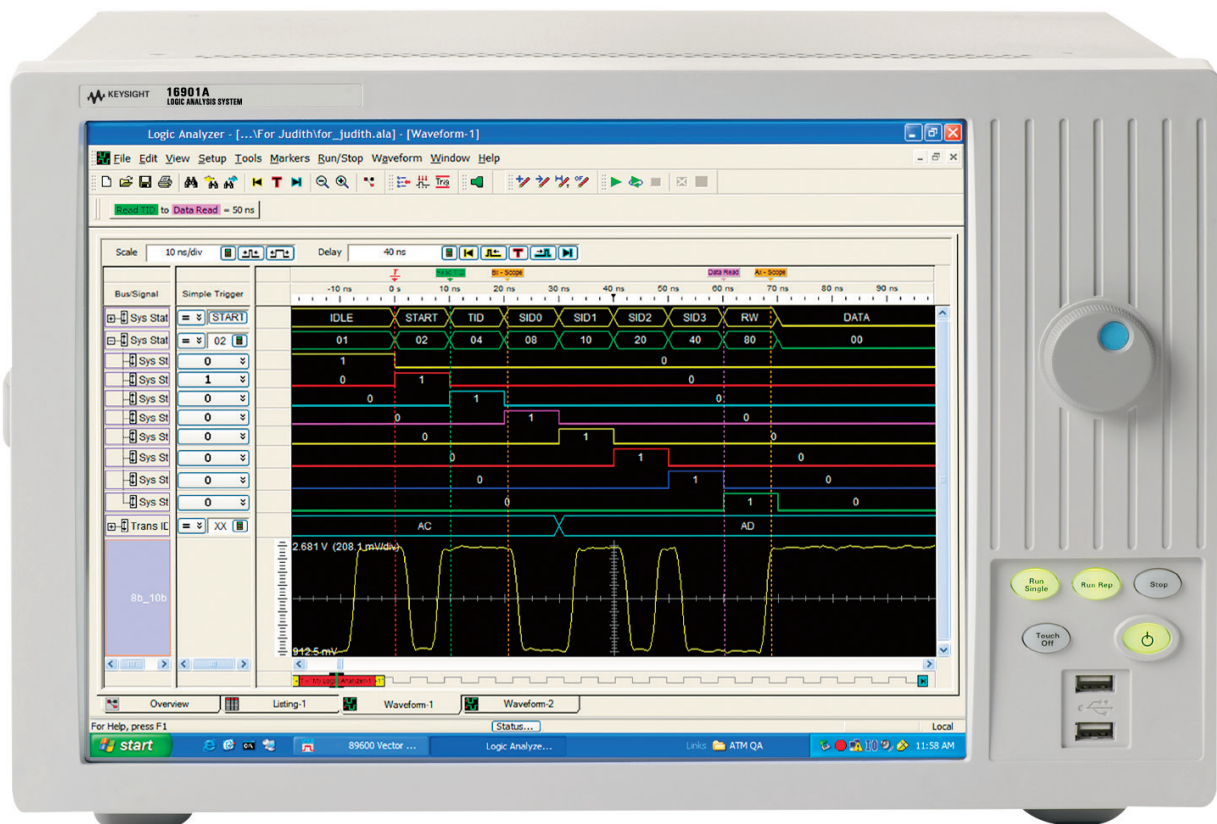


Keysight 16900 Series Logic Analysis Systems

- Exceptional performance
- Intuitive user interface
- State of the art probing
- All within budget



Get your Leading-Edge Designs to Market Faster

Debugging today's digital systems is tougher than ever. You need high-performance, reliable tools to help you overcome the difficult engineering challenges you face.

The 16900 Series logic analysis systems help you solve tough debug problems, minimize your project risk, and get your leading-edge products to market faster.

These systems provide excellent performance and accurate, reliable measurements, priced to match your budget. And, because you can't measure what you can't probe, we've used innovative probing technologies so you can access critical signals in your designs. These analyzers include the familiarity of Windows, an intuitive graphical user interface and straightforward triggering capability, so you spend more time on design and debug and less time learning how to use them.

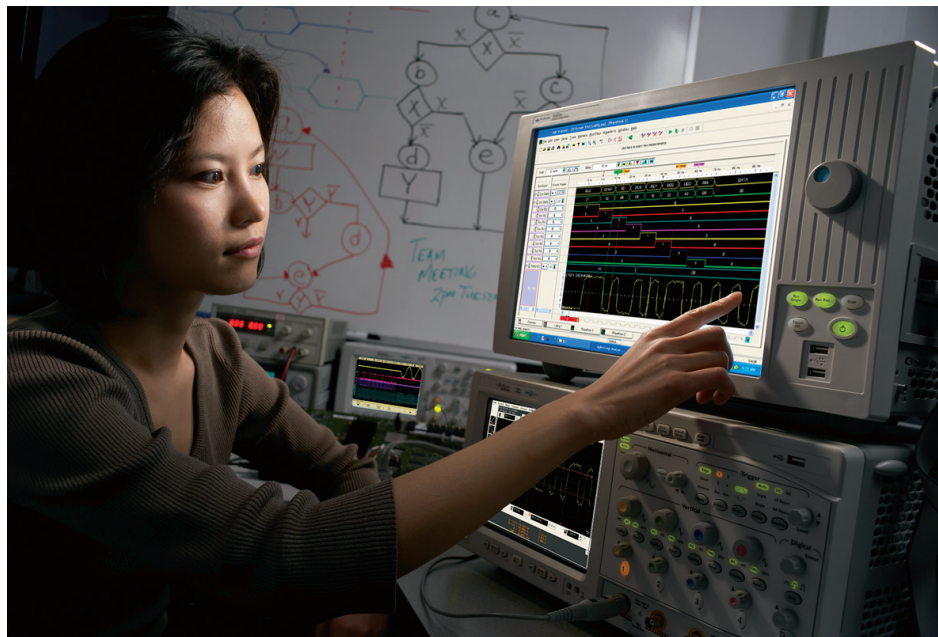


Figure 1. Conquer your toughest debug problems with a Keysight 16900 Series logic analysis system.

From our HP test and measurement foundation, Keysight's leadership in logic analysis spans four decades. Beginning with the creation of the logic analyzer in the 1970s, Keysight consistently delivers high-value products that keep pace with your latest designs and set the standard of price-performance and ease of use in the logic analysis market.

Now a new generation of logic analyzers, the Keysight 16900 Series logic analysis systems, deliver what you've come to expect from the industry leader in logic analysis—and more.

Get the Performance You Need at a Price to Match your Budget

The 16900 Series logic analysis systems from Keysight Technologies, Inc. deliver the power and performance you need to conquer your toughest debug problems. The mainframe you select is the foundation of your system. The 16900 Series mainframes' multithreading software architecture takes full advantage of gigabit local area networks (Gbit LANs) and the latest in multi-processor, large memory computer technology to achieve the fastest performance in the industry. They provide you with extremely rapid zooming, searching and scrolling updates for deep memory, high-channel count acquisitions.

Performance doesn't end with the mainframe. Keysight's 4 GHz timing zoom and eye finder technologies make accurate measurements on high-speed signals, so you can find critical problems that occur on the industry's fastest buses. You get accurate and reliable measurements, all time-correlated, for today's complex circuits, with expandability and performance headroom to cover future technology trends.

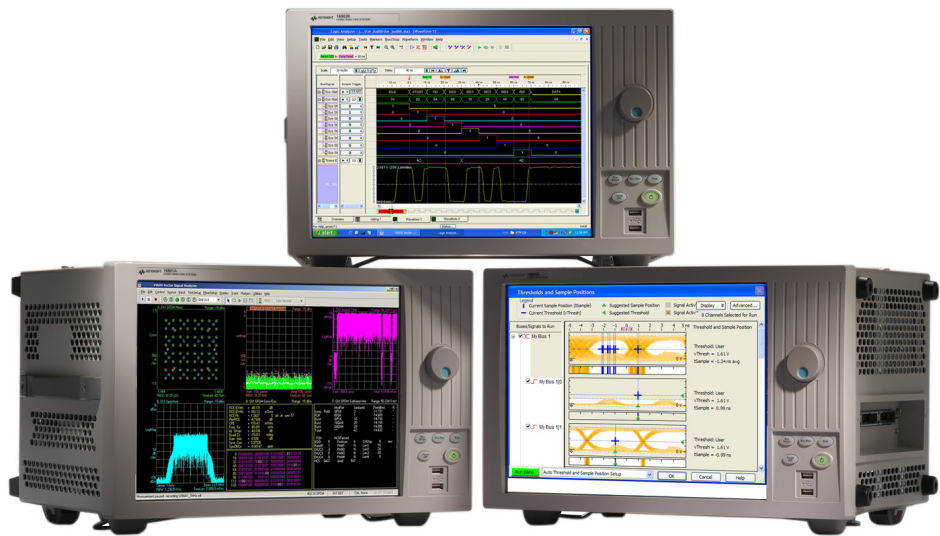


Figure 2. The 16900 Series logic analysis systems provide exceptional performance, usability and superior probing at prices to match your budget.

Table 1. Keysight modular 16900 Series mainframes.

Model number	16901A	16902B
Number of Slots	2	6
Multiframe Pro expandability	Yes	Yes
Display type(s) and resolution	Built-in color touch screen display, 15 inch (38.1 cm), 1024 x 768: supports up to four external monitors, up to 1600 x 1200 (with PCI video card)	Built-in color touch screen display, 15 inch (38.1 cm) 1024 x 768: supports up to four external monitors, up to 1600 x 1200 (with PCI video card)
PCI expansion slots	1 full profile	1 full profile

Easily Integrate the Analyzer into your Debug Environment

In addition to performance, usability and excellent pricing, you also get flexibility. You can make measurements and analyze, store and share data according to your work style. Whether you work alone at a bench or with team members distributed around the world, the 16900 Series provides a use model that easily integrates into your debug environment.

Work at your bench – operate the analyzer via touch screen or keyboard and mouse.

Expand view across multiple monitors – get the most comprehensive view of your data with extended desktop viewing using up to four monitors.

Remotely control and monitor the logic analyzer – access a remote logic analyzer over the network with hosted power mode or via built-in Windows desktop sharing. Receive an email when the logic analyzer triggers.

Comply with your company's network standards – add anti-virus software to the open Windows-based analyzer.

Use the power of your latest multiprocessor, deep memory PC or server – increase your analyzer's usage and team's productivity. Use any Windows-based computer on the network to host the logic analyzer application software and remotely control the logic analyzer. View and analyze captured data on the PC while the logic analyzer makes additional measurements. You can also create setups for your next round of measurements.

Run automated tests – execute a series of tests via the ASCII remote programming interface or Microsoft DCOM.

Offload data for custom analysis – move data quickly over the Gbit LAN connection to an external computer.

Share results and setups easily, anywhere in the world – transfer files to USB flash drives or to shared drives over high-speed LAN to share or archive results and setups with team members worldwide. Copy and paste data into other applications and document your findings.

Combine mainframes to expand measurement capability – use mainframes individually, then connect them together when you need to analyze complex, multiple-bus problems.

Easily Integrate the Analyzer into your Debug Environment (Continued)



Figure 3. Get the most comprehensive view of your data with extended desktop viewing using up to four monitors.

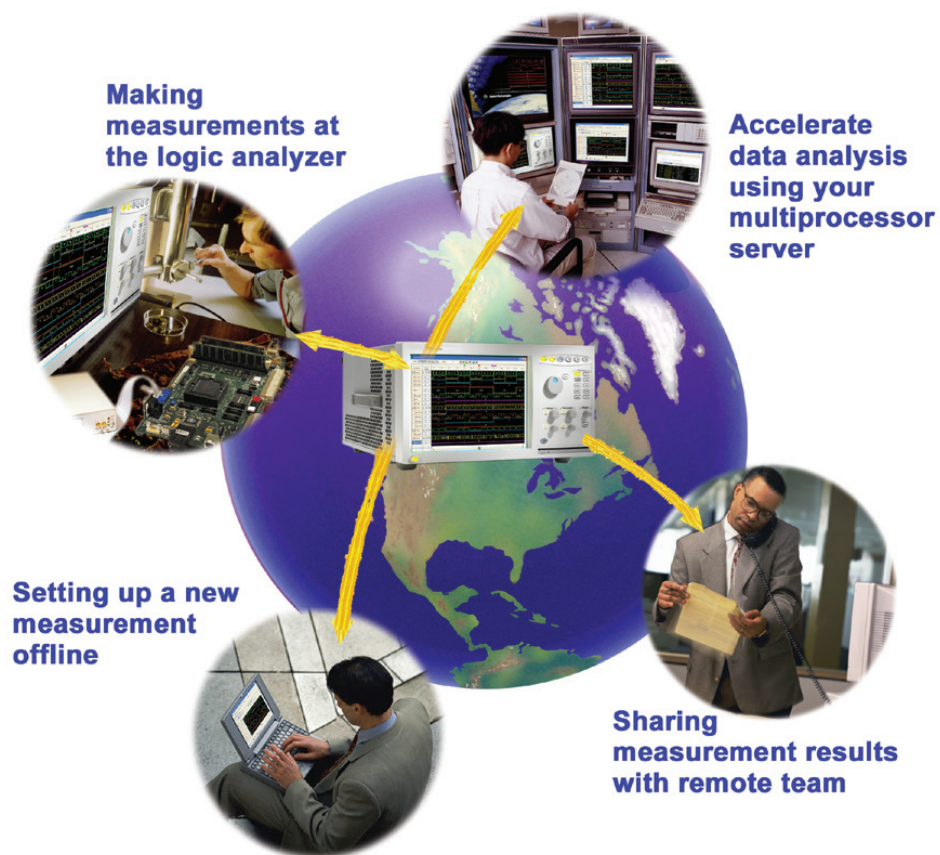


Figure 4. Whether you work alone at a bench or with team members distributed around the world, the 16900 Series provides a use model that easily integrates into your debug environment.

Easily Configure your 16900 Series System

Configuring a 16900 Series modular system is as easy as 1, 2, 3.

Select the probing, measurement modules and analysis options that are best suited for your specific application.

1. Connect

Create the physical and electrical connection between the logic analyzer and your device under test with innovative probing.

2. Acquire

Obtain accurate and reliable measurements, with power to support future technology trends.

3. View and analyze

Consolidate large amounts of data rapidly into displays that provide views of your system's behavior in a format you understand.

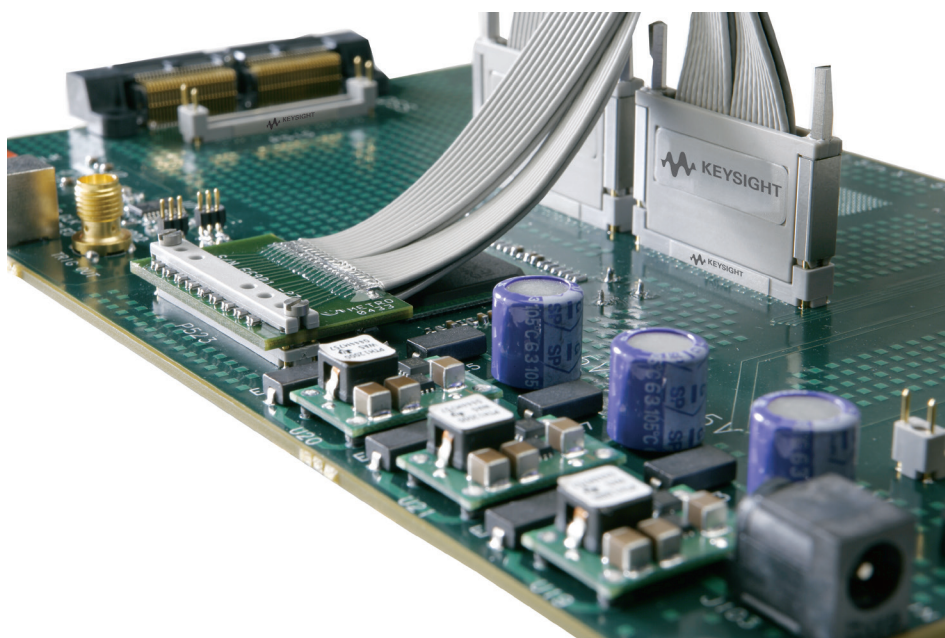


Figure 5. Soft touch connectorless probes provide a powerful combination of easy, reliable connection with high performance.



Figure 6. Choose from a family of logic analyzer and pattern generator modules to meet your requirements.

Easily Configure your 16900 Series System (Continued)

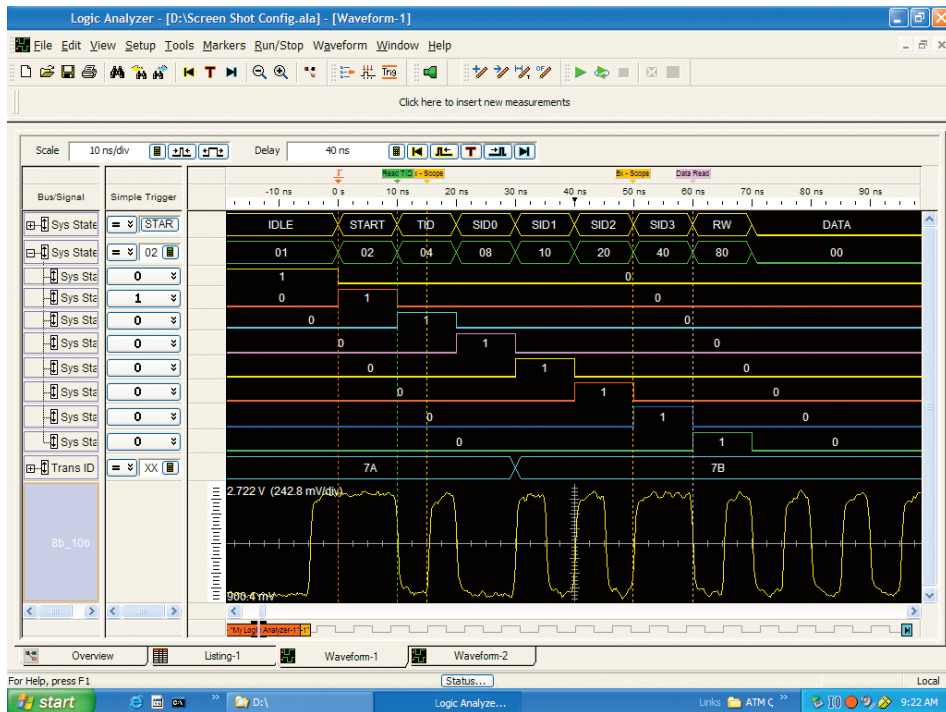


Figure 7. Get instant insight into your design with multiple views and analysis tools.

Get Accurate Measurements with Reliable Probing

Keysight offers a wide variety of probing accessories that support general-purpose and application-specific measurement needs.

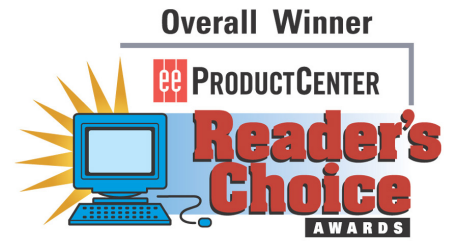
Keysight consistently delivers the leading edge in probing hardware and techniques to give designers like you access to the very signals that hold the key to your system's problems.

Quickly Debug your Xilinx or Altera FPGA and Surrounding System

FPGAs play an increasingly important role in your digital designs. The high level of features and integration available in today's FPGAs allows you to use them in ways that weren't envisioned just a few years ago. It's likely that your FPGA design contains a subsystem or system that formerly would have occupied an entire board.

These higher levels of integration present new challenges for designers. Signals that were previously available on the board may exist exclusively as nodes inside the FPGA. Getting visibility across critical internal interactions can be time-consuming. This makes integration of the FPGA and the surrounding system challenging.

Logic analyzer measurements are particularly effective in debug of FPGAs and the surrounding systems. Combined with an Keysight logic analyzer, the FPGA dynamic probe provides the most effective solution for debugging complex and elusive problems.



Electronica, 2004

View internal FPGA activity

With a logic analyzer, you are normally limited to measuring signals at the periphery of the FPGA. With the dynamic probe, you get the additional benefit of being able to look at signals internal to the FPGA. Access up to 256 internal FPGA signals for every debug pin.

Make multiple measurements in seconds

Moving probe points internal to an FPGA used to be time consuming. Now, in less than a second you can easily measure a different group of internal signals—without changing your design.

Leverage the work you did in your design environment

The FPGA dynamic probe is the first tool on the market that maps internal signal names from your FPGA design tool to your logic analyzer. Eliminate mistakes and speed the setup of signal and bus names and connections on logic analyzers.



Figure 8. The FPGA dynamic probe dramatically increases debug productivity.

Accurate Measurements Start with Reliable Probing

Soft touch connectorless probing

Keysight's soft touch probing advantages include quick, easy connection, minimal loading on your target system and no need for a connector designed into your target circuit board.

Connector probing

Connector probes are a proven industry standard for probing many signals in one easy connection.

Flying-lead probing

Flying-lead probes provide flexibility for solving a variety of probing problems. They offer connection to individual signals so you can measure ones you may not be able to measure otherwise.

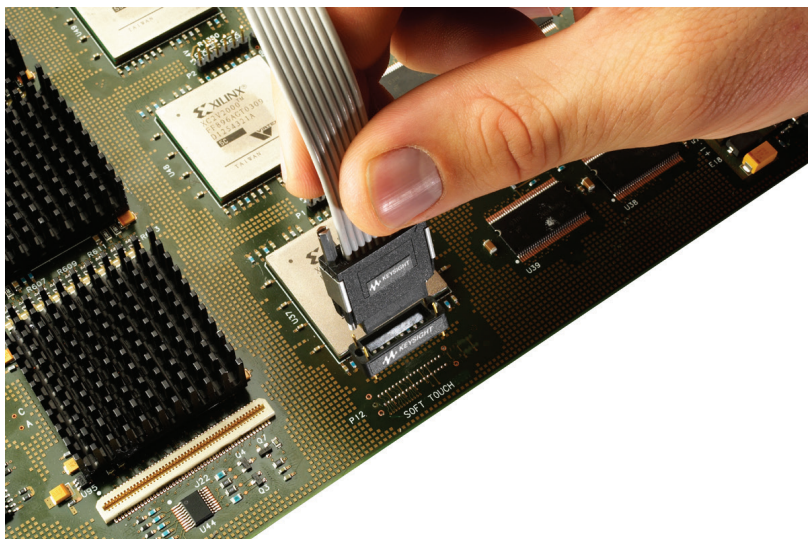


Figure 9. The compact 17-channel soft touch probe is ideal for tight spaces or times when fewer signals need to be probed.

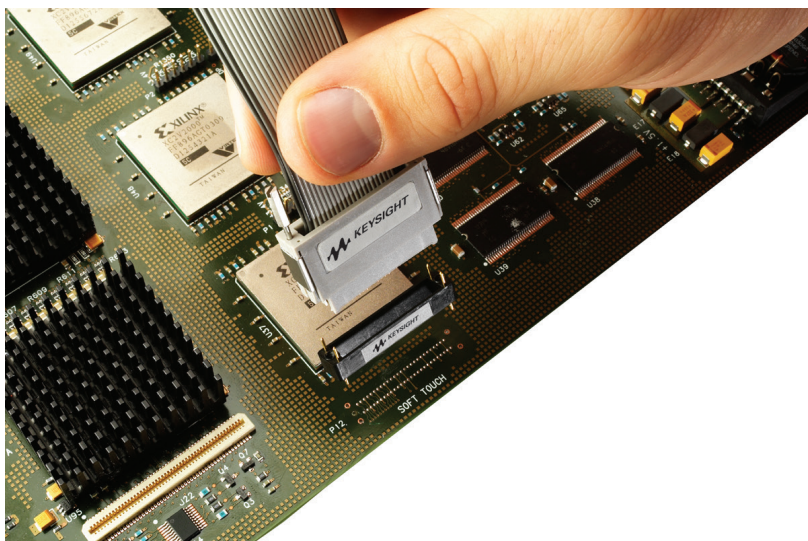


Figure 10. Soft touch connectorless probes have 1/4 the capacitive loading of connector probes and are the industry's most reliable connectorless solution.



Figure 11. Use Keysight's high-performance flying-lead probes when you need the most flexibility in probing.

Save Time Analyzing your Unique Design with a Turnkey Setup

Keysight and its partners provide an extensive range of bus and processor analysis probes. They provide non-intrusive, full-speed, real-time analysis to accelerate your debugging process.

- Save time making bus- and processor-specific measurements with application-specific analysis probes that quickly and reliably connect to your device under test.
- Display processor mnemonics, bus cycle decode, or protocol packets.
- Get support for a comprehensive list of industry-standard processors and buses.

Keysight and third-party processor support

AMCC	Infineon
AMD	Intel
ARM	Motorola
Freescale	Siemens
IBM	Xilinx

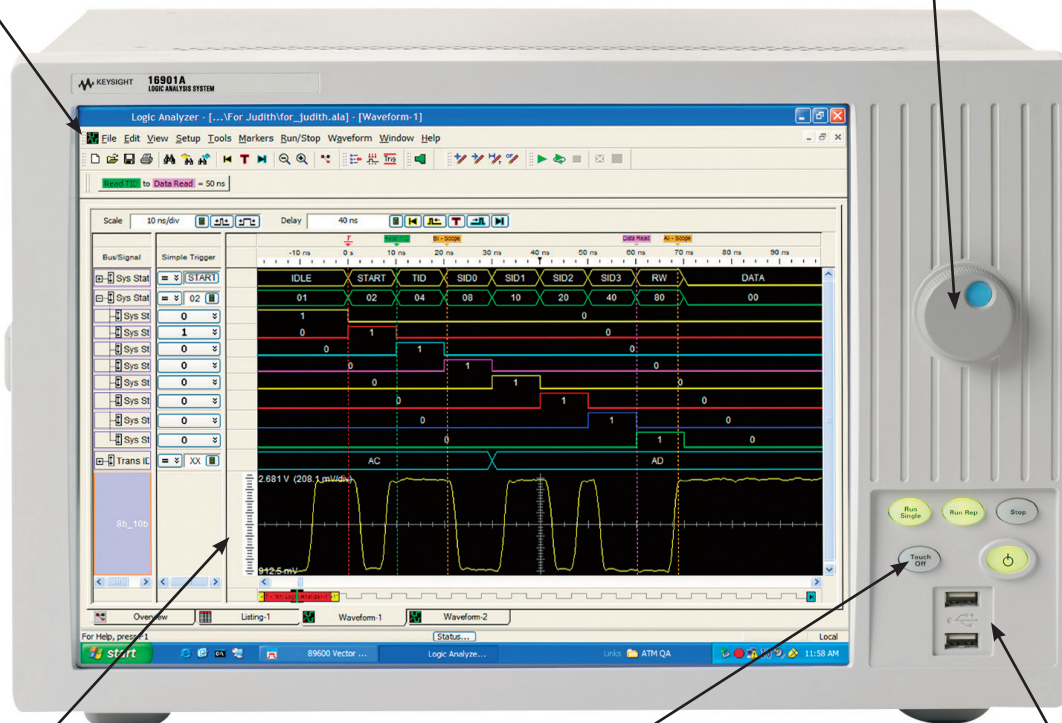
Keysight and third-party bus, protocol or FPGA support

Advanced Switching Interface	PCI
Altera:	PCI Express®
– Stratix II GX	PCI-X®
– Stratix II	RS-232, RS-449
– Stratix GX	Serial ATA
– Stratix	Serial attached SCSI
– Cyclone II	SPI (Serial Peripheral Excalibur Interface)
– Cyclone	SPI-4.2/PL4 (System Packet Interface)
– Max II	USB
– APEX 20K	Xilinx:
– APEX II	– Virtex-5
– Excalibur	– Virtex-4
CAN	– Virtex-II Pro Series
DDR1, DDR2, DDR3	– Virtex-II Series
Fibre channel	– Spartan-3
Fully buffered DIMM	– Spartan-3A
GDDR3	– Spartan-3E
HyperTransport	
I²C	
InfiniBand	

Get Exceptional Performance, Usability and Superior Probing at a Price to Match your Budget

15-inch (38.1 cm) color touch screen display, allows you to see more data. Viewing relationships between large numbers of signals and buses helps you identify a problem sooner.

General-purpose knob lets you quickly adjust your viewing and measurement parameters. Select a modifiable variable, then turn the knob to quickly step through values for the variable.



View Scope lets you quickly validate signal integrity and timing relationships between analog and digital domains by seamlessly integrating your scope and logic analyzer waveforms into a single display. Synchronized sampling clocks keep the logic analyzer and oscilloscope measurements tightly time-correlated across deep acquisitions.

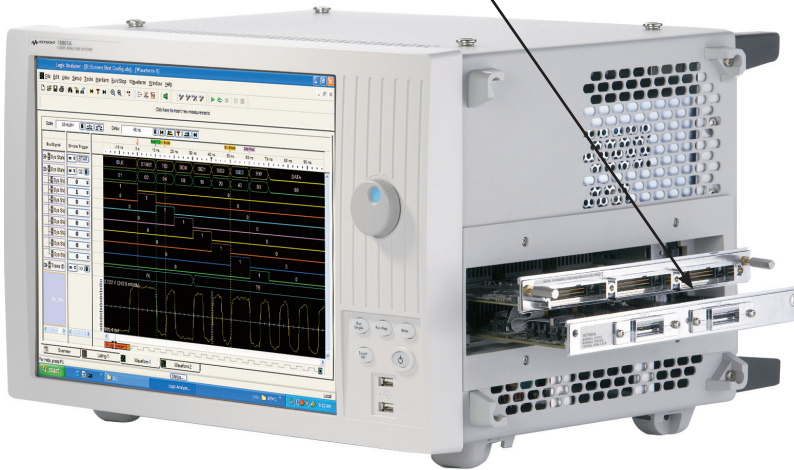
Touch screen gives you direct access to all logic analyzer functionality so you can stay focused on your measurement. “Touch Off” key disables the touch screen and allows you to point out anomalies to a colleague without altering the display settings.

Six 2.0 USB ports, two in front, four in the rear, let you “hot connect” a mouse, keyboard or USB storage drives.

Get Exceptional Performance, Usability and Superior Probing at a Price To Match your Budget (Continued)

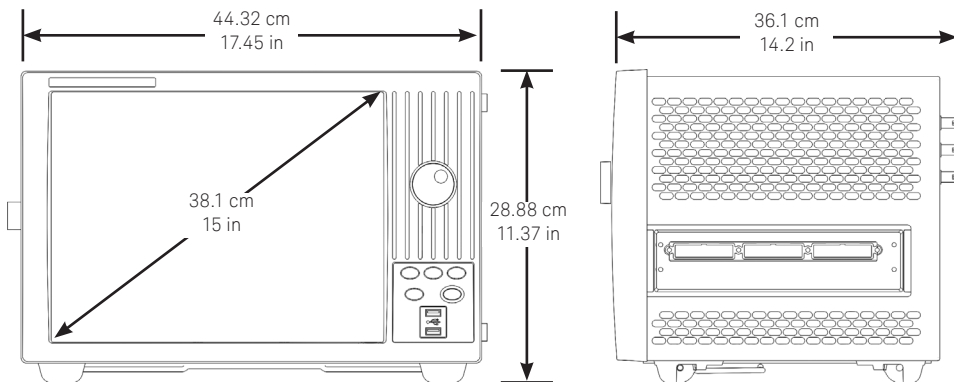
Up to **256 M deep memory** for identifying the root cause of a problem and symptom that are widely separated in time.

Modularity provides configuration flexibility to meet your measurement needs – now and in the future.



16901A dimensions

See the 16900 Series Logic Analysis System Mainframe - Data Sheet, 5989-0421EN for 16902B dimension details.



Choose the Modules that Meet your Specific Needs

Modular expandability is the key to the long-term value of the Keysight 16900 Series logic analysis systems. Purchase the capability you need now, then expand as your needs evolve. Configure a custom logic analysis system with modules to fit your performance and price needs. Protect your investment by upgrading analyzer module memory depths or state speeds as your needs change.

Only Keysight enables you to split each logic analyzer module into two separate time bases. You can correlate activity across multiple buses using a single module with this capability.

- Create higher-channel-count systems by combining modules.
- Find elusive cause and effect problems separated in time by using deep memory.

Make accurate high-speed state measurements

Eye finder automates the process of finding the precise moment to sample each signal relative to the clock.

- Save time during measurement setup with automated threshold and sample position adjustments.
- Quickly determine which signals have activity.
- Compensate for skew induced by variances in signal path lengths.

Accurately measure precise timing relationships

A parallel acquisition architecture provides up to 4 GHz high-speed timing zoom simultaneously with other state or timing measurement. Timing zoom stays active all the time with no tradeoffs.

- Gain confidence in your system, whether you're making timing or state measurements.

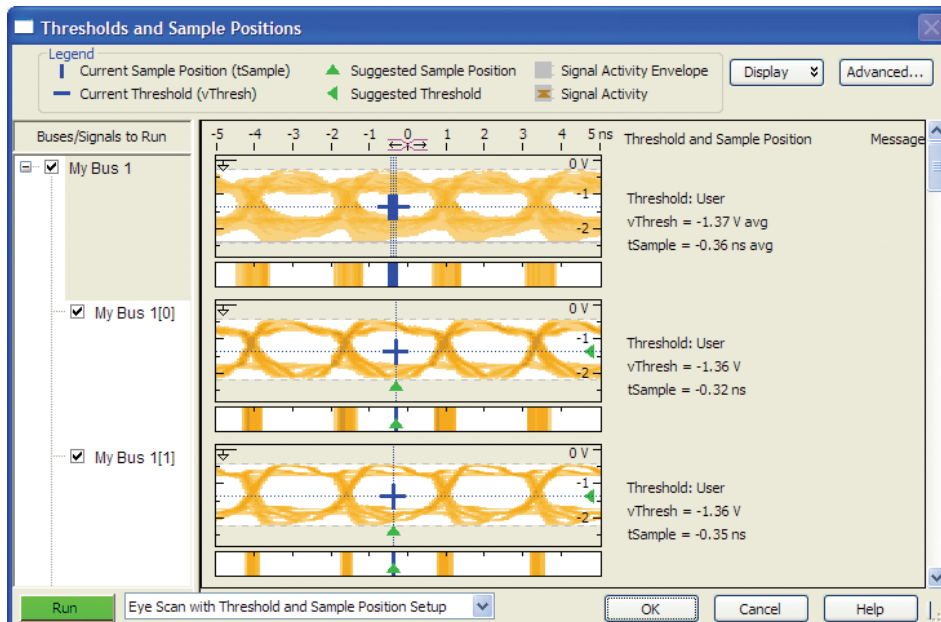


Figure 12. Identify problem signals quickly by viewing eye diagrams across all buses and signals simultaneously.

Choose the Modules that Meet your Specific Needs (Continued)

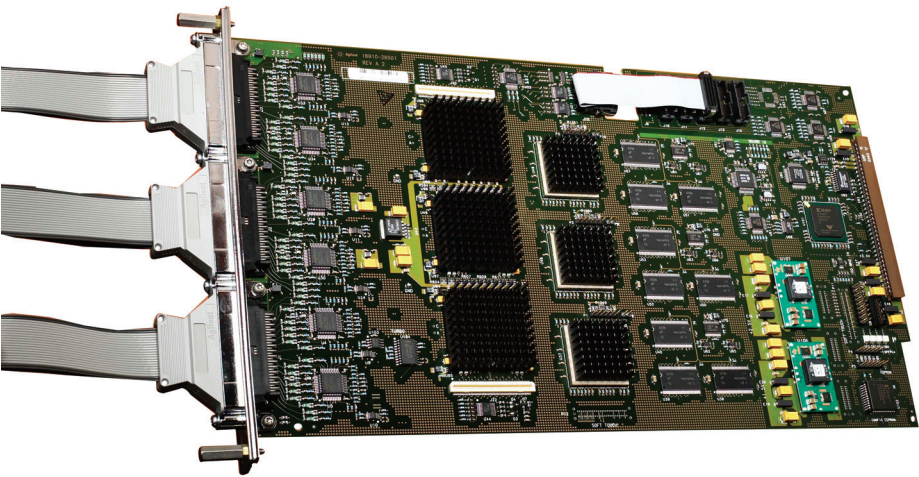


Figure 13. Combine multiple acquisition modules when you need to measure across many channels.



Figure 14. Modularity provides configuration flexibility to meet your measurement needs—now and in the future.

Choose the Modules that Meet your Specific Needs (Continued)

Table 2. Select the analyzer modules that best suit your requirements.

Model number	Ultra performance 16950B ² /16951B ²	High performance 16910A ² /16911A ²
Channels per module	68	102 68
Max channels on single time base and trigger	340	510 340
High-speed timing zoom ¹	4 GHz (250 ps) with 64 K depth	4 GHz (250 ps) with 64 K depth
Max timing sample rate (Half/Full channels)	1.2 GHz (833 ps)/ 600 MHz (1.67 ns)	1.0 GHz (1.0 ns)/ 500 MHz (2.0 ns)
Max state clock rate	667 MHz	450 MHz with option 500 250 MHz with option 250
Max state data rate	1066 Mb/s	500 Mb/s with option 500 250 Mb/s with option 250
Memory depth	256 M (16951B) 1 M up to 64 M (16950B)	256 K up to 32 M
Supported signal types	Single-ended and differential	Single-ended
Automated threshold/ sample position, simultaneous eye diagrams, all channels	Yes	Yes
Probe compatibility	90-pin cable connector	40-pin cable connector

1. All channels, all the time, simultaneous state and timing through same probe.
2. Probes are ordered separately. Please specify probes when ordering to ensure the correct connection between your logic analyzer and the device under test. Specify desired memory depth, state clock and data rate using available options. Feature also available via software upgrade to existing module.

Table 3. Add a pattern generator module to drive down risk early in product development.

16720A1	Half channels	Full channels
Max clock speed	300 MHz	180 MHz
Max memory depth	16 M Vectors	8 M vectors
Channels per module	24	48
Max 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 3.3 V ECL, 5 V PECL, 3.3 V LVPECL, 3 state 2.5 V, 3 state 1.8 V, LVDS	

1. Order at least one clock pod for each module used as a master and at least one data pod for every 8 output channels.

Support for other modules

The 16900 Series also support the following measurement modules:

Timing/State modules

- 16950A
- 16760A
- 16753A, 16754A, 16755A, 16756A
- 16750A/B, 16751A/B, 16752A/B
- 16740A, 16741A, 16742A

Pattern generator module

- 16720A

Headroom for your future needs (Extend the life of your equipment)

Easily upgrade your 16900 Series modules. “Turn on” additional memory depth and state speed when you need more. Purchase the capability you need now, then upgrade as your needs evolve.

16910A	Upgrade max. state speed from
16911A	250 MHz to 450 MHz and max. data rate from 250 Mb/s to 500 Mb/s
	Memory depth options 256 K, 1 M, 4 M, 16 M or 32 M
16950A	Memory depth options 256 K, 1 M, 4 M, 16 M, 32 M or 64 M
16950B	Memory depth options 1 M, 4 M, 16 M, 32 M or 64 M

Unleash the complementary power of a logic analyzer and an oscilloscope

Effectively track down problems across the analog and digital portions of your design. Easily make time-correlated measurements between an Keysight 16900 Series logic analyzer and 80000, 8000, 6000, or 5000 Series oscilloscope.

Simplify Debug with Intuitive Triggering

Keysight's intuitive triggering helps you identify the cause of elusive problems in less time, so you can debug and validate your design more quickly.

Simple trigger

Set the trigger according to how you think about your target signals. Use standard events, such as rising edge, falling edge, glitch or pattern to define a trigger event. These events are accessible via an easy pull-down menu without leaving the waveform display.

You can set the trigger for an event on the basis of activity on one or more buses or signals. Simply select the patterns, edge or levels for the signals that apply.

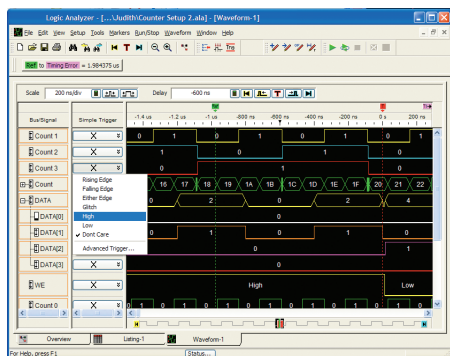


Figure 16. Define a single trigger event as a combination of levels, edges, patterns or glitches across multiple signals and buses.

Set "Quick Trigger"

See something you didn't expect in the current trace? Simply draw a box around the questionable event and select **Set Quick Trigger** to see if it occurs again. You don't have to spend time defining the trigger. The analyzer does the work for you.

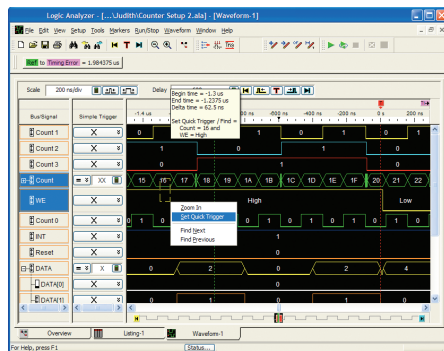


Figure 17. Create a trigger by simply drawing a box around an event in the current trace.

Advanced trigger

With the **Advanced Trigger** feature, you can customize a trigger for your specific situation. You can use modifiable trigger functions as individual trigger events or as building blocks for complex scenarios.

Icons provide a graphical representation for each trigger function. Simply drag-and-drop an icon into the trigger sequence. To fully define the trace event, fill in the blanks with values or select standard options from the pull-down menu.

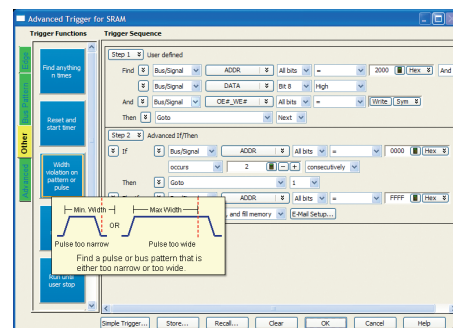


Figure 18. Customize a trigger to specify the sequence of events leading up to a trigger event.

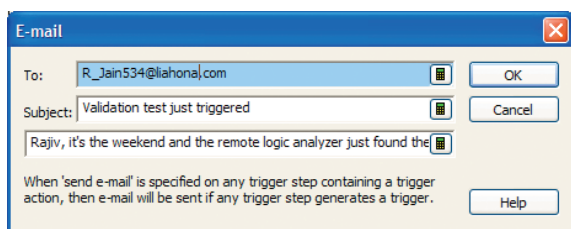


Figure 19. Working remotely? Tell the analyzer to send you an email when it finds a trigger condition and acquires a snapshot of your system.

Get Instant Insights into your Design with Multiple Views and Analysis Tools

The 16900 Series' navigation, data view and analysis features provide instant insights into your system's operation.

Waveform/Chart view

Validate correct hardware operation by viewing timing relationships between multiple buses and signals, including waveforms imported from a scope.

Track a symptom on one bus to its cause on another bus or signal using time-correlated global markers.

Verify that all of the signals in your target are functioning with a quick glance at the activity indicators.

Highlight and differentiate signals of interest by individually coloring and sizing signals/buses.

Compare signals/buses directly with the Overlay feature.

Graphically validate digitized signals to and from A/D converters by charting a bus's values over time.

Make quick, precise measurements using snap-to-edge marker placement.

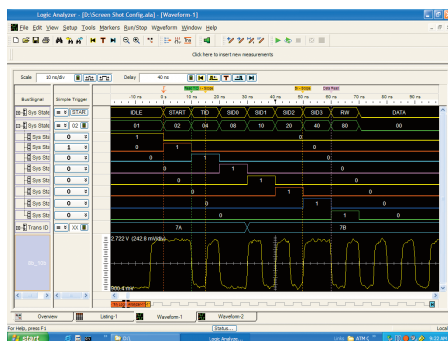


Figure 20. View timing relationships to validate hardware operation with the Waveform window.

Listing window

Examine data patterns and sequences of events in the same order they were captured and placed into memory.

View data in a format that has meaning to you – binary, hex, octal, decimal, signed decimal (twos complement), ASCII, symbols, or processor mnemonics.

Mark and navigate to points of interest with individually colored, named and annotated markers.

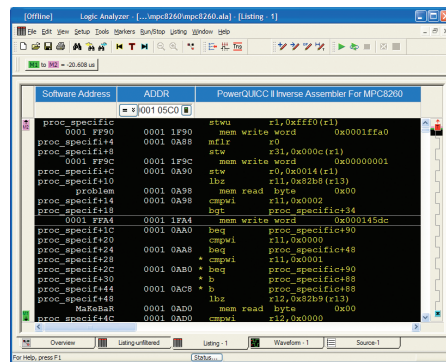


Figure 21. The Listing window is typically used to view states.

Source correlation window

Correlate your logic analyzer trace to the high-level source code that produced it.

Locate the cause of a problem by “stepping backward” from the point where you see a problem to its root cause.

Set up your next logic analyzer acquisition by simply pointing and clicking on a line of source code.

Determine the cause of data corruption by acquiring all activity relative to a variable.

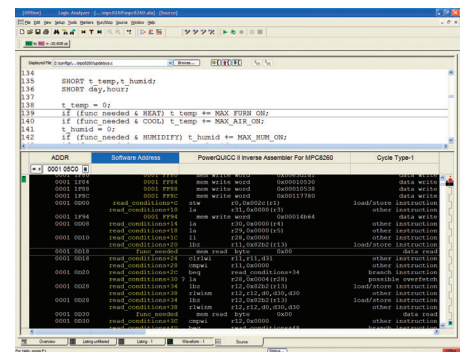


Figure 22. The split Source window displays the source code on top and the inverse-assembled trace below. The two traces are time-correlated and track as you scroll.

Get Instant Insights into your Design with Multiple Views and Analysis Tools (Continued)

Compare window

Find functional differences between a known good device and one that has a problem by comparing traces from each device.

Determine how your device will respond differently under varying operating conditions like temperature or frequency changes.

Find intermittent errors. Stop a repetitive run when a compare difference or number of differences is found.

Work remotely and let the analyzer notify you via email when a new acquisition has more than a specified number of compare differences.

Compare traces of different lengths or just a specific range of the trace. Offset the reference data so that the samples being compared are properly aligned.

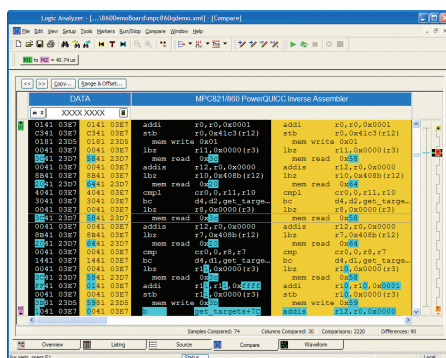


Figure 23. The Compare window lets you quickly identify differences between two traces.

Filter/Colorize tool

Perform multiple analysis scenarios without re-acquiring data when you're not sure what you're looking for.

View data in an easy to understand format that provides insight and answers. The VBA view charting function is seamlessly integrated, providing multiple ways to categorize data – line charts, XY scattergrams (I/Q plots), horizontal and vertical bar charts, pie charts and more.

Focus on just the information you need. Filter uninteresting data such as idle states and cache fills from deep, complex acquisition traces.

Gain quick insight into the frequency of an event. Scroll through the trace with the filter tool's color highlighting enabled.

Save time performing your favorite analysis scenarios. Store, recall and share your favorite search/filter conditions and VBA views, each individually named for easy recognition.

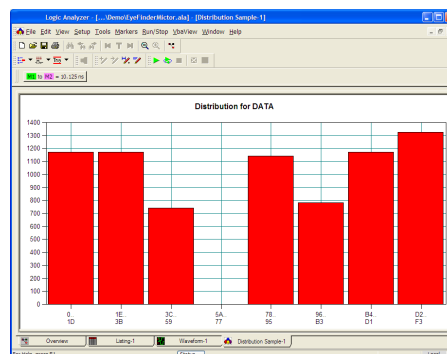


Figure 24. Customize your data view with the Filter/Colorize tool and Keysight's exclusive VBA view.

Making measurements and customizing analysis

Save time by creating custom dialogs that perform repetitive tasks and analysis.

Create an automated test suite that modifies the trigger for the next run based on the analysis results of previous runs.

Perform further analysis using the analysis functions of other COM-enabled PC applications by launching and transferring data to an application like MathWork's MATLAB.

Customize your measurement by developing your own inverse assemblers or analysis tools with the Analysis API.

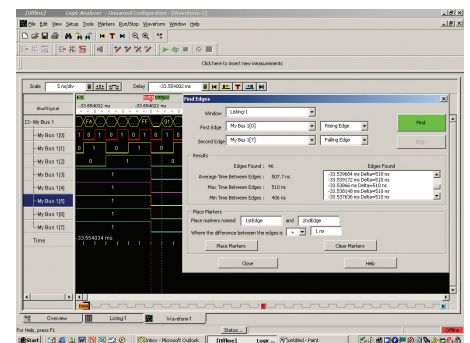


Figure 25. Extend your measurement results with customized data analysis.

Save time debugging your system when you trigger, search, view and analyze at the packet level.

Use Keysight's solutions for industry standard protocols like PCI Express or use our B4641A Protocol Development Kit to create a solution for your proprietary protocol.



Perform in-depth time, frequency and modulation domain analysis on your digital baseband and IF signals.

Eliminate writing custom software to analyze your data. The 89600 Vector Signal Analysis software provides a wealth of display formats, measurements, and digital modulation analysis – all using consistent, industry-tested algorithms.



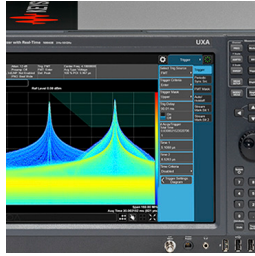
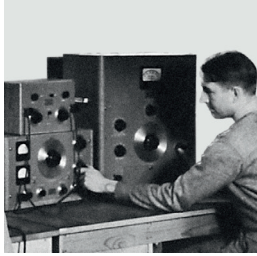
Related Literature and CD-ROMS

Publication title	Publication number
16900 Series Logic Analysis System Mainframes - Data Sheet	5989-0421EN
Measurement Modules for the 16900 Series - Data Sheet	5989-0422EN
16800 Series Portable Logic Analyzers - Brochure	5989-5062EN
16800 Series Portable Logic Analyzers - Data Sheet	5989-5063EN
B4655A FPGA Dynamic Probe for Xilinx - Data Sheet	5989-0423EN
B4656A FPGA Dynamic Probe for Altera - Data Sheet	5989-5595EN
Probing Solutions for Logic Analyzers - Data Sheet	5968-4632E
Application Support for Keysight Logic Analyzers - Configuration Guide	5966-4365E

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Keysight Services can help from acquisition to renewal across your instrument's lifecycle. Our comprehensive service offerings—one-stop calibration, repair, asset management, technology refresh, consulting, training and more—helps you improve product quality and lower costs.



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