HEWLETT PACKARD

HP 16500C Logic Analysis System

HP 16505A Prototype Analyzer

Rapid Insight for Designers of Complex, High-Speed Digital Systems

Complex Problems Demand Powerful Solutions

The digital systems you design are growing more complex every day. Today's trends include the following:

- More buses
- Faster, wider buses
- Multiple processors
- Increasing architectural complexity:
  - More intelligence hidden in silicon
  - Large internal caches
  - Pipelining and out-of-order execution
  - Hierarchies of buses

Problems can show up at prototype verification, in hardware-software integration, or in conformance or compatibility testing. The roots of those problems may lie in architecture, logic design, timing, or analog effects.

To help you solve these problems quickly, the HP 16500C logic analysis system and HP 16505A prototype analyzer let you look at your design's behavior from every angle—from code execution to analog signals. All views are displayed together, time-correlated, on the HP 16500C or HP 16505A screen.

With the HP 16505A prototype analyzer, you can view the same measurement data simultaneously in different display modes, including waveform, listing, chart, and statistical distribution. Drag-and-drop markers provide time correlation across all displays.

The powerful cross-domain triggering of the HP 16500C is indispensable for solving problems in complex digital systems. Triggering on code execution or bus cycles, for example, can establish a context for finding the cause of problems in timing or analog behavior.

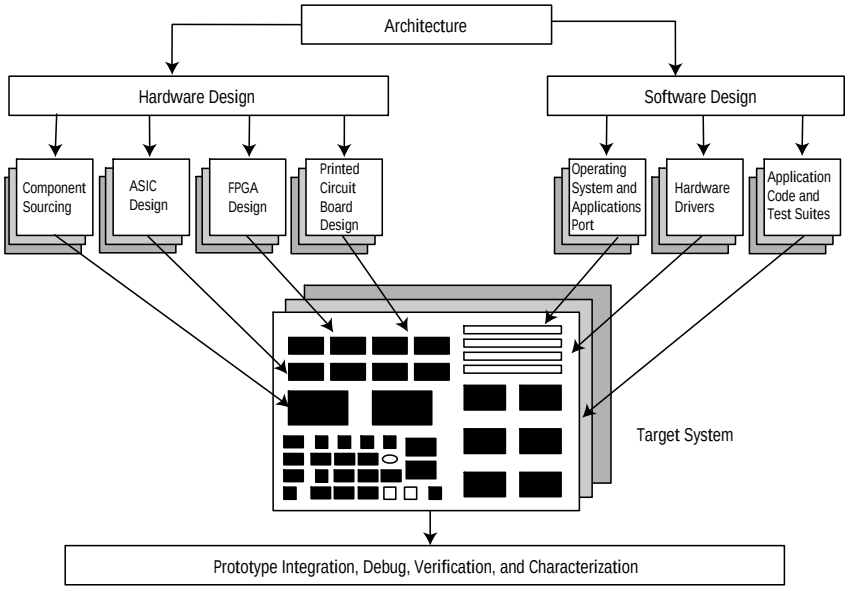

Figure 1. HP logic analyzers save valuable time in debugging, verifying, and characterizing prototypes of hardware and software.

HP 16500C/16505A Key Features

	HP 16500C	HP 16505A
User Interface	Touchscreen, knob, mouse, optional keyboard	Mouse, keyboard
	Built-in 9-inch color CRT display	Multiple, individually sizable windows
		VGA display
Printing	Local printing	Local or network printing
Network Capabilities	File transfer, remote interface, programmable setups NFS server X-Windows client	File transfer, remote interface, network printing NFS client/server X-Windows client/server
Other Interfaces	RS-232-C HP-IB Parallel printer	Parallel printer

Unleash Your Power to Explore

You want to concentrate on your design and apply your brain power to problem solving. In addition, you want tools that are easy to learn and use so you can gain insight quickly. The HP 16500C's intuitive user interface harnesses the power of the HP 16500C measurement modules to tackle your problems.

The HP 16505A prototype analyzer provides additional analysis capabilities and a large-screen, windowed user interface to the HP 16500C logic analysis system, to help you discover the root cause of your toughest design integration and debug problems quickly. The HP 16505A's measurement, analysis, and display tools are located in a toolbox in the main window. You can drag and drop the appropriate tools onto the workspace and connect the tools to customize your environment. Measurement tools contain the configuration, format, and trace setup controls for the HP 16500 measurement modules.

If you don't use a logic analyzer frequently, you'll especially appreciate the HP 16505A and 16500C. With their intuitive interface, you'll immediately start using them productively, instead of wasting time relearning the interface each time.

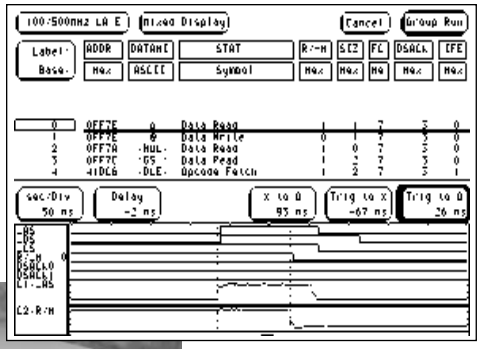

Figure 2.
Viewing state, timing, and analog information together, time-correlated on the HP 16500C screen, makes it easy to find the cause of problems.

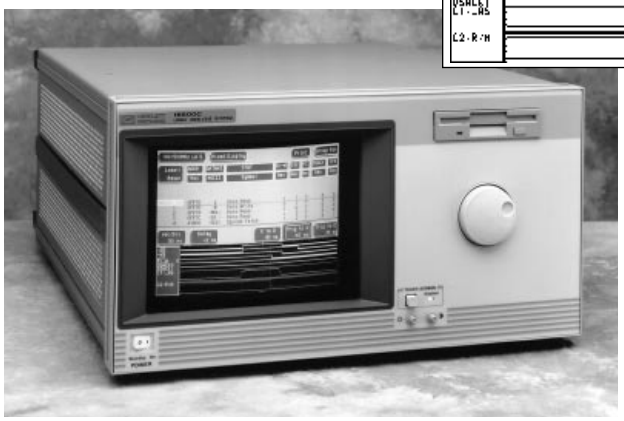

Figure 3.
The HP 16500C logic analysis system can be operated using its own built-in user interface, without the HP 16505A.

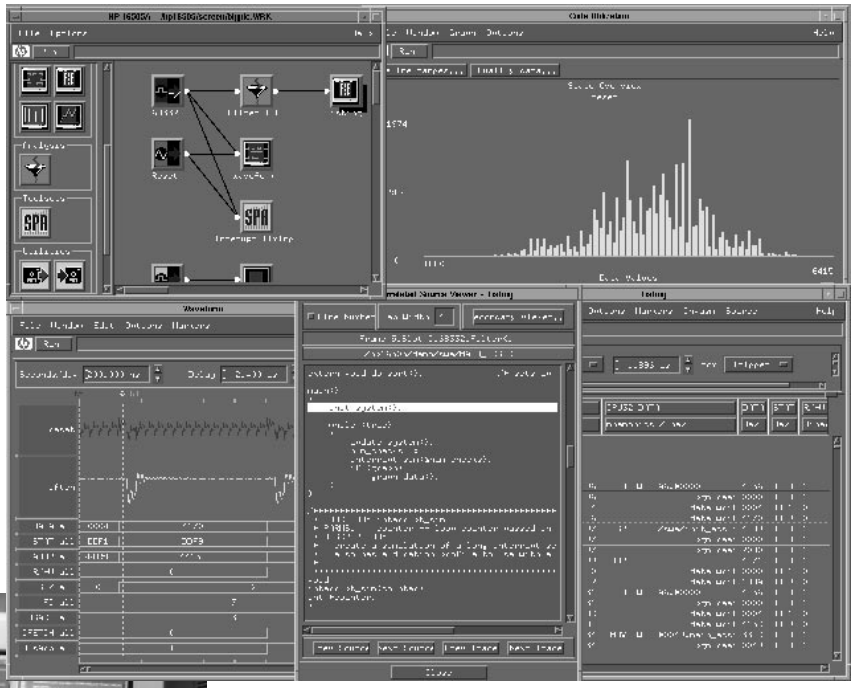

Figure 5.
The HP 16505A lets you view your design's behavior from analog signals to source code.

Figure 4.
The HP 16505A prototype analyzer is a measurement server that uses the HP 16500C's real-time measurement power. It adds a large-screen, windowed display and powerful analysis tools.

Take The Fast Track to Insight

The HP 16505A prototype analyzer helps you quickly solve your toughest design integration and debug problems. Simultaneous viewing of source, trace, and waveform displays enables you to quickly track down cross-domain cause and effect. Move from chart or histogram overview of bus activity to detailed timing or analog waveforms in seconds—or view them all simultaneously.

Get the Best View with Multiple, Sizable Windows

You can individually size each window in the HP 16505A display up to the full width of the local display, at resolutions up to 1024 x 768. 1280 x 1024 resolution is available with option 001, additional video RAM, and a local monitor that supports 1280 x 1024 resolution. Waveform, histogram, and chart display windows can be dynamically resized with the mouse. Simply drag the mouse across the area you want to view in more detail, and the window automatically rescales the viewing area.

Timing and analog waveforms can be individually sized and colored to emphasize important channels. Waveforms can be reduced in size to view more channels, to give you a broad overview of system activity. You can view up to 100 individual waveforms simultaneously.

You can resize the state listing windows to the maximum screen dimensions, and vary the text size for ease of viewing. You can also dynamically reorder system labels to optimize visual comprehension.

Multiple instruments can transmit data to a single display window, which makes it easy to correlate data from multiple domains.

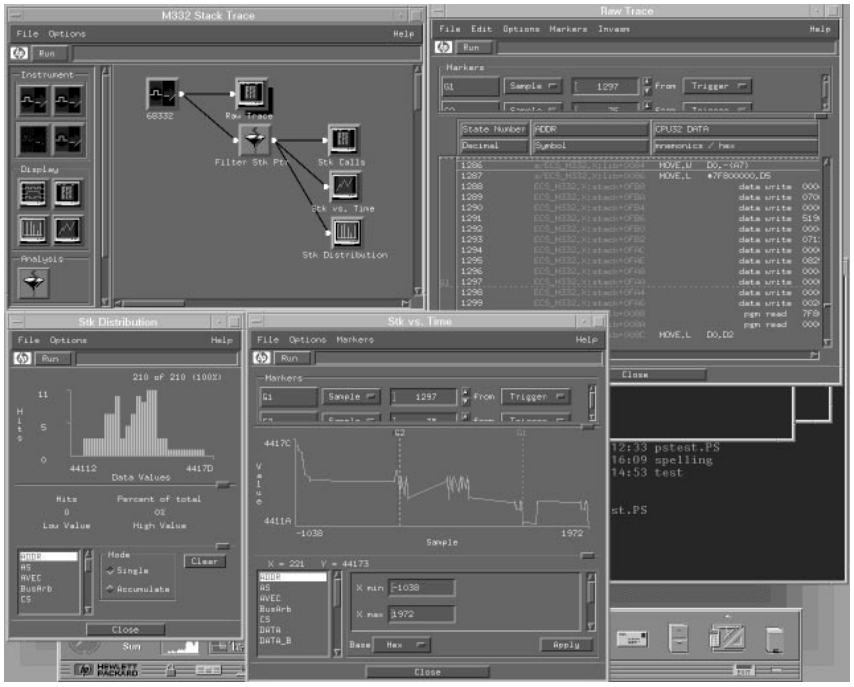

Figure 6.
Multiple windows in the HP 16505A prototype analyzer let you view and analyze a problem in many different ways—simultaneously.

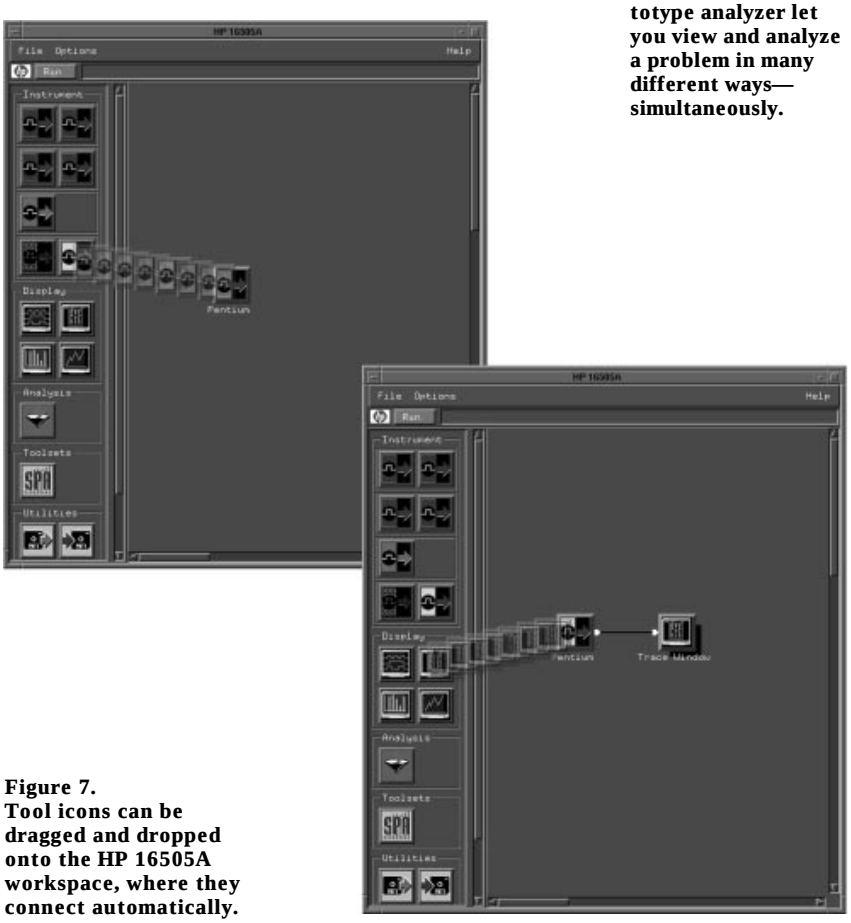

Figure 7.
Tool icons can be dragged and dropped onto the HP 16505A workspace, where they connect automatically.

Correlate Data with Drag-and-Drop Markers

Display windows have two local and two global markers. Global markers provide time-correlation across multiple displays of data captured on the same run. As you move a global marker in one window, markers in the other windows follow. Local markers can measure time intervals in a single window without moving the global markers.

Find the Answers in Real-World Data with Postprocessing

See just the address bus values you want using the HP 16505A's pattern filter tool. Or use the pattern filter on a data bus to see those data values that correspond to a certain variable value.

The pattern filter is placed between the source of the measurement data and one or more display tools. It filters the data going to the display tool, so you see only the data of interest. You can also see data both before and after filtering. You can even cascade pattern filters. In all cases, the data is time-correlated.

The pattern filter can be used with any data, including analog and state. Combine the outputs of multiple pattern filters to create displays using the X-Y chart display tool—for example, to track the value of a variable as conditions change.

Debug Complex Microprocessor Systems

Customize the way you view the activity in multiprocessor systems for insight into their complex behavior. Data captured from any processor or bus can be viewed in any display. You can create unique timing or listing displays to view just the data you need to understand a problem.

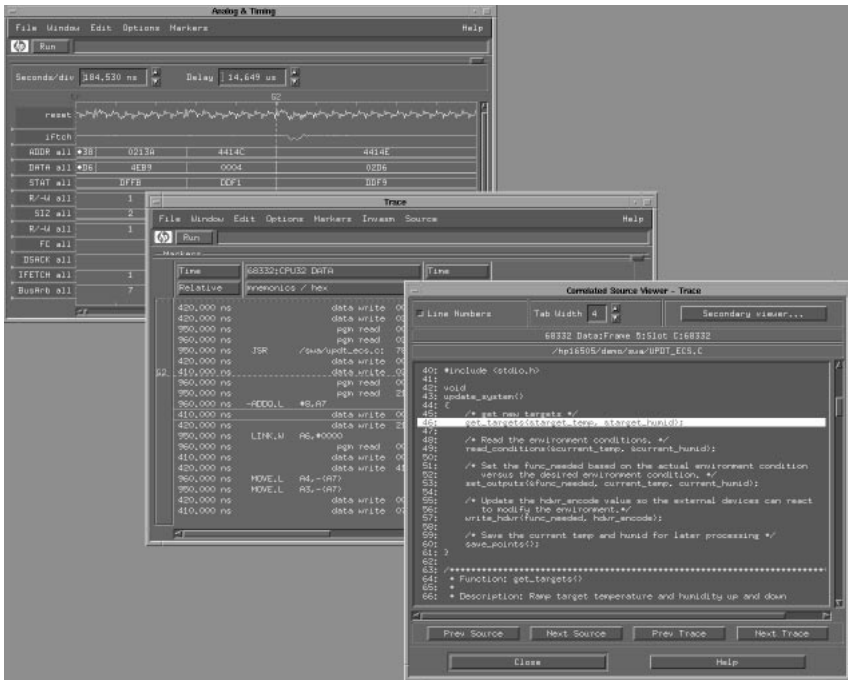

Figure 8. Time-correlated waveform and source code windows enable you to isolate the root cause of your system integration problems.

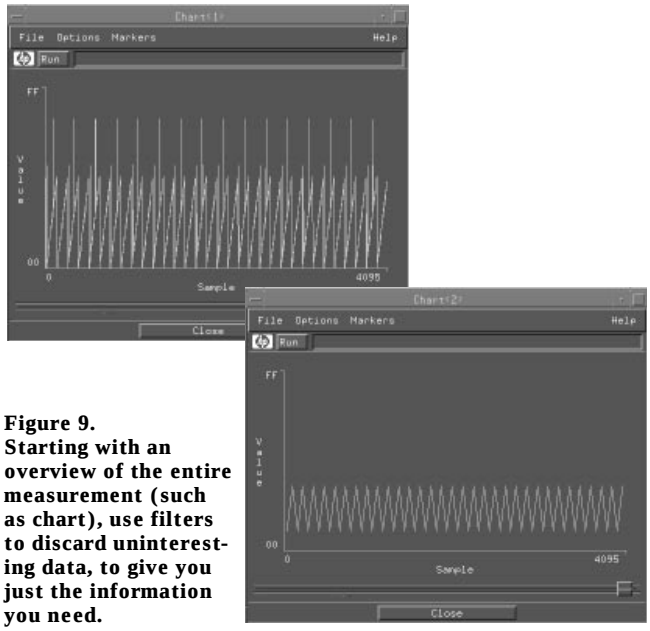

Figure 9. Starting with an overview of the entire measurement (such as chart), use filters to discard uninteresting data, to give you just the information you need.

Optional Software Tool Sets for the HP 16505A

Take Advantage of Real-Time Software Analysis

The HP B4620A software analyzer tool set for the HP 16505A applies the power of a logic analyzer to tackle your software problems. By combining the HP B4620A with the HP 16500C and HP 16505A, you can make valid software measurements on real hardware running at full speed.

With the HP B4620A, you get the optimum view of both software execution and hardware behavior simultaneously, to solve tough hardware-software integration problems.

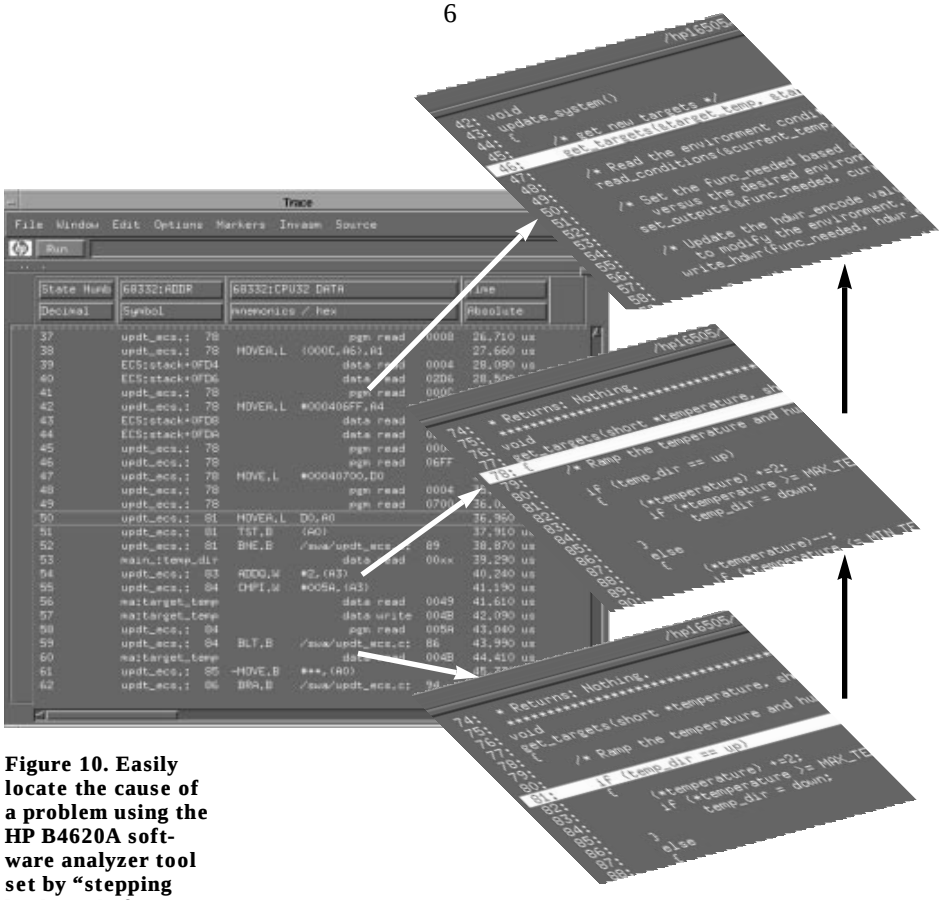

Figure 10. Easily locate the cause of a problem using the HP B4620A software analyzer tool set by "stepping backward" from the point where a problem is manifested.

Use System Performance Analysis for the Entire Design Team

Optimal performance requires a balance of both hardware and software, because they are interdependent. The HP B4600A system performance analysis tool set lets you optimize the performance of your overall product by analyzing the performance of both hardware and software at the same time. It is designed to profile the entire system at all levels of abstraction—from analog signals to high-level source code. Members of the design team can use the HP B4600A individually to optimize performance in their area of responsibility, and also work together effectively to optimize overall system performance.

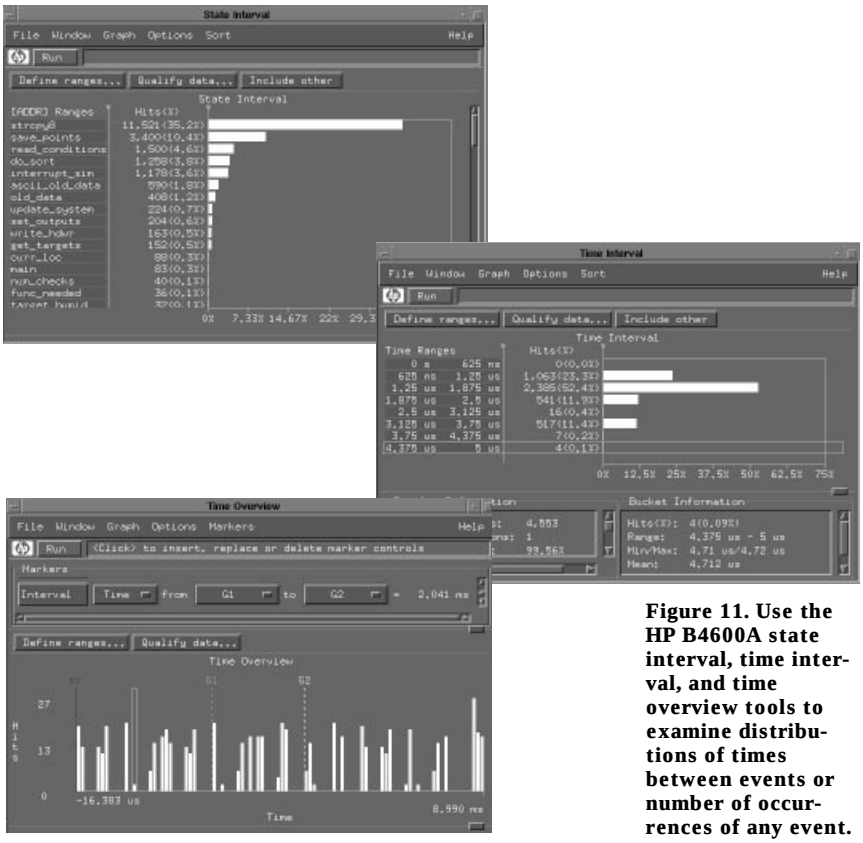

Figure 11. Use the HP B4600A state interval, time interval, and time overview tools to examine distributions of times between events or number of occurrences of any event.

Solve Today's Problems—With Room to Grow for Tomorrow

The HP 16500C system is a powerful, flexible logic analysis system that lets you buy what you need now and expand its capabilities as your needs change. The system provides the following capabilities:

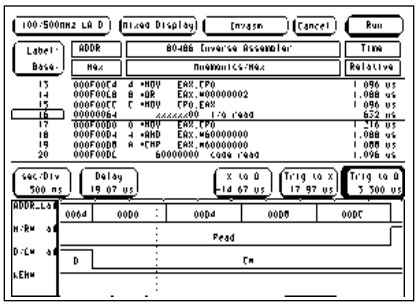

Figure 12.
General-Purpose State and Timing

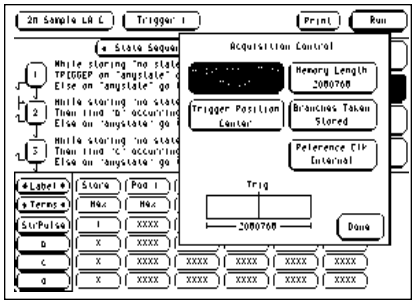

Figure 13.
Deep-Memory State and Timing

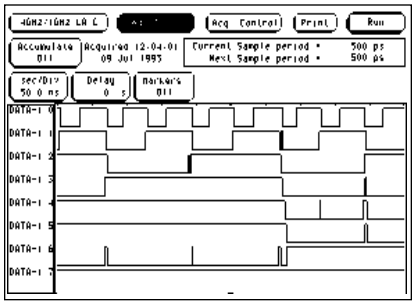

Figure 14.
High-Speed Timing

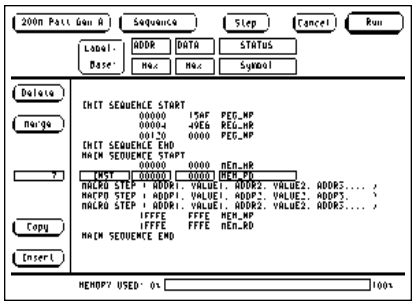

Figure 15.
Pattern Generation

General-Purpose State and Timing Analysis

- 100-MHz state analysis
- 500-MHz timing analysis, 250-MHz transitional timing analysis
- Memory depth up to 8 Ksamples (half-channel mode), 4 Ksamples at full channel count
- Up to 1020 channels in one HP 16500 system
- Up to 204 channels on one time base and trigger

Deep-Memory State and Timing Analysis

- Memory depth up to 4 Msamples (half-channel mode, timing only), 2 Msamples at full channel count
- Up to 110-MHz state analysis
- Up to 500-MHz timing analysis
- Up to 680 channels in one HP 16500 system
- Up to 340 channels on one time base and trigger

High-Speed Timing and Synchronous State Analysis

- Up to 4-GSa/s timing analysis
- Synchronous state analysis up to 1-GHz external clock speed
- Up to 131,072 sample memory depth (half-channel mode)
- Up to 160 channels in one system
- Up to 80 channels on one time base and trigger

Pattern Generation

- Up to 200 Mvectors/second
- Up to 400 channels in one HP 16500 system
- Up to 200 channels in one synchronized pattern generator system
- 258,048-vector memory depth

Oscilloscope

- 1-GSa/s or 2-GSa/s sampling rate
- 250-MHz or 500-MHz bandwidth
- 32 K-sample memory depth
- Up to 8 channels on a single time base and trigger
- Up to 20 channels in one HP 16500 system

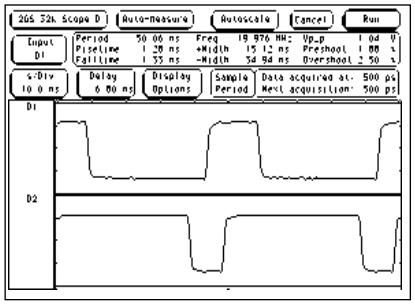

Figure 16.
Oscilloscope

Preprocessor Support for Most Processors and Buses

Multipoint Analog Probing Using the HP MultiProbe System

- Up to four input pods in one MultiProbe system for accessing hundreds of nodes on fine-pitch surface-mount ICs
- Up to 960 input connections, selectable two at a time
- Up to 1-GHz bandwidth

Real-Time High-Level Source Language Listing and Referencing

Microprocessor Run Control (With the HP 16505A Prototype Analyzer)

System Performance Analysis Tool Set (HP 16505A)

Software Analysis Tool Set (HP 16505A)

All these system tools are tightly integrated in both the HP 16500C's and the HP 16505A's easy-to-use interface.

Up to 10 measurement modules can be combined in one system by using the HP 16501A expansion frame with the HP 16500C logic analysis mainframe. Each expansion frame has five slots for measurement modules.

The HP 16500C system can evolve as your needs change. Since 1987, HP has continually introduced new measurement modules, added preprocessors for the latest processors and buses, and expanded system software capabilities. The oldest HP 16500A can be upgraded to the latest HP 16500C configuration with the HP E2479A upgrade kit. Installation by an HP service center is included with the purchase of the upgrade kit.

The modular design of the HP 16500C and HP 16505A allows you to select the tools you need today and add more capabilities as your needs change.

Figure 17.
Add more HP 16500-series measurement modules to your HP 16500 logic analysis system with the HP 16501A expansion frame.

Connect to Your Target System with HP Probes and Preprocessors

HP offers the most effective solutions for your hardest probing requirements. HP's innovative probing technologies offer optimum probing access for today's fine-pitch, surface-mount IC packages by easily connecting to devices with hundreds of pins.

Reliable connection is a must in probing. HP's unique probing technologies make dependable mechanical and electrical connections to the target.

The performance of any real-world measurement system can only be as good as the probes. HP probing systems are designed for maximum bandwidth and minimum loading of the target, so what you see is a true representation of the target's behavior.

Preprocessors and inverse assemblers make it easy to analyze microprocessor and bus activity by making the physical connection to the target and disassembling bus states into microprocessor assembly language. HP and HP Channel Partners provide hundreds of preprocessors and adapters for HP logic analyzers, offering broad support for microprocessors, industry standard buses, and system interfaces. HP introduces new preprocessors as new processors become available.

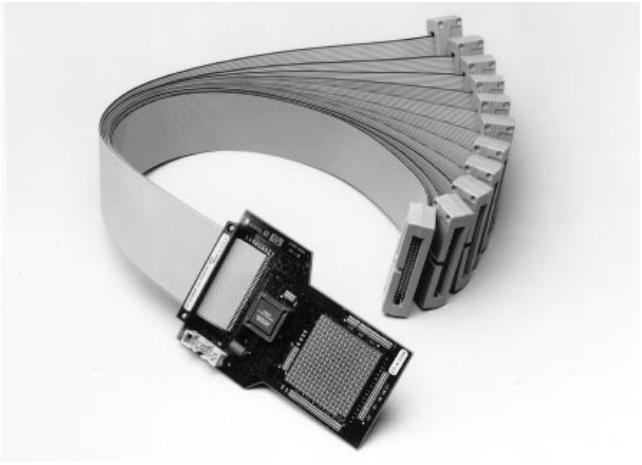

Figure 18. HP's innovative probing solutions make it easy to probe dense IC packages reliably.

Connect to the World and Your Team Members with LAN

Work from the convenience of your office, with the target system located in a lab. You and other team members located in different cities—or different countries—can work together concurrently on problems, using the same logic analysis system and observing the same target system.

Use the LAN to import data into your workstation or PC for convenient post-capture analysis and documentation. Build a common database of target behavior so all team members have access to a complete history of measurements. With the HP 16505A prototype analyzer, you can import previous measurement results or even simulation files to compare with current measurements. You can even filter and view data off-line for added insight. Files can be exported in ASCII or binary format. Screen images can be exported as black-and-white or color TIFF files, PCX files, or encapsulated PostScript®.

The HP 16500C and HP 16505A support NFS and FTP server protocols. You can operate both remotely using any workstation or PC with X11 Windows capability.

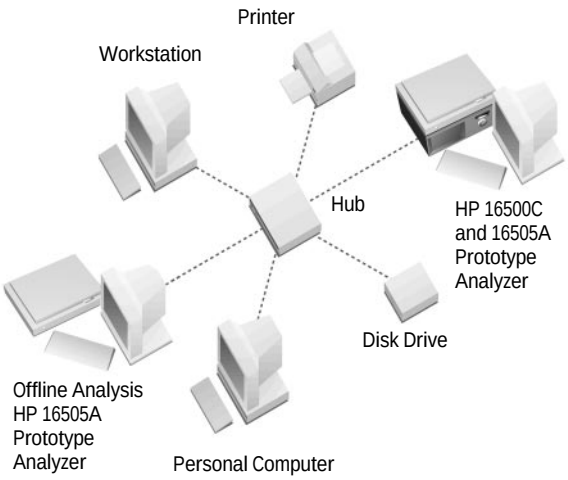

Figure 19. Networked measurement tools enable design team members to view data from the same target system.

Program Your System Over HP-IB or RS-232-C

The HP 16500C also offers HP-IB and RS-232-C interfaces. The HP 16500C and any installed measurement modules can be programmed over either of these interfaces. Every function that can be controlled from the user interface can be controlled programmatically as well. The HP 16500C and 16505A also provide a Centronics parallel printer interface.

The HP-IB and RS-232-C interfaces on the HP 16500C can also be used to connect to printers that have an HP-IB or RS-232-C interface (see the section below about printers).

Take Control of Your Target System

The target control port on the HP 16500C can be used to provide convenient control of the target system. You can control the target remotely from your office, your home, or anywhere with the remote interface capabilities of the HP 16500C.

The target control port has eight connections that can activate reset or interrupt lines—for example, to set registers or counters. Eight vectors can be preloaded and then sequenced manually. All eight connections can be individually tri-stated. Activity indicators are provided on all eight connections.

View and Trigger on Symbol Names

The symbol download utility provided with the HP 16500C extracts symbolic information from popular OMF file formats. Symbol names from your source code, such as function and variable names, can be used to specify trigger conditions or viewed in trace listings.

The HP 16500C supports the following OMF file formats:

- HP/MRI IEEE695
- Intel OMF86
- Intel OMF286
- Intel OMF386 (used for Intel80486 and Pentium®)
- Ti-COFF
- ELF DWARF

Code sections can be offset to match dynamically loaded PC relative code. Multiple OMF modules can be loaded concurrently.

See Your Measurements in Print

For information about supported printers, see the table below.

HP 16500C Printing Capabilities

Print screen images in black and white or color. State or timing listings can be printed in full or in part, starting from center screen. Every color can be individually adjusted to your printing and viewing preferences, and color setups can be stored and recalled.

HP 16505A Printing Capabilities

Print your screen images to HP PCL-compatible printers in black and white or color. Screen images can be printed to PostScript-compatible printers in black and white or grayscale. The colors of most display items can be selected for viewing and printing from a predefined palette. In addition, the HP 16505A supports network printing.

	HP 16500C	HP 16505A
Interfaces for printers	Centronics, RS-232-C, HP-IB (IEEE 488)	Centronics (for local printers) LAN
Printers	Printers which support the HP printer control language (PCL) Recommended: HP DeskJet, HP LaserJet Epson FX80, LX80, and MX80 printers with a Centronics or RS-232-C interface are supported in the Epson 8-bit graphics mode.	PostScript™ compatible printers Printers which support the HP printer control language (PCL)

Figure 20. Control the HP 16500C remotely using the X-windows interface.

Figure 21. Import HP 16500C and 16505A screen images into your documents.

Trigger and Correlate Measurements Between HP 16500-Series Modules

The intermodule bus in the HP 16500C is the key to cross-triggering and time-correlation among modules. Any module can arm other modules using the intermodule bus. The other modules can be triggered immediately upon being armed, or wait after arming until their own trigger conditions are satisfied. The delay from recognizing the trigger condition to arming other modules on the intermodule bus depends on the module and the trigger conditions, but is typically 100 ns.

A port-out BNC connector allows the intermodule bus to trigger or arm external devices. External inputs can be used to arm HP 16500C modules with the port-in connector.

Data from different modules acquired on the same group run can be time-correlated. The resolution and accuracy of time correlation depends on the individual modules. The common intermodule bus clock that tracks individual module trigger times has a resolution of 2 ns.

Have Control at Your Fingertips

DIN connectors for a PS-2 keyboard and mouse are provided on the HP 16500C. The HP E2427B keyboard is available for the HP 16500C and includes an overlay for the special function keys. A keyboard is convenient for entering labels, for example. A PS-2 mouse is standard with the HP 16500C.

A mouse and keyboard are both provided with the HP 16505A prototype analyzer.

Store Settings and Data

A built-in hard disk drive and a 1.44-MB floppy disk drive are provided with both the HP 16500C and HP 16505A. An external, removable hard disk drive is available on the HP 16500C as Option 060.

Get the Most Out of Your HP Logic Analyzer

HP offers training in how to use HP logic analyzers, as well as a variety of flexible consultation services. Learn from an experienced HP instructor who is an expert in applying HP instruments to your unique needs. HP training includes extensive hands-on experience and interactive class discussions. In addition, HP training pays off immediately because it is geared to real-world solutions. You can choose to have training at an HP facility or at your site. Call 1-800-HPCLASS in the U.S. for information about training schedules and locations, or to register.

Figure 22.
The 16500C's easy-to-use interface includes a touch screen, PS-2 mouse and optional keyboard.

Figure 23.
Both the HP 16500C and 16505A come with a built-in hard disk drive and a 1.44-MB floppy disk drive.

For more information refer to the following HP publications:

Title	HP publication number
The HP 16500C/16505A Configuration Guide	5965-3185E
The HP 16500C Logic Analysis System Mainframe and HP 16501A Expansion Frame Technical Data	5965-3184E
A Family of State and Timing Analyzers for the HP 16500 Logic Analysis System	5962-7245E
4-GSa/s Timing and 1-GSa/s Synchronous State for the HP 16500 Logic Analysis System	5091-8096E
HP 16517A/18A Technical Specifications	5091-7216E
1 Gigasample/second and 2 Gigasample/second Oscilloscope Modules for the HP 16500 Logic Analysis System	5964-0238E
HP 16522A 200 Mvector/second Pattern Generator Modules for the HP 16500 Logic Analysis System	5964-2250E
The HP MultiProbe System	5964-0239E
HP B3740A Software Analyzer	5962-7114E
Accessories for HP Logic Analyzers	5963-3376E
Probing Solutions for TQFP/CQFP/PQFP Packages	5965-2790E
Microprocessor and Bus Interfaces and Software Accessories for HP Logic Analyzers	5963-2435E
HP E3491A Pentium® Processor Probe	5963-6855E
HP E3492A Embedded MIPS Processor Probe	5964-3958E
HP E3477A and E3494A Processor Probe for the PowerPC 603E and 603	5965-2789E
The HP B4600A System Performance Analysis Tool Set	5964-3561E
The HP B4620A Software Analyzer Tool Set	5964-9333E
HP Journal, June 1996 (this issue contains four in-depth articles on the HP 16505A prototype analyzer)	5964-6219E

Ordering Information

HP 16500C Logic Analysis System Mainframe

Options

ABD	German language training kit manual
ABF	French language training kit manual
ABJ	Japanese language user's guide and training kit manual
W03	Convert standard one-year return-to-HP warranty to three-month on-site warranty
W30	Three-year return-to-HP repair service
0B0	Delete manual set
0BF	Add programmer's guide
0B3	Add service guide
001	Add 16 MB memory (recommended for use with the symbol download utility, for very large symbol tables; also recommended when using the HP 16501A expansion frame with the HP 16500C)
060	External removable hard disk drive
908	Rackmount kit

Accessories

HP E2427B	Keyboard
HP 1181A	Testmobile system cart
HP 35181D	Work surface for mouse and keyboard (for HP 1181A cart)
HP 35181G	133-mm (5.25-inch) storage drawer (for HP 1181A cart)
HP part no. 5181-8723	Support shelf (for HP 1181A cart)

HP 16501A Logic Analysis System Expansion Frame

Options

ABJ	Japanese language manual
W03	Convert standard one-year return-to-HP warranty to three-month on-site warranty
W30	Three-year return-to-HP repair service
908	Rackmount kit

HP 16505A Prototype Analyzer

Options

ANT	Add 64 MB RAM for a total of 96 MB (recommended for use with HP 16500C systems with two or more HP 16554A, 16555A, 16555D, 16556A, or 16556D modules)
UF3	1-MB video RAM (enables support for SVGA local monitors with 1280 x 1024 resolution)
W03	Convert standard one-year return-to-HP warranty to three-month on-site warranty
0B1	Add service manual (not required for normal operation)

Upgrade Kit

HP E2479A upgrade kit	Upgrades any HP 16500A or HP 16500B to the HP 16500C configuration

Training Kit

HP E2433E training kit	Includes demonstration board, learning manual, and configuration files for the HP 16500C

Measurement Modules and Tool Sets

For complete ordering information on measurement modules and tool sets, refer to the HP 16500C and HP 16505A configuration guide, HP publication number 5965-3185E.

Training and Consulting

The following information applies to the U.S. only. In other areas, contact your HP sales office for information on consulting services and training.

HP 16500C +24Z	One-day course, "Improving Productivity Through Logic Analysis"
HP 16500C +24Y	Two-day course, "Improving Productivity Through Logic Analysis"

Up to ten students per session can attend these courses at either an HP site or at the customer's site.

50629F	Hourly HP T & M specialist productivity assistance. Hourly charges apply from portal to portal to cover travel expenses.

Warranty

All Hewlett-Packard products described in this document are warranted against defects in material and workmanship for a period of one year from date of shipment. Option W03 provides a three-month on-site warranty in lieu of the standard one-year return-to-HP warranty. Three-year and five-year return-to-HP repair services are also available. Refer to individual product manuals for detailed descriptions and terms of warranty.

For more information on Hewlett-Packard Test & Measurement products, applications or services please call your local Hewlett-Packard sales offices. A current listing is available via Web through AccessHP at http://www.hp.com. If you do not have access to the internet, please contact one of theHP centers listed below and they will direct you to your nearest HP representative.

United States:
Hewlett-Packard Company
Test and Measurement Organization
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