PACE
- QED
- Rockwell
- Siemens
- Texas Instruments
- Xilinx
- Zilog

Agilent and Third-Party Bus, Protocol or FPGA Support

- AGP2X, AGP4X, AGP8X
- CAN
- CSIX
- PC 100, PC 133, DDR, DDR 200, DDR 266, DDR 333, DDR I-400, DDR II,
- Fibre Channel
- FireWire (IEEE 1394)
- Gigabit Ethernet (TBI)
- GMII
- HyperTransport
- I^2C
- InfiniBand 1X, 4X, 12X
- ISA
- JTAG (IEEE 1149.1, 1149.5)
- MPEG-2
- PC 100/ 133 DIMM
- PCI CardBus
- PCI-EIO
- PCI Express
- PCI Mezzanine
- PCI/EXT-32/64
- PCI-X 1.0, 2.0
- POS-PHY L1 – L3
- Rambus®
- RapidIO
- RS-232, RS-449
- SCSI, Ultra SCSI, SCSI LVD
- Serial ATA
- SIMM, DIMM
- SPI-4.2
- USB 1.1, USB 2.0
- Utopia
- VME 64
- VXI
- Xilinx: Virtex, Virtex – E, Virtex ll, Virtex ll Pro, Spartan–ll, Spartan–ll E
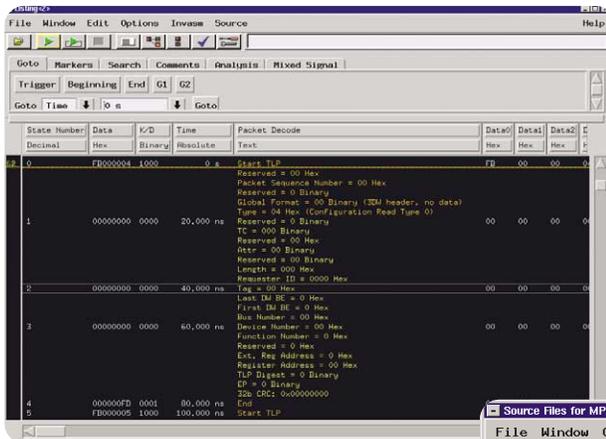
Figure 13. Focus on PCI Express packets instead of format details.
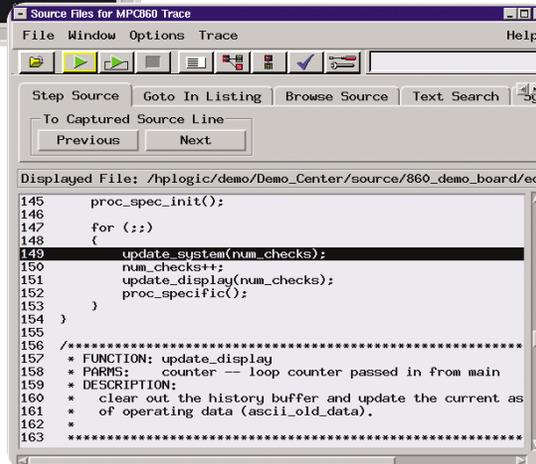
Figure 14. Correlate your logic analyzer trace to the high-level source code that produced it. Easily set up your next logic analyzer trace by simply pointing and clicking on a line of source code.

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Trace Port Analyzers and Emulation

Add processor execution (run) control and real-time trace capture to best-in-class debuggers

Figure 15. The Agilent E5904B trace port analyzer.

- Control your processor with break, run, reset and single step capabilities
- Download code and modify register/memory values
- Trace analysis up to 200 MHz, integrated with industry-standard debuggers
- Xilinx ChipScope Pro with deep external trace and advanced triggering tools

Agilent Technologies emulation probes utilize a processor's debug port to provide a convenient way to download code, modify memory and registers, and control program execution. Trace port analyzers provide real-time trace information, in addition to the standard emulation functionality. When integrated with a 16700 Series logic analysis system, both the emulation probes and trace port analyzers can support coordinated system analysis of hardware/software interaction for a wide range of industry-standard embedded processors.

Agilent Trace Port Analyzers and Emulation Probes

Emulation Probes Link to the processor's debug port for a convenient way to download code, modify memory and registers, and control program execution.	**Model Number**
ARM® ARM7TDMI, ARM7DI, ARM710T, ARM720T, ARM740T, ARM9TDMI, ARM920T, ARM922T, ARM925T, ARM940T, ARM946ES, ARM966ES	E5900B #300
IBM PPC4XX 401 (all), 403 (all), 405 (all), NPe405H, NPe405L, 440A4, 440GP, 440GX	E5900B #060
IBM PPC6XX 603, 603e - rev 3, 4, 5, 603ev – rev 2, 12, 603e2, 603P, 603ec, 603R	E5900B #060
IBM PPC7XX 740, 740L, 740P, 750, 750L, 750P, 750CX, 750CXe, 750FX	E5900B #070
MIPS MIPS32-4Kc, MIPS32-4Km, MIPS32-4Kp, MIPS64-5Kc	E5900B #200
Motorola MPC6XX 603, 603e - rev 3, 4, 5, 603ei, 603ev – rev 2, 12, 603e2, 603P, 603ec, 603R	E5900B #060
Motorola MPC7XX 740, 740L, 740P, 745, 750, 750L, 750P, 750M, 755	E5900B #070
Motorola MPC74XX 7400, 7410, 7440, 7441, 7445, 7450, 7451, 7455	E5900B #110
Motorola MPC8XX 801, 821, 823, 850, 852, 855, 857, 859, 860, 862, 866 families	E5900B #080
Motorola MPC82XX 8240, 8241, 8245, 8250, 8250A, 8255, 8255A, 8260, 8260A, 8264A, 8265A, 8266A	E5900B #100
Motorola M-Core M2107	E5900B #090

Trace Port Analyzers Provides emulation and real-time trace execution information, can be integrated with the 16700 Series for coordinated system analysis.	**Model Number**
ARM ARM7/9-ETM	E5904B #300
IBM PPC4XX 401 (all), 403 (all), 405 (all), NPe405H, NPe405L, 440A4, 440GP, 440GX	E5904B #060
Xilinx Virtex II, Virtex II Pro, Spartan-II, Spartan-IIE, Spartan-III, Virtex, and Virtex-E	E5904B #500

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Agilent 16700 Series

In Summary

Validation of digital systems continues to be a vital piece of product development. Technologies are increasing in speed and complexity, while R & D budgets, resources and market windows are shrinking. These issues make meeting your time-to-market goals more difficult.

Overcome your time-to-market obstacles with the Agilent 16700 Series logic analysis systems.

Related Agilent Literature

16700 Series Logic Analysis System, product overview, 5968-9661E

Probing Solutions for Logic Analysis Systems, product overview, 5968-4632E

Processor and Bus Support for Agilent Technologies Logic Analyzers, configuration guide, 5966-4365E

Agilent E5850A Logic Analyzer/Oscilloscope Time Correlation Fixture, photo card, 5988-1684EN

Infiniium 54850 Series Oscilloscopes, Infiniimax 1130 Series Probes, data sheet, 5988-7976EN

Infiniium 54800 Series Oscilloscopes, color brochure, 5988-3788EN

Deep Storage with Xilinx ChipScope Pro and Agilent Technologies FPGA Trace Port Analyzer, product overview, 5988-7352EN

PCI Express Tools, color brochure, 5988-7780EN

Signal Integrity Solutions, color brochure, 5988-5405EN

Test Tools for InfiniBand, color brochure, 5988-2424EN

Figure 16. The Agilent 16700 Series logic analysis systems help you meet your time-to-market demands.

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