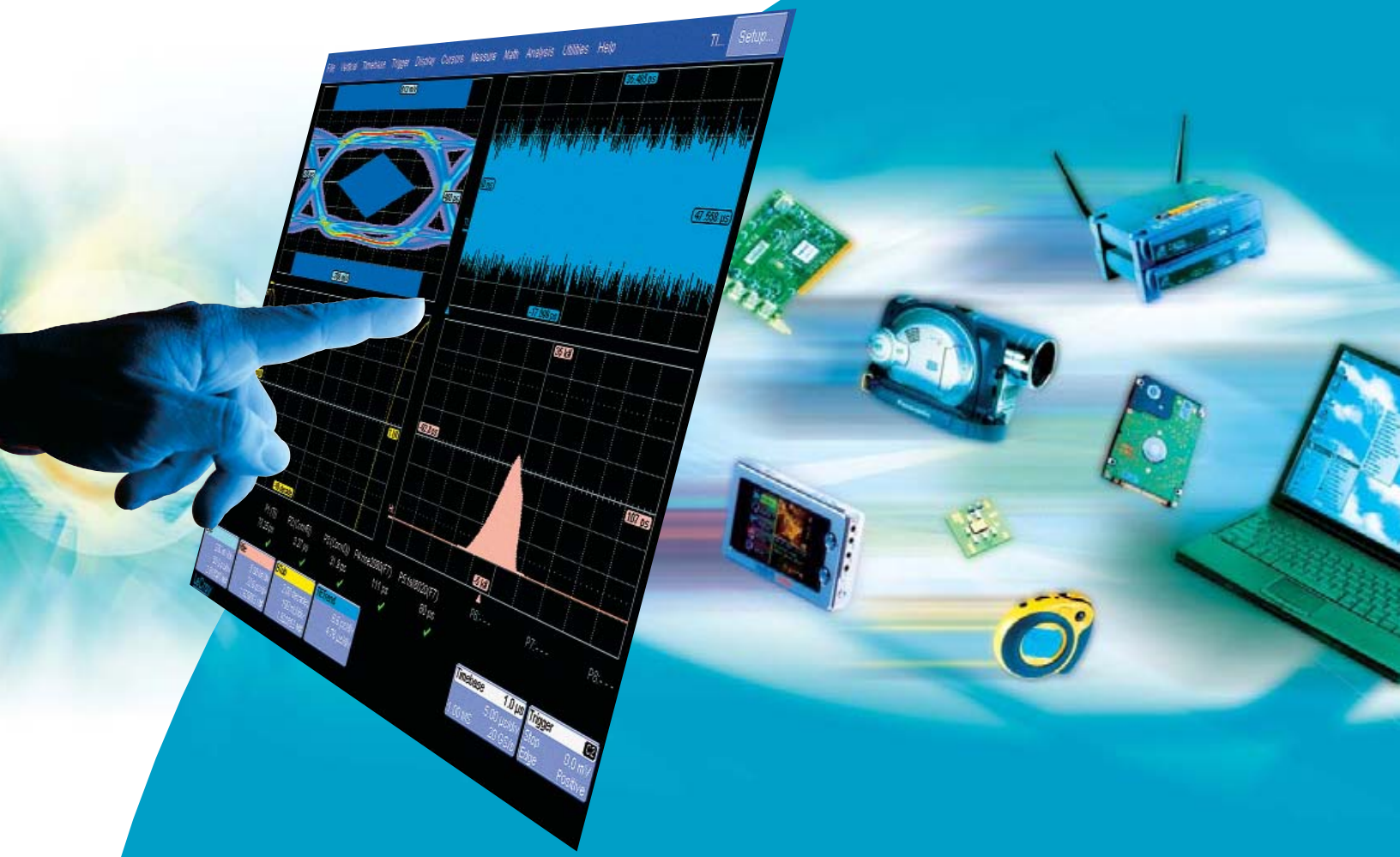
LeCroy

Oscilloscopes, Protocol Analyzers, and Serial Data Test Solutions

2005/2006 Catalog



OVERVIEW

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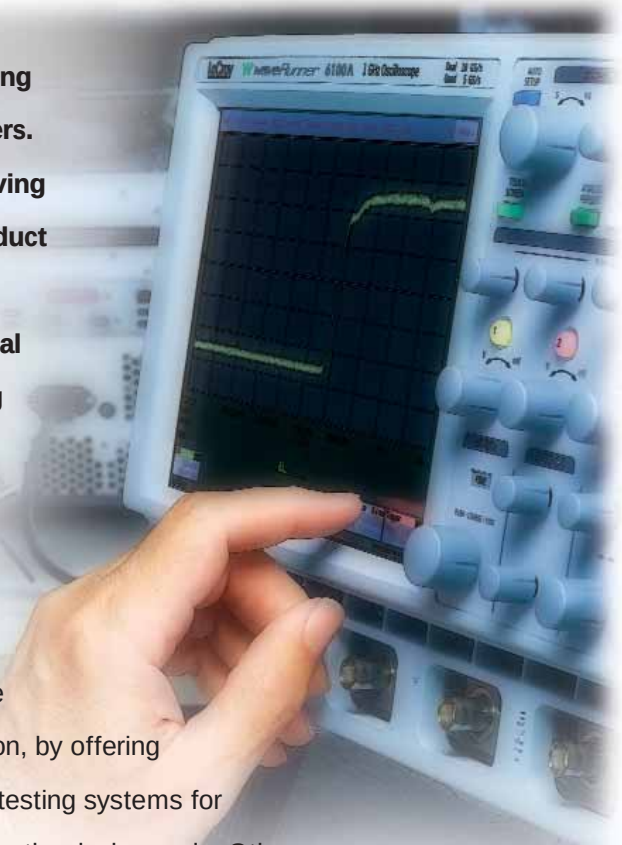
Innovative Test Solutions for Electronic Design Engineers



Since the company's founding in 1964, LeCroy has focused on being a leading innovator of test solutions for electronic design engineers. These solutions enable engineers to be more productive by resolving design issues faster and more effectively, thereby shortening product time-to-market. By developing industry leading test systems in serial data analysis, protocol analysis, and analog and digital signal measurement, the company has played a major part in advancing the technological revolution.

A Complete Toolbox for Serial Data Analysis

As serial data becomes the dominant standard for data transmission, fast and accurate signal analysis is critical. LeCroy Corporation's industry-leading expertise in serial data analysis has proven itself in the computer market, particularly in serial data bus development. In addition, by offering the best products for physical layer testing along with expert protocol testing systems for the message layer, LeCroy provides the ultimate end-to-end solution for the design cycle. Other key standards are equally well served by industry-preferred test devices for PCI Express™, SAS, SATA, and Wireless USB.

Expanding Our Lead in Communications Standards

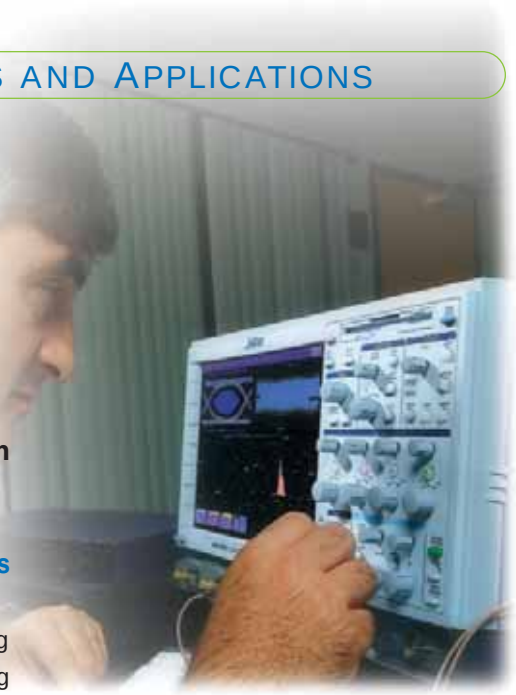
The rapid introduction of new consumer devices and capabilities is placing a high priority on interoperability and the flawless implementation of digital communications standards like PCI Express, SAS, SATA, and Wireless USB. With the recent acquisition of Computer Access Technology Corporation (CATC), LeCroy now offers a comprehensive range of leading test solutions for computer I/O, storage, and networking protocols.

Superior Analog and Digital Signal Analyzers

WaveShape Analysis is the LeCroy cornerstone for capturing, viewing, and analyzing highly complex electronic signals. Based on LeCroy's unique hardware and software architecture, it gives engineers a window into circuit design, enabling them to study and analyze signal performance in minute detail. This revolutionary technology is available in the Wave family of oscilloscopes—from innovative new bench scopes to the faster sampling rate, longer memory, and superior processing power of our high-end scopes. This technology also underpins the company's dominant systems in power analysis and automotive bus testing.

Solutions Spanning Diverse Industries and Applications

LeCroy high-performance oscilloscopes and analyzers are used across a diverse range of industries. Our close relationships with leading companies in sectors such as computers, semiconductors, consumer electronics, data storage, and automotive electronics, help us to continuously refine our products to better address the requirements of the latest technologies. It is the main reason why engineers and research professionals worldwide rely on our systems for their most demanding test and measurement applications.



Computer and Semiconductor Design

The transition to the digital technology world has required a new generation of test and measurement instruments. In the computer and semiconductor industry, LeCroy is firmly established as a leader in the market for PCI Express compliance and debug tools like PCI *Tracer/Trainer*. Our SDA-PCIE tool dramatically simplifies the new measurements necessary to qualify the PCI Express interface and thus fully evaluate the integrity of new serial data product designs. Our SDA-SATA software package is the only commercially available test suite that meets the specification requirements for both Gen1 and Gen2, as well as Serial ATA transmitter compliance testing.

Consumer Electronics

In the consumer marketplace where electronic products tend to be thinner, lighter, faster, and more highly connected, interoperability is the key to success. A myriad of new devices is required to share data and seamlessly communicate with each other quickly and accurately. LeCroy expert systems provide advanced protocol analysis, precisely monitoring communications traffic and diagnosing operational problems to ensure compliance with interoperability standards such as PCI Express, SAS, SATA, USB, Wireless USB, Bluetooth®, Fibre Channel, and more.

Automotive and Industrial Electronics

Automotive electronics is an area where exciting new digital innovations are coming to market. LeCroy oscilloscopes are helping automotive manufacturers design and test enhancements such as the latest in-dash screens, Global Positioning Systems (GPS), lighting, and collision systems. In this sector, our new CANbus TDM/TD test system has established itself as the premier serial data solution. It is the first system that moves up the protocol stack from the physical layer to data-level measurements.

Power Measurement

As manufacturers (especially those in the semiconductor, computer, and medical industries) bring more sophisticated products to market, there is a corresponding demand for more flexible and powerful instrumentation to test and measure the advanced power supplies their products incorporate. LeCroy's PowerMeasure Systems provide an exceptional ability to measure and analyze the operating characteristics of power conversion devices and circuits. Providing unmatched performance with a complete set of measurement tools, each system includes an easy-to-use yet high-performance digital storage oscilloscope, high-performance current probe and differential voltage amplifier, and PMA2 PowerMeasure Analysis software.

Telecommunications

From wireless devices to broadband networks and fiber-optic transmission lines, signal complexity and transmission rates are increasing. Engineers working on next generation Telco systems must ensure network products can accurately send and receive complex data streams. LeCroy breakthroughs in serial data analysis are enabling them to keep pace with instruments designed to validate product performance and reliability.

Military and Aerospace Electronics

The growing connectivity and sophistication of digital control systems is fueling productivity advances in industry and government. These systems are driven by massive amounts of serial data requiring tremendous bandwidths. LeCroy's proprietary X-Stream technology, a revolutionary method of data transfer and processing, enables our family of oscilloscopes and analyzers to perform 10–100x faster analysis of complex signals—the fastest in the industry.

A 40-Year Track Record of Technology Innovation

LeCroy is a global technology innovator with a 40-year successful track record of providing high-performance systems that are faster, more accurate, and more affordable. Our reputation for bringing cutting-edge systems to market is founded on our core competency in signal acquisition and analysis, and our ability to develop and leverage innovative technologies and capabilities.

MAUI Scope Operating System

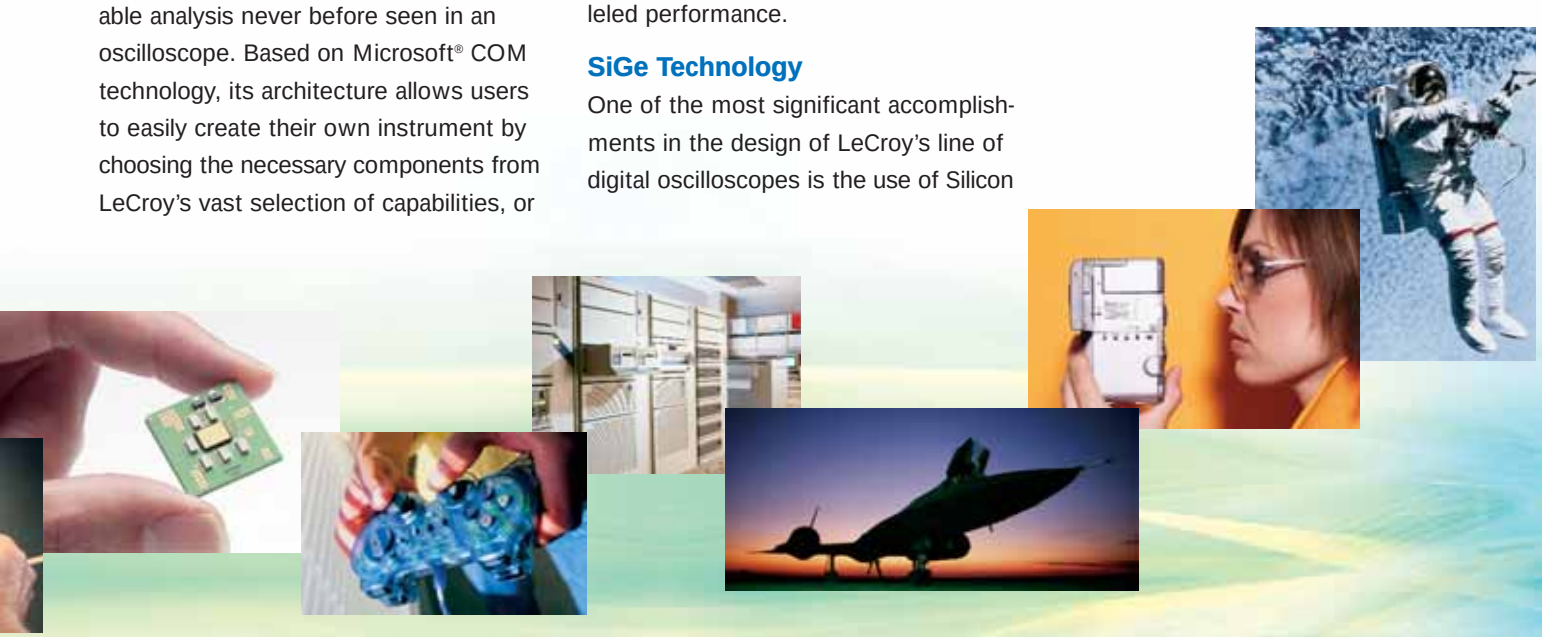
LeCroy's proprietary MAUI software gives users high-speed throughput and customizable analysis never before seen in an oscilloscope. Based on Microsoft® COM technology, its architecture allows users to easily create their own instrument by choosing the necessary components from LeCroy's vast selection of capabilities, or adding their own custom ones. MAUI works in tandem with LeCroy's X-Stream hardware architecture to provide unparalleled performance.

SiGe Technology

One of the most significant accomplishments in the design of LeCroy's line of digital oscilloscopes is the use of Silicon Germanium (SiGe) technology, which allows amplifiers and other devices to operate with a combination of high-speed, low noise, high gain, and excellent linearity capabilities. This unique pairing enables our oscilloscopes to achieve levels of performance not previously possible. These performance improvements provide engineers with the bandwidth and sampling speed they need when working with complex electronic signals.

Jumping the Power Curve

Recently LeCroy has announced a number of new technologies that push the limits of silicon-based processing. The exclusive LeCroy Digital Bandwidth Interleaving (DBI) technology is a breakthrough invention (patent pending) that extends the bandwidth of any silicon platform by up to four times. Sampling scopes have been reinvented with the availability of the new Near Real-time Oscilloscope (NRO) WaveExpert. Enabled by Accelerated Throughput Architecture (ATA – patent pending), WaveExpert offers 100 GHz bandwidth and signal acquisition speeds 100 times faster than conventional sampling scopes.



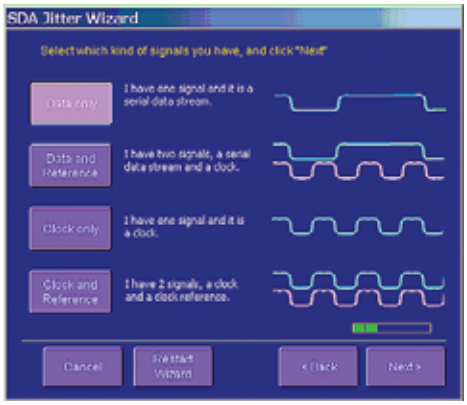
A TOTAL SOLUTION FOR SERIAL DATA ANALYSIS

Optical and electrical serial data has become a dominant form of data transmission. The LeCroy Serial Data Analyzer (SDA) Series, which features the ASDA-J option, is the first family of devices to combine sampling oscilloscopes, Timing Interval Analyzers (TIAs), and bit error rate test sets in a single jitter engine. With these powerful capabilities in one instrument, engineers can easily view and understand the differences between these standard methods.

Thorough Jitter Analysis

Jitter is the most critical measurement in physical layer serial data analysis. LeCroy SDAs can measure a full set of clock and data jitter parameters as well as Time Interval Error (TIE) measurements for data signals. With the fully featured ASDA-J option, engineers can take advantage of the most effective jitter analysis tool available today, with support for the following advanced capabilities:

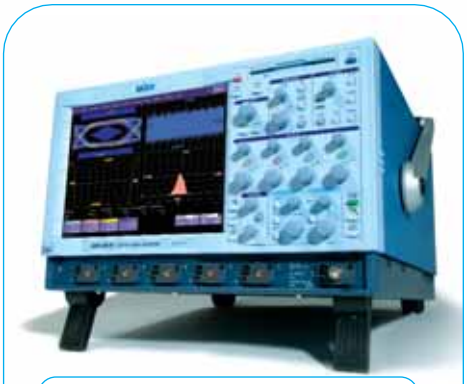
- **Jitter Wizard**
  This function guides the user through the instrument setup and automatically detects the sampling rate, bit rate, and pattern length of the signal to achieve the highest accuracy.



- **Edge-to-edge Jitter**
  This function enables the SDA to correlate its jitter measurements with both sampling oscilloscopes and TIA-based instruments.

Other capabilities include:

- Filtered Jitter
- N-cycle vs N Jitter Plot
- Jitter Analysis: Rj, Dj, Tj
- ISI Plot



SDA "A" Series

- 3, 5, or 6 GHz
- 2.7 Gb/s serial pattern trigger
- 10 GS/s per channel
- 75 ps rise time
- 10.4" SVGA TFT

Key Measurements

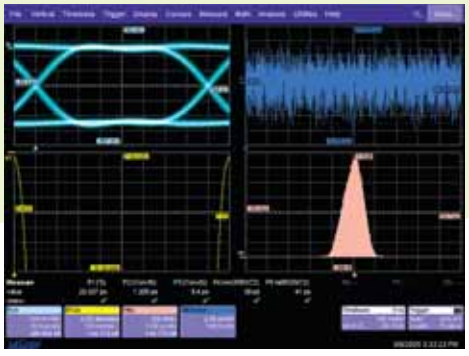
Several different views are available to display processed data, including a bathtub curve, histograms, time trends, and data dependent jitter. TIE measurements are performed using precise software clock recovery. Other measurements include total, random, and deterministic jitter derived from a histogram.

SDA 11000

- 11 GHz
- up to 40 GS/s per channel
- 40 ps rise time
- 10.4" SVGA TFT

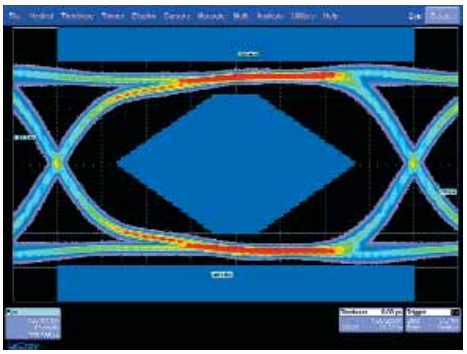
SDA 11000

The new SDA 11000 brings outstanding high-end performance to leading edge serial data-based design. It offers 11 GHz bandwidth on 2 channels and 6 GHz on 4 channels. Sampling rates are up to 40 GS/s at deepest memory. Equipped with a full suite of innovative jitter and eye pattern analysis tools, it also supports the testing of next generation serial data standards like: ***5 Gb/s PCI Express Gen2; 4.25 Gb/s Fibre Channel; 6 Gb/s SATA III; 4.8 Gb/s FB-DIMM; and 6.25 Gb/s double XAUI.***



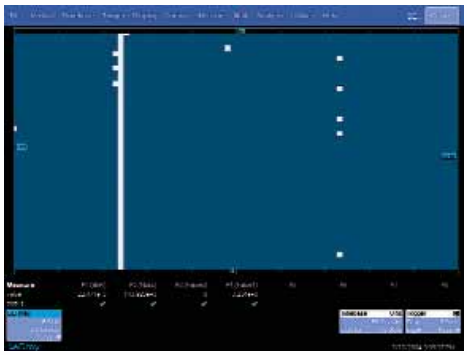
The Ultimate in Clean Eye Patterns

The LeCroy SDA analyzer measures eye patterns on a continuous record of up to 8 million consecutive unit intervals (UI). A software clock recovery algorithm separates the record into one UI length segments that are overlaid to form the eye pattern. Subsequent acquisitions are added with the previous ones.



Bit Error Rate Analysis

LeCroy's SDA converts the captured record of consecutive bits using a software recovery and threshold detector to generate a bit stream. The bit stream is compared to the expected pattern to determine the number of bit errors and the error ratio.



DDA Series

- 5 GHz
- 10 GS/s per channel
- 20 GS/s dual channel
- 5 GHz trigger
- 10.4" SVGA TFT

DDA Series

A unique combination of sophisticated measurement capability and an intuitive user interface makes the DDA 5005A the solution for disk drive analysis. Its X-Stream architecture integrates the SiGe "digitizer-on-a-chip" technology, and a high-speed streaming bus design enables the transfer of data from the ADC to a proprietary acquisition memory.

Signal Integrity is Assured

The DDA 5005A analyzer hardware includes a high-quality front end amplifier for low noise and a precise timebase for timing accuracy. High-quality clock sources with jitter ≤ 1 ps over a 1 ms period and low trigger jitter (2 ps max.) ensure that the sampling points are precisely captured.

WaveMaster® Series

The WaveMaster oscilloscope offers a unique, full performance combination of high bandwidth, fast sampling speeds, and long memory capture. It is the first oscilloscope that can sample up to 20 GS/s on 4 channels (with up to 6 GHz bandwidth) into 48 Mpts of memory. Full sample rate is available at any memory length, and without compromising speed.

Customization Capabilities

WaveMaster can be fine-tuned to meet specific needs. Custom functions can be created with current third-party analysis packages and inserted directly into the WaveShape Analysis engine, allowing the user to view results directly. A custom user interface can also be developed. These features enable users to complete their measurement and analysis more efficiently.

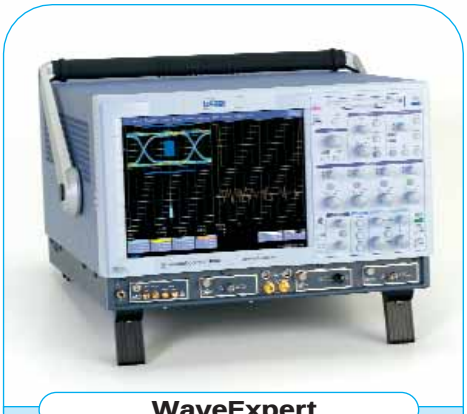
WaveMaster "A" Series

- 6, 5, or 3 GHz
- 10 GS/s per channel
- 20 GS/s dual channel
- 5 GHz trigger
- 10.4" SVGA TFT

WaveExpert™ Series

ULTRAHIGH BANDWIDTH IS HERE

The LeCroy WaveExpert NRO 9000 and SDA 100G are the first test instruments to combine the high bandwidth—100 GHz—and accuracy of a sampling oscilloscope with the speed and flexibility of a real time instrument. In so doing, these instruments have eliminated most of the constraints of traditional sampling oscilloscopes.

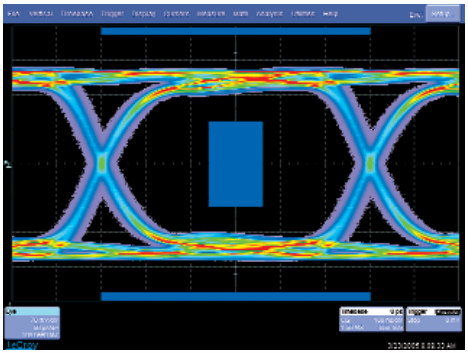


WaveExpert

- 100 GHz
- 10 MS/s
- Coherent interleaved timebase
- < 20 ps TDR rise time
- 10.4" SVGA TFT

Real-time Interface

The WaveExpert oscilloscope has earned the customer designation Near Real-time Oscilloscope (NRO) for its high acquisition speed, responsive GUI, and powerful suite of analysis tools. Enabled by a new LeCroy technology—Accelerated Throughput Architecture (ATA) (patent pending)—the WaveExpert oscilloscope offers signal acquisition speeds 100 times faster than conventional sampling scopes. ATA also allows for much longer acquisition memories and signal analysis algorithms that rival the capabilities found in only real-time oscilloscopes.



WavePro® Series

A Powerful Scope Offering Outstanding Value

With the WavePro 7000A Series, LeCroy put the premium into the performance, not the price. We have made our groundbreaking X-Stream architecture available in the very affordable WavePro range, enabling the oscilloscopes to perform WaveShape Analysis 10–100x faster than any other oscilloscope in the 1 GHz–3 GHz bandwidth class.

WavePro "A" Series

- 1–3 GHz
- 10 GS/s per channel
- 48 Mpts/Ch
- 10.4" SVGA TFT

Intuitive Operation

WavePro eliminates the trade-offs between long record lengths and fast processing. Familiar controls like timebase, voltage, and cursors can be operated from the front panel or through the touch screen graphical user interface. Users can easily view signals in time, frequency, or statistical domains. Visual indications of parameter distributions are also shown as small histogram views called Histicons.

THE STANDARD FOR PROTOCOL ANALYSIS

Used by semiconductor, device, system, and software developers, LeCroy protocol analysis solutions feature impressive capabilities including:

- **Monitoring bus activity, diagnosing operational and design problems, and confirming interoperability**
- **Variety of configurations for large range of applications**
- **Functionality to assist design and test engineers and technicians through each phase of their product life-cycle**
- **Powerful software that may be used directly with the equipment or independently as a viewer and analysis tool**
- **Flexible platforms that offer future functionality via field upgrades**

PE*Tracer*™ EML

The PE*Tracer* EML analyzer is built on the CATC 100K Platform and supports PCI Express Specification 1.0 and 1.0a at the full speed of 2.5 GHz per lane.

SAS*Tracer*™

Utilizing the CATC 10K platform, the SAS*Tracer* analyzer captures traffic from either 2- or 4-wide port configurations or from up to 8 points along a complex topology.

USB*Tracer/Trainer*™

The USB*Tracer/Trainer* system is the total solution for cutting edge USB 2.0 and On-the-Go (OTG) development and analysis, and is based upon our CATC 2500H Platform.

Configuration Options

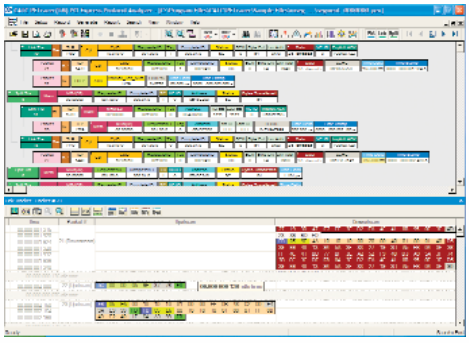
LeCroy products deliver a wide array of test and measurement applications, with capabilities ranging from economical single-purpose instruments to modular systems that analyze multiple links of high-speed serial traffic.

Display Options

LeCroy's *Tracer* expert analysis software provides a variety of powerful tools for reviewing bus traffic. These options include the CATC Trace™ hierarchical display as well as the chronologically-based Link Tracker™ and Frame Tracker™ displays. Using colors, symbolic representations, and textual data, these displays turn complex raw traffic across multiple links into understandable information viewable at multiple levels of detail.

Powerful Triggering and Filtering

The most important function of a protocol analyzer is to capture the most interesting bus traffic. *Tracer* software and hardware delivers this capability. The software interface allows easy access to this power. The depth of these features varies appropriately with the complexity of the specific protocol.



Traffic Reports and Summaries

Tracer software provides powerful reports on the captured traffic. Not only will the number of occurrences of certain events, such as packet types, primitives, errors and interactions between participants on the bus be seen, but these reports can also be used interactively. The numbers in these traffic summaries hyperlink back to the trace displays to enable seeing reported items in context. "Next" and "Previous" buttons facilitate skipping through the trace to each instance of specific events.

Tooltips and Metrics

The trace displays provide easy access to additional detailed information simply by rolling your cursor over the item in question. These Tooltips may include information about particular fields, protocol specifications, values captured, 10b codes, and more.

Search

The advanced search features in the *Tracer* software locate information quickly. By utilizing the search features, the dialog indicates whether such an item is within the trace even before beginning the search. Using the Find dialog, selection criteria can be chosen to create a new trace file for the desired information.

THE NEW BENCHMARK FOR EVERYDAY OSCILLOSCOPES

The WaveRunner 6000A Series is simply the best scope for everyday signal testing. It combines a rich feature set with outstanding signal fidelity to provide "lab instrument" capabilities at a highly attractive price point. Its acquisition technology produces measurements that are accurate and reliable. The intuitive interface is ideally designed for today's busy engineer. Right out of the box, it's a strong performer with the capability to add even more functionality.

WaveRunner "A" Series

- 350 MHz – 2 GHz
- 10 GS/s per channel
- 12 Mpts/Ch
- 10.4" SVGA TFT

An Outstanding Scope Experience

The WaveRunner 6000A oscilloscope is designed to be a custom fit for individual working styles. The interface is efficient because most common measurements and functions are available in only one or two touches. Signal detail is clear and sharp on the 800 x 600 pixel bright, high resolution SVGA screen. Each channel has its own volts per division (V/div) control knob, eliminating the need to multiplex a single V/div across all four channels.

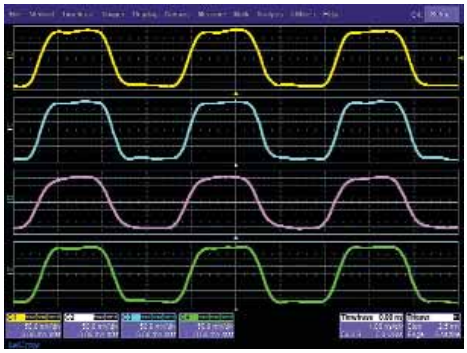
Excellent Signal Fidelity

The WaveRunner 6000A Series is powered by the same SiGe chipset that is used in LeCroy's WaveMaster oscilloscopes. This provides:

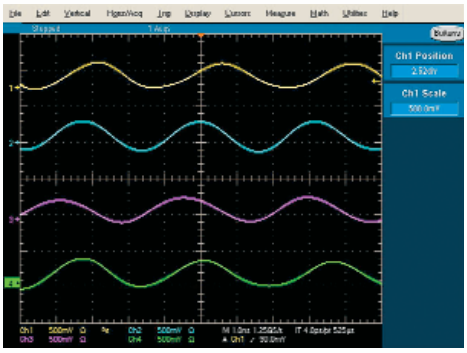
- Fast sample rate to capture high frequency transients and sharp edges
- Very low residual jitter (2 ps typical)
- An ultra-stable clock (±5 ppm)

This outstanding performance delivers timing resolution that rivals oscilloscopes costing twice as much.

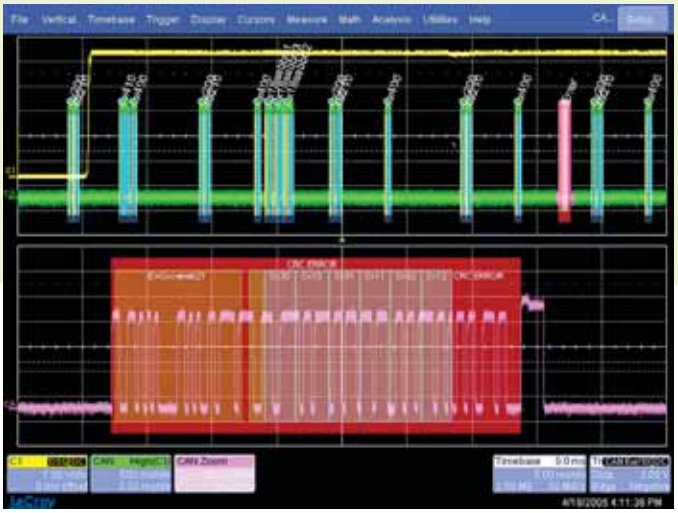
The WaveRunner 6000A is a true 4 channel instrument—allowing sampling at a full 5 GS/s on each channel. Other oscilloscopes can only use a single channel at 5 GS/s or 1/4 that rate when using all four channels. WaveRunner offers more than Nyquist sample rate on each channel.



With 5 GS/s on each channel, this 300 MHz square wave is displayed accurately.



Scopes limited to 1.25 GS/s display a less-than-informative sinusoidal signal.



CANbus TDM/TD

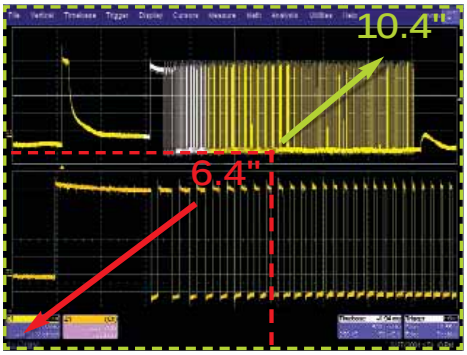
Here is an industry leading solution for testing and debugging CAN systems. Now Analog, CAN message data, and digital signals can all be viewed on a single instrument—an easy-to-use, everyday bench oscilloscope. Capture over 10,000 CAN messages in one acquisition. Trigger on CAN Data, Remote, or Error Frames, and much more.

RADICAL THINKING FOR THE BENCH

Extensive connectivity, a wide range of documentation tools, and an attractive price point make the WaveSurfer oscilloscope the perfect fit for today's environments. The big 10.4" high resolution WaveSurfer color screen is 250% larger than any other scope in its class; but, at only six inches deep, it tucks neatly into limited space. It provides the room to work and the screen size to see every signal nuance.

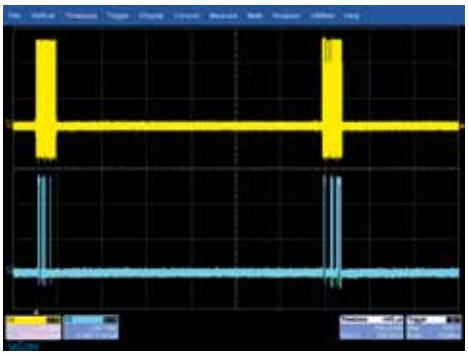
Super Large Bright 10.4" Screen

The waveform is bright and crisp on the new WaveSurfer SVGA color touch screen—it displays 250% larger and with much higher resolution than any scope in its class.



Long Capture Time

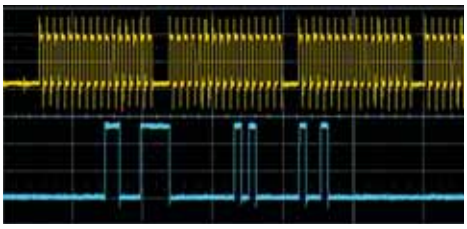
The WaveSurfer oscilloscope effectively eliminates the trade-off between high sample rates and long capture time by having deep memory. It delivers more than 100x the capture window at full sample rate compared to other oscilloscopes in its class.



1 ms long acquisition

Capturing Mixed Signals

Its long memory is especially important when capturing a mix of signals that are spaced widely apart in time, or when a long pre-trigger time must be captured. When debugging common circuit problems like clock/data issues or timing errors, WaveSurfer beats short memory scopes hands down.



Zoom for detail—sample rate remains high

Simple Zooming and Math

Zooming is easy with the WaveSurfer—users need to simply draw a box around the area to be zoomed via the touch screen (or use the front panel QuickZoom button). Built-in math and FFT capabilities are easily applied with an intuitive interface. In addition, a power spectrum FFT is standard. It can be quickly invoked and easily set up, even by someone not familiar with FFTs.

WaveSurfer Series

- 10.4" LCD touch screen
- Only 6" deep
- 200–500 MHz
- 2 GS/s up to 4 channels
- Extensive communication capabilities

A Price to Fit Any Budget

With prices starting at under $4,500, WaveSurfer scopes are available in six models: two- and four-channel units with bandwidths of 200 MHz, 350 MHz, and 500 MHz. Each scope includes a high quality 500 MHz probe per channel and a three-year warranty.

32 Channels for Mixed Signals

The LeCroy MS-32 is the first mixed signal testing solution that combines 4 analog channels with 32 digital channels. With standard oscilloscope tools like cursors and zooming combined with long memory, MS-32 is ideal for the testing of embedded controllers.

OPTIMUM CONNECTION AND SIGNAL CAPTURE

High performance probes are an essential tool for accurate signal capture. Consequently LeCroy offers an extensive range of probes to meet virtually every application need. The probes are optimized for use with LeCroy oscilloscopes and perform to the same high standards as all LeCroy products. The most recent LeCroy probe system sets new standards for wideband signal connection to test instruments.

HFP Series – Active Voltage Probes

This new series of probes has a versatile, small, and lightweight design with high bandwidth from 1 GHz to 2.5 GHz. The HFP Series includes five interchangeable styles of tips to make probing easy. In addition to a traditional straight probe tip, a sharp tip allows easier access to tightly-packed test points and circuit vias.

High Bandwidth Differential Probes

The new wideband WaveLink probe system offers unprecedented flexibility for probe interconnection. Its unique adjustable tips are ideal for restricted spaces. They are the first differential probes to employ SiGe technology, enabling extremely accurate signal measurement.

Differential Amplifiers and Probes

LeCroy differential amplifiers are intended to act as signal conditioning preamplifiers for oscilloscopes and network and spectrum analyzers, providing differential measurement capability to instruments having only a single-ended input.

The DA1855A is a 100 MHz differential amplifier with an industry leading offset range and fast overdrive recovery.

Active Probes

In order to access the ever increasing variety of devices and test points in circuit design, today's probing solutions need to be versatile, small, and lightweight while maintaining high bandwidth. LeCroy HFP probes offer five different tip styles and an innovative FreeHand probe holder making them an ideal test solution.

Passive Probes

The LeCroy Series of high impedance probes is available in 350 MHz and 500 MHz bandwidths. They include a probe-sense ring for automatic scale factor readout on LeCroy oscilloscopes. These passive probes offer an economical solution for low/medium frequency applications.

Additional Probe Options

The LeCroy probe range also includes alternative solutions to provide maximum flexibility for busy engineering departments. These additional options include:

- High frequency, ultra low capacitance probes
- High voltage passive probes
- Current probes

Visit www.lecroy.com for details

O to E Converters

LeCroy offers several wideband multimode optical-to-electrical converters designed for measuring high-speed optical communication signals. Up to 5 GHz frequency range makes these converters ideal for Gigabit Ethernet, Fibre Channel, and SONET/SDA signal measurements. A universal calibrated reference receiver feature is available for most X-Stream model oscilloscopes.

Accessories

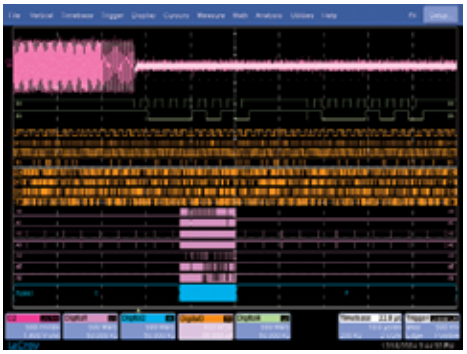
LeCroy offers a variety of oscilloscope carrying cases, rack mounts, and carts.

ADD-ON CAPABILITIES TO MEET SPECIFIC NEEDS

Much of the added value of a digital scope is in its ability to provide application specific solutions. LeCroy has worked very closely with users in a variety of industries to create software packages that offer best-in-class performance for specific applications. Many of these software packages are upgrades of choice in their specific industries.

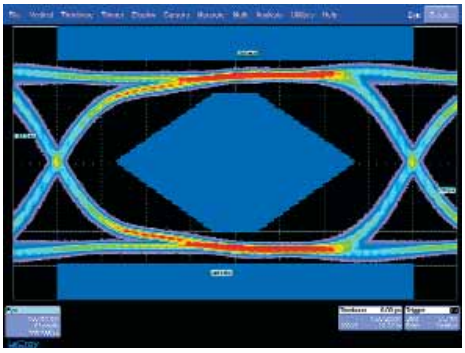
No matter what your needs, LeCroy software packages efficiently extend the scope's capabilities into your specific applications. Each package supplies measurements that use the whole oscilloscope memory. The result is better time accuracy at long time settings, better resolution in the frequency domain, and more measurements extracted from the waveform in the statistical domain.

LeCroy's architecture seamlessly adds the package's capabilities directly into the scope's simple graphic user interface. Measurements are explained on the screen or in the scope's help system so signal calculations are always clear and understandable. Even tracking the trend of a measurement over time is simple. Using these functions, troubleshooting gets easier as the signal makeup becomes clearer.

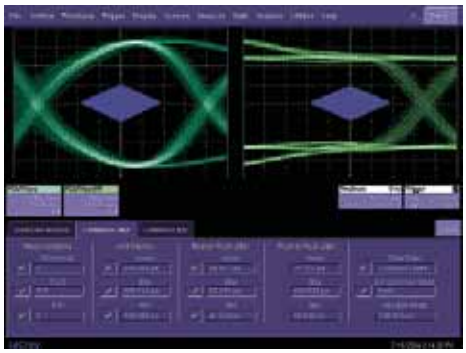


MS-32 extends the range of WaveSurfer and WaveRunner by enabling 4 analog channel and 32 digital channel (4+32) measurement capability.

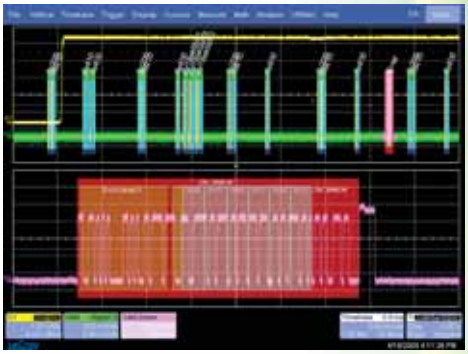
There is an expandable package for virtually every application. Need more capability? The LeCroy XDEV package enables the creation of custom oscilloscope measurements that run in your scope. No other oscilloscope company provides this type of customized measurement at such an integrated level.



SDA eye patterns are measured on a continuous record of up to 8M consecutive UI giving low jitter, high update rates, and the ability to capture single-bit anomalies.



The SDA-PCIE software option for the SDA implements PCI-SIG compliant eye pattern and jitter measurements.



With CANbus TDM/TD, the robust toolset makes all the difference in understanding CAN system performance.

PMA2 PowerMeasure Analysis software can be used with most LeCroy X-Stream oscilloscopes. Combine PMA2 with other accessories for a complete PowerMeasure System.

EXTENDING THE VALUE OF LECROY PRODUCTS

Building long-term relationships with our customers is a deeply-held commitment at LeCroy. This commitment applies to our product development, manufacturing, sales, and support processes. It is reflected in the unprecedented level of customization that we build into our products, enabling the companies who use our equipment to easily tailor solutions for their specific applications.

At LeCroy, we believe an important way that we can provide significant added value for our customers is by extending the usable life of their LeCroy equipment. We believe our service practices are the best in the industry:

- Service Centers located around the world to speed repair and calibration of all LeCroy products
- 3 year warranties on Windows-based real-time oscilloscopes
- 3 year warranties on protocol analyzers
- 1 year warranties on sampling oscilloscopes and associated plug-in modules
- 7 year long term product repair support after a product has been discontinued
- Product calibration support guaranteed for 7 years after the product is discontinued and best efforts after 7 years
- Goal of less than five days turnaround time in our Service Centers on most repairs

Obsolescence Protection

We believe we are unique in the T&M industry in offering a variety of plans to enable our customers to not only get the best equipment for the job at hand, but to finance it in a way that best matches their requirements. We call this program "Open Access," and it contains a family of plans to choose from. The plans are designed to ensure that engineers have the best instrumentation without expensive capital equipment purchases each and every time. They include a rental plan, a lease plan, and a subscription service. Contact LeCroy Customer Support for details.

After-sale Option Add-ons and Upgrades

LeCroy has made it a standard policy that customers may add after-sale options at any time without stiff pricing penalties. This practice has enabled our customers to grow their instrument capabilities as required.

Software Enhancements

LeCroy customers may upgrade to the latest software revisions without charge. Downloads of the latest instrument software can be found under the "Service and Support" menu, Software Download menu selection.

Retrofit of New Features

When technically feasible, we make product extensions and new features available for existing equipment. These may include capabilities associated with an "A" version of a product as well as features enabled by software/firmware upgrades.

Sales and Technical Support

Our highly trained and knowledgeable sales and technical professionals are always available to help LeCroy customers solve their test and measurement challenges. Their application, product, and technology understanding is second-to-none. Sales and service staff work hand-in-hand to ensure that LeCroy customers get the maximum value from their equipment investment.

LeCroy is committed to setting the standard for expert test and measurement solutions backed by dedicated customer service for the life of your product.

SDA 11000

A TOTAL SOLUTION FOR NEXT GENERATION SERIAL DATA ANALYSIS

With serial data quickly becoming a dominant form of data transmission, fast and accurate analysis is a priority. The LeCroy SDA integrates all the key measurement and analysis tools into one device.

SDA 11000

Features:

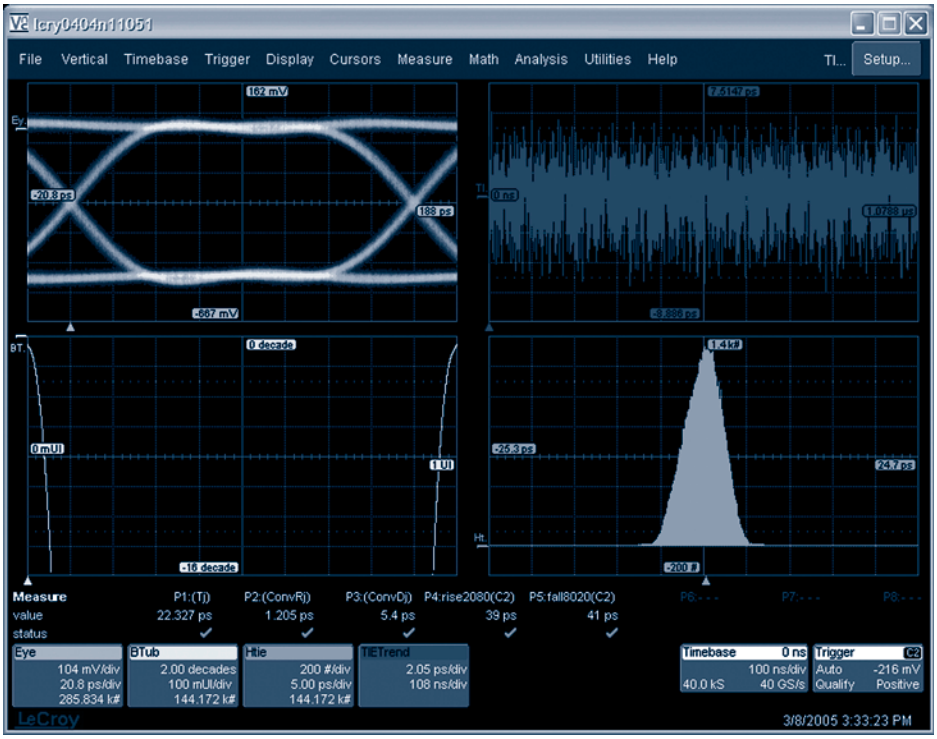
- 11 GHz bandwidth with tightly controlled frequency response
- 28 ps rise time (20 to 80%, typical)
- 11 GHz on 2 channels 6 GHz on 4 channels
- One touch to Serial Data Analysis
- Sampling rates up to 40 GS/s with deepest memory
  - 16M on 2 Ch/8M on 4 Ch: Standard
  - 32M on 2 Ch/16M on 4 Ch: Option L
  - 100M on 2 Ch/50M on 4 Ch: Option XL
- Wavepilot – provides easy access to powerful signal analysis capabilities.
- Front panel USB
- Serial data measurements up to 6.25 Gb/s
- Testing support of next generation serial data standards:
  - 5 Gb/s PCI Express™ Gen2
  - 4.25 Gb/s Fibre Channel
  - 6 Gb/s SATA III / SATA II
  - 4.8 Gb/s FB-DIMM
  - 6.25 Gb/s double XAUI
- Ability to capture up to 12 million UI in a single acquisition

Advanced Analysis Tools

Many different instruments such as sampling oscilloscopes, time interval analyzers (TIA's), and bit error rate test sets are used to evaluate the jitter in serial data streams. The SDA 11000 is the first oscilloscope to implement all of these methods. With a single instrument, the slight differences among methods can be viewed and understood. The SDA 11000 provides specific jitter measurements to meet all serial data standards.

- **Jitter Wizard** – This feature automatically selects all of the critical instrument settings, ensuring the highest accuracy and repeatability. Sampling rate, level, bit rate, and pattern length are automatically detected.
- **Edge-to-Edge Jitter** – In this mode, timing is measured on data transitions relative to one another in the same way as a timing interval analyzer (TIA). Measurements can be displayed directly or compensated to correlate with phase jitter measurements. Tj, Rj, and Dj measurements can be made at specific UI spacings or for all spacings in the data stream.
- **Filtered Jitter** – A filtered jitter mode supports ITU-T and SONET measurements. Band-pass filter with selectable upper and lower cutoff frequencies supplied.
- **N-cycle vs. N Jitter Plot** – This display shows the rms jitter as a function of the UI spacing. It provides a very sensitive way of viewing periodic jitter effects. The minimum value of this plot gives the rms value of the random jitter.
- **Jitter Analysis: Rj, Dj, T** – The SDA measures total jitter by extrapolating the histogram of jitter measurements. It includes the following three methods for determining the random and deterministic components to support all existing standards:
  - *Conventional* – Deterministic jitter is measured directly and Rj is the difference between the total and deterministic parts.
  - *Effective* – BERT-scan method using the bathtub curve to fit a "dual dirac" jitter model.
  - *MJSQ* – Fibre Channel method using two Gaussian curves to fit the extremes of the measured distribution.

SDA 11000



A four-quadrant 360° analysis of your Serial Data Signal.

A Sharp Focus For Eye Patterns

Eye pattern analysis is a widely used tool for assessing the signal integrity of serial data streams. The SDA measures eye patterns on a continuous record of up to 12M consecutive unit intervals (UI). A software-defined clock recovery algorithm is used to separate the record into segments that are one UI in length. The segments are then overlaid to form the eye pattern. Subsequent acquisitions are accumulated with the previous ones.

- Consecutive UI ensures the capture of transient events on any single bit.
- Eye pattern measurement compliant for PCI Express, Serial ATA, USB 2.0, and Serial Attached SCSI.
- Trigger jitter is eliminated, giving a measurement jitter that is 7x lower than traditional methods of measuring eye patterns.
- Fully programmable clock recovery algorithm, including first- and second-order PLL models, provides compliance to all existing standards and allows the modeling of specific receiver types.
- Clock recovery modes for PCI Express, DVI/HDMI, and “GOLDEN” PLL.
- Fast update rate for both electrical and optical signals with reference receiver.

The Cleanest Eye Patterns Possible

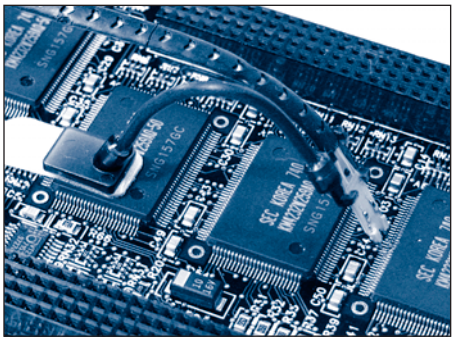
Eye violation location displays individual bits that violate the eye mask boundaries. The SDA measures eye patterns on consecutive unit intervals of the data stream under test. The original waveform is indexed by the software so that the parts of the overall waveform that violate the mask boundaries, when formed into an eye pattern, can be identified by the particular bit that caused them. The signal waveform around the failed bit is displayed, and relationships between the failure and adjacent bits can be easily seen. A second channel from the instrument can also be displayed and time aligned with the signal under test to locate relationships between failures and other signals in the system under test.

SDA 11000

- Measures total errors, 1's errors, 0's errors, and error rate.
- Up to 1e-7 BER on a single capture.
- Error map shows locations of bit errors accumulated over multiple signal acquisitions to measure lower bit error rates.
- Reference patterns can be PRBS5 to PRBS23, and arbitrary patterns can be entered into the instrument or stored in a file.

D11000PS DIFFERENTIAL PROBE SYSTEM

The D11000PS is a high-performance differential probe system that complements the SDA 11000. It is the only high-performance probe that maintains full "oscilloscope only" bandwidth at the probe tips. The probe features extremely low circuit loading, fast rise time, and low noise. The probe system includes tip configurations supporting both direct solder in and SMA cable connections.



D11000PS Differential Probe System

SDA 11000 SOFTWARE OPTIONS

Standards Compliance

The SDA 11000 offers a growing list of compliance packages to support everything from USB 2.0 to PCI Express. These optional packages enhance the basic analysis and debug capabilities of the SDA by adding specific compliance measurements and displays. Simple single-button operation can be invoked to perform an entire set of measurements and to display all results, including a pass/ fail indicator. LeCroy continues to add new measurements to the SDA to support current and emerging serial data standards.

The Solution for PCI Express Gen2 Testing and Development

The PCI Express Compliance and Development Software helps you achieve faster time to market and meet the high demands of PCI Express Gen2. With high transfer speeds and timebase accuracy for jitter measurements scheduled to increase with Gen2, the SDA 11000 Serial Data Analyzer and PCI Express Compliance and Development software is the ideal solution to meet your needs. This powerful solution, which will be upgraded as the specification evolves, features the ability to measure up to 6.25 Gb/s and 11 GHz bandwidth, and sample 40 GS/s and up to 100 million acquisition points.

SDA-SATA Validation and Debugging Tools

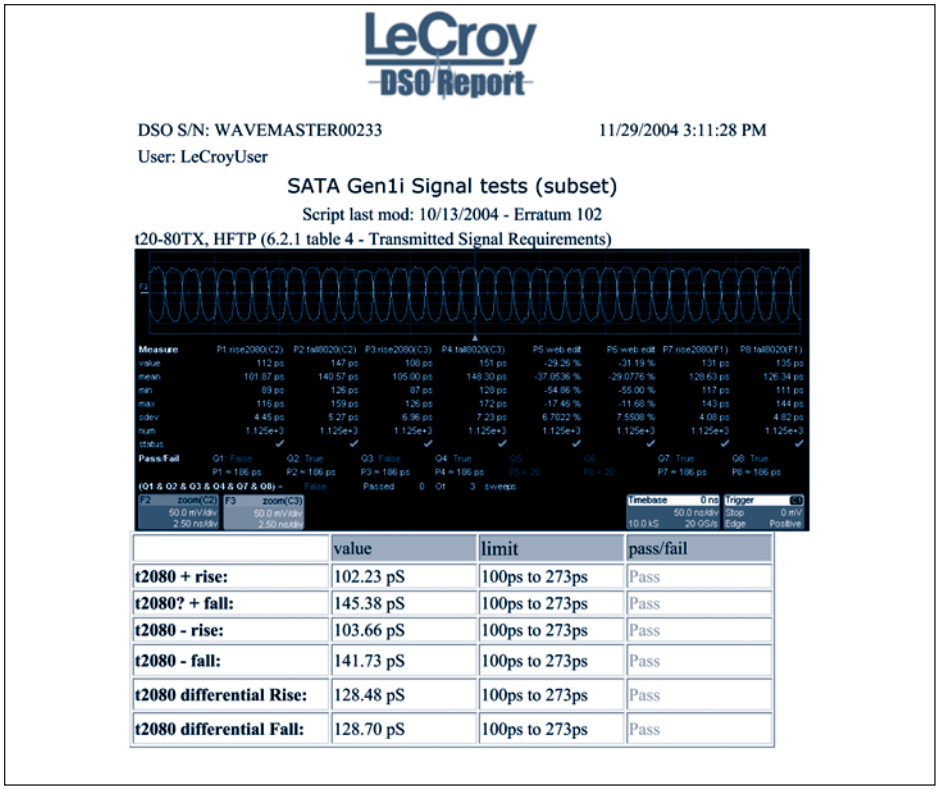
The SDA-SATA software package for the SDA 11000 provides an extensive set of validation/verification and debug tools written in accordance with SATA Gen1 (1.5 Gb/s) and SATA Gen2 (3 Gb/s) electrical specifications. Covered SATA test modes include Internal (1i/2i mode), Short Backplane and External Desktop Applications (1x/2x mode), and Extended, System-to-System Applications.

In addition to standard eye pattern tests for Gen1, the SDA-SATA solution provides a complete set of amplitude and jitter measurements as defined in the Serial ATA Gen2 specification. These robust capabilities make SDA-SATA the only commercially available automated test suite that meets the requirements for both Gen1 and Gen2 Serial ATA transmitter compliance testing.

Features:

- Extensive support for Gen1 and Gen2 SATA specifications
- Automated test report generation
- Flexible, powerful suite of test tools for PHY layer
- Amplitude, timing, and jitter measurements
- Integrated/open user interface
- Clock recovery option supports all SATA Gen2 jitter requirements.
- Data-to-data jitter measurement mode for SATA Gen1
- Instrument support for Sigtest

SDA 11000



LeCroy DSO Report

DSO S/N: WAVEMASTER00233 11/29/2004 3:11:28 PM
User: LeCroyUser

SATA Gen1i Signal tests (subset)
Script last mod: 10/13/2004 - Erratum 102
t20-80TX, HFTP (6.2.1 table 4 - Transmitted Signal Requirements)

	value	limit	pass/fail
t2080 + rise:	102.23 pS	100ps to 273ps	Pass
t2080? + fall:	145.38 pS	100ps to 273ps	Pass
t2080 - rise:	103.66 pS	100ps to 273ps	Pass
t2080 - fall:	141.73 pS	100ps to 273ps	Pass
t2080 differential Rise:	128.48 pS	100ps to 273ps	Pass
t2080 differential Fall:	128.70 pS	100ps to 273ps	Pass

SDA-SATA includes Advanced Report Generation.

STANDARD TOOLS

Advanced Serial Data Analysis Tools

Eye Diagram

- bit rate
- pattern detect
- Tx density
- mask test with violation locator
- eye amplitude
- eye timing
- eye crossing
- extinction ratio
- average power

Clock Recovery

- standard PLL settings (FC GOLDEN, PCI Express, DVI, Custom)
- custom filter settings
- number of poles
- natural frequency
- damping factor

Jitter Analysis

- jitter wizard
- edge to reference (data to clock)
- edge to edge (data to data)
- conventional
- effective
- MJSQ
- basic (Tj, Rj, Dj)
- Dj breakdown (DDj, Pj, DCD)
- advanced (peak-peak and rms)
- TIE jitter
- ISI plot with bit sequence tracking
- synchronous N-cycle with bit pattern display
- bathtub curve
- jitter histogram
- filtered jitter
- periodic jitter (Pj) with peak frequency listing
- TIE clock jitter
- period jitter
- half-period jitter
- cycle-cycle jitter

SDA 11000

ADVANCED SERIAL DATA ANALYSIS TOOLS (CONTINUED)

Math Tools

Display up to four math function traces (F1 – F4). The easy-to-use graphical interface simplifies setup of up to two operations on each function trace, and function traces can be chained together to perform math-on-math

absolute value
Auto-correlation function
average (summed)
average (continuous)
cubic interpolation function
derivative
deskew (resample)
difference (–)
enhanced resolution (to 11 bits vertical)
envelope
exp (base e)
exp (base 10)
fft (power spectrum, magnitude, phase, up to 25 Mpts)
floor
histogram of 2 billion events
integral
invert (negate)
log (base e)
log (base 10)
parameter math (+,-,*,/ of two different parameters)
product (x)
ratio (/)
reciprocal
rescale (with units)
roof
(sinx)/x
sparse function
square
square root
sum (+)
track graphs
trend (datalog) of 1 million events
zoom (identity)

Measure Tools

Displays any 8 parameters together with statistics, including their average, high, low, and standard deviations. Histicons provide a fast, dynamic view of parameters and wave shape characteristics

amplitude
area
base
cycles
delay
Δ delay
duty cycle
duration
falltime (90–10%, 80–20% @level)
frequency
first
histogram parameters
last
level@ x
maximum
mean
median
minimum
narrowband power measurements
number of points
+overshoot
-overshoot
peak-to-peak
period
phase
risetime (10–90%, 20–80% @level)
rms
std. deviation
top
width
time@minimum (min.)
time@maximum (max.)
Δ time@level
Δ time@level from trigger
x@min
x@max

ADDITIONAL SOFTWARE OPTIONS (SEE SECTION J)

SDA 11000

SPECIFICATIONS

VERTICAL SYSTEM

Analog Bandwidth @ 50 Ω (-3 dB)	11 GHz on 2 Ch, 6 GHz on 4 Ch
Rise Time, 10-90% (typical)	< 40 ps in 11 GHz mode
Input Channels	4
Bandwidth Limiter	25 MHz; 250 MHz; 500 MHz–4 GHz Adjustable (6 GHz mode)
Input Impedance	50 Ω ±2.0%
Input Coupling	DC, GND
Maximum Input Voltage	±4 Vpeak
Vertical Resolution	8 bits; up to 11 bits with enhanced resolution (ERES)
Sensitivity	2 mV–1 V/div (fully adjustable in 6 GHz mode, < 10 mV/div through zoom)
DC Gain Accuracy	±1.5% of full scale
Offset Range	2 mV–194 mV/div: ±750 mV; 196 mV–1 V/div: ±4 V
Offset Accuracy	±(1.5% of full scale +1.5% of offset value +2 mV)

HORIZONTAL SYSTEM

Time per Division Range	6 GHz mode 20 ps/div – 10 s/div	11 GHz mode 10 ps/div – 50 µs/div (Std. memory) 10 ps/div – 100 µs/div (-L memory) 10 ps/div – 500 µs/div (-XL memory)
Math and Zoom Traces	8 independent zoom and 8 math/zoom traces	
Sample Rate and Delay Time Accuracy	±1 ppm over less than 10 interval (typical)	
Jitter Noise Floor	< 350 fs rms measured with 35 ps rise time (typical)	
Trigger and Interpolator Jitter	< 2 ps rms (typical)	
Channel-Channel Deskew Range	±9 x time/div. setting, or 25 ns, whichever is larger	

ACQUISITION SYSTEM

Single-Shot Sample Rate/Ch	40 GS/s on 2 Ch; 20 GS/s on 4 Ch
Max. Random Interleaved Sampling (RIS)	200 GS/s (RIS only in 6 GHz mode)
Maximum Trigger Rate	166,667 waveforms/second
Intersegment Time	≤ 6 µs

Memory Options	Length (Mpts)		Max. Aquistion Segments; Sequence Mode	
	4 Ch Mode	3 or 2 Ch Mode	4 Ch Mode	3 or 2 Ch Mode
Standard	8	16	5000	7500
SD11-XL	50	100	20,000	7500
SD11-L	16	32	10,000	7500

ACQUISITION PROCESSING

Averaging	Summed Averaging to 1 million sweeps; Continuous Averaging to 1 million sweeps
Enhanced Resolution (ERES)	Up to 3 additional bits with enhanced vertical resolution
Envelope (Extrema)	Envelope, floor, or roof for up to 1 million sweeps

SDA 11000

TRIGGERING SYSTEM

Modes	Normal/Auto/Single/Stop
Sources	Any input channel, External Ext X10, Ext ÷10, or line; slope and level unique to each source (except line trigger and C1/C4 in 11 GHz mode)
Coupling Mode	DC
Pre-trigger Delay	0–100% of memory size (adjustable in 1% increments)
Post-trigger Delay	The smaller of 0–10,000 divisions or 86400 seconds
Hold-off by Time or Events	From 2 ns up to 20 s or from 1 to 99,999,999 events
Internal Trigger Range	±5 div from center
External Trigger Input Range	Aux (±0.4 V); Aux X10 (±0.04 V); Aux/10 (±4 V)
Trigger Sensitivity (Edge)	3 Divisions @ 5 GHz; 2 Divisions @ 4 GHz; 1.2 Divisions @ 3 GHz (typical)

BASIC TRIGGERS

Edge/Slope/Line	Triggers when signal meets slope and level condition.

SMART TRIGGERS®

State or Edge Qualified	Triggers on any input source only if a defined state or edge occurred on another input source. Delay between sources is selectable by time or events.
Dropout	Triggers if signal drops out for longer than selected time between 2 ns and 20 s.
Pattern	Logic combination (AND, NAND, OR, NOR) of 5 inputs – 4 channels (2 channels in 11 GHz mode) and external trigger input. Each source can be high, low, or don't care. The High and Low level can be selected independently. Triggers at start or end of the pattern.

SMART TRIGGERS WITH EXCLUSION TECHNOLOGY

Glitch	Triggers on positive or negative glitches with widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Width	Triggers on positive or negative pulse widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Interval	Triggers on intervals selectable between 2 ns and 20 s.

SETUP STORAGE

Front Panel and Instrument Status	Store to the internal hard drive/floppy drive or to a USB-connected peripheral device.

CPU

Processor	Intel Pentium 4@2.53 GHz or better
Processing Memory	Up to 2 Gbytes
Realtime Clock	Dates, hours, minutes, seconds displayed with waveform. SNTP support to synchronize to precision internet clocks.

INTERFACE

Remote Control	Via Windows Automation or via LeCroy Remote Command Set
GPIB Port (Optional)	Supports IEEE-488.2
Ethernet Port	10/100Base-T Ethernet interface
Floppy Drive	Internal, DOS-format, 3.5" high-density
USB Ports	4 USB 2.0 ports support Windows-compatible devices
External Monitor Port Standard	15-pin D-Type SVGA compatible
Parallel Port	1 standard

SDA 11000

ENVIRONMENTAL

Temperature (Operating)	+5 °C to +40 °C including floppy disk and CD-ROM drives
Temperature (Non-Operating)	-20 °C to +60 °C
Humidity (Operating)	5% to 80% relative humidity (non-condensing) up to +30 °C. Upper limit derates to 25% relative humidity (non-condensing) at +40 °C.
Humidity (Non-Operating)	5% to 95% relative humidity (non-condensing) as tested per MIL-PRF-28800F
Altitude (Operating)	Up to 10,000 ft. (3048 m) at or below +25 °C
Altitude (Non-Operating)	Up to 40,000 ft. (12,192 m)
Random Vibration (Operating)	0.31 grms 5 Hz to 500 Hz for 15 minutes in each of three orthogonal axes
Random Vibration (Non-Operating)	2.4 grms 5 Hz to 500 Hz for 15 minutes in each of three orthogonal axes
Functional Shock	20 g peak half sine 11 ms pulse; 3 shocks (positive and negative) in each of three orthogonal axes; 18 shocks total

POWER REQUIREMENTS

100–240 VAC at 50/60/400 Hz; 200–240 VAC at 50/60 Hz;
Automatic AC Voltage Selection Max. Power Consumption: < 800 VA (800 W)

PHYSICAL DIMENSIONS

Dimensions (HWD)	310 mm x 447 mm x 500 mm; 12.2" x 17.6" x 19.7" (height excludes feet)
Weight	27 kg; 59 lbs.
Shipping Weight	36 kg; 80 lbs.

CERTIFICATIONS

CE Compliant; UL and cUL listed;
Conforms to EN 61326 (for EMC); EN 61010, UL 61010B-1 and
CSA C22.2 No. 1010.1 (for safety)

WARRANTY AND SERVICE

3-year warranty; calibration recommended annually. Optional service programs include extended warranty, upgrades, and calibration services.

SDA 11000

ORDERING INFORMATION	PRODUCT CODE
4 Ch 11/6 GHz Serial Data Analyzer; 11 GHz, 40 GS/s 16 Mpts in 2 Ch mode; 6 GHz 20 GS/s 8 Mpts in 4 Ch mode	SDA 11000

INCLUDED WITH STANDARD CONFIGURATION

ProLink Adapter SMA; 4 each
ProLink Adapter BNC; 2 each
Printed Getting Started Manual, Operator's Manual
CD-ROMs containing Operator's Manual, Remote Control Manual, Automation Manual, and Software Options Manual
CD-ROMs containing Utility Software and Norton Antivirus Software (1 year subscription)
Floppy Disk Drive
CD-ROM Drive
Optical 3-button Wheel Mouse-USB
Standard Ports; 10/100Base-T Ethernet, Parallel, SVGA Video Output, USB
Power Cable (for the country ordered from)
Protective Front Cover
Standard Commercial Calibration and Performance Certificate
3-Year Warranty

MEMORY OPTIONS

32 Mpts/2 Ch, 16 Mpts/4 Ch	SDA11-L
100 Mpts/2 Ch, 50 Mpts/4 Ch	SDA11-XL

STANDARDS COMPLIANCE SOFTWARE OPTIONS

PCI Express Development and Compliance Software for Gen1 and Gen2	SDA-PCIE-G2
SATA Gen1/Gen2 Solution Analysis Software Package	SDA-SATA
Ethernet Test Software Package	ENET
USB 2.0 Compliance Test Software Package	USB2

SOFTWARE OPTIONS

Advanced Optical Recording Measurement Software Package	AORM
Disk Drive Measurements Software Package	DDM2
Digital Filter Software Package	DFP2
Advanced Customization Software Package	XDEV
Processing Web Editor Software Package for Functions and Parameters	XWEB

HARDWARE OPTIONS AND ACCESSORIES

1 MΩ Adapter includes PP005A Passive Probe	AP-1M
Dual Monitor Display	DMD-1
Keyboard, USB	KYBD-1
ProLink-to-BNC Adapter; 1 each	LPA-BNC
Kit of 4 ProLink BNC Adapters with Case	LPA-BNC-KIT
ProLink-to-SMA Adapter	LPA-SMA
Kit of 4 SMA ProLink Adapters with Case	LPA-SMA-KIT
Oscilloscope Cart with Additional Shelf and Drawer	OC1024
Oscilloscope Cart	OC1021
Removable Hard Drive Package	WM-RHD
Additional Removable Hard Drive (includes USB, CD-ROM, and spare hard drive)	WM-RHD-02
SDA 11000 Hard Shell Transit Case	SDA11-TC1

SDA 11000

ORDERING INFORMATION	PRODUCT CODE
PROBE AND PROBE ACCESSORIES	
Differential Probe System	D11000PS
WaveLink 7.5 GHz Differential Probe with Adjustable Tip Module	D600A-AT*
WaveLink 7 GHz Differential Probe with Small Tip Module	D600ST*
WaveLink 4 GHz, 5 V Differential Probe with Small Tip Module	D350ST*
WaveLink ProLink Probe Body	WL600
1 GHz Active Differential Probe (÷1, ÷10, ÷20)	AP034
7.5 GHz Low Capacitance Passive Probe 500/1000 Ω	PP066
2.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP2500
Probe Deskew and Calibration Test Fixture	TF-DSQ
Ethernet Compliance Test Fixture for 10Base-T	TF-10BT
Telecom Adapter Kit 100 Ω Bal., 120 Ω Bal., 75 Ω Unbal.	TF-ET
Ethernet Compliance Test Fixture for 100Base-T/1000Base-T [Includes a Set of 2 Test Fixtures Signals on Twisted Pair Cables (UTP)]	TF-ENET
Serial ATA Test Fixture (Includes Pair of SMA Cables)	TF-SATA
USB 2.0 Testing Compliance Test Fixture	TF-USB

* For a complete probe, order a WL600 Probe Body with the Probe Tip Module.

SDA SERIES

Serial data has grown to become a dominant form of data transmission. Fast and accurate analysis is critical to ensuring the highest possible signal transmission capabilities. The LeCroy SDA is a powerful measurement tool that integrates all key tests into one device.

SDA 6020
SDA 6000A
SDA 5000A
SDA 3000A

Features:

- Four-quadrant 360° analysis
- Eye pattern measurement with violation locator
- Accurate and repeatable jitter analysis
- Precision numerical clock recovery with adjustable PLL response
- Bit error analysis
- 1 ps jitter noise floor
- Compliance testing of physical layer signal characteristics in support of a broad range of standards:
  - InfiniBand™
  - PCI Express™
  - Fibre Channel (133 Mb/s to 4.25 Gb/s)
  - USB 2.0 (HS signal quality)
  - 1 EEE 1394b (jitter and eye pattern)
  - SONET/SDH (up to OC48/STM16)
  - Gigabit Ethernet 1000Base-SX, 1000Base-LX
  - RapidIO (Parallel/Serial)
  - Serial Attached SCSI
  - 10Base-LX4 (XAUI)

The LeCroy SDA also offers 'future-proof' customization capabilities. Specialized parameters and functions can be implemented using MATLAB, Mathcad, Excel, Visual Basic or any other programming language. These functions can then be embedded into the instrument, creating custom measurements that can be accessed in the same manner as any of the standard instrument.

Standard Math Tools

Display up to four math function traces (F1 – F4). The easy-to-use graphical interface simplifies setup of up to two operations on each function trace, and function traces can be chained together to perform math-on-math.

absolute value
Auto-correlation function
average (summed)
average (continuous)
cubic interpolation function
derivative
deskew (resample)
difference (–)
enhanced resolution (to 11 bits vertical)
envelope
exp (base e)
exp (base 10)
fft (power spectrum, magnitude, phase, up to 25 Mpts)
floor
histogram of 2 billion events
integral
invert (negate)
log (base e)
log (base 10)
parameter math (+,-,*,/ of two different parameters)
product (x)
ratio (/)
reciprocal
rescale (with units)
roof
(sinx)/x
sparse function
square
square root
sum (+)
track graphs
trend (datalog) of 1 million events
zoom (identity)

SDA SERIES

Standard Measure Tools

Displays any 8 parameters together with statistics, including their average high, low, and standard deviations. Histicons provide a fast, dynamic view of parameters and wave shape characteristics.

amplitude
area
base
cycles
delay
Δ delay
duty cycle
duration
falltime (90–10%, 80–20% @level)
frequency
first
histogram parameters
last
level@ x
maximum
mean
median
minimum
narrowband power measurements
number of points
+overshoot
-overshoot
peak-to-peak
period
phase
risetime (10–90%, 20–80% @level)
rms
std. deviation
top
width
time@minimum (min.)
time@maximum (max.)
Δ time@level
Δ time@level from trigger
x@min
x@max

SDA SOFTWARE OPTIONS

ASDA-J Advanced Serial Data and Jitter Software

Many different instruments such as sampling oscilloscopes, time interval analyzers (TIA's) and bit error rate test sets are used to evaluate the jitter in serial data streams. The LeCroy ASDA-J option, is the first software to implement all of these standard methods. With a single instrument, the slight differences among methods can be viewed and understood. ASDA-J provides specific jitter measurements to meet all serial data standards.

Features:

- **Jitter Wizard** automatically selects all of the critical instrument settings, ensuring the highest accuracy and repeatability.
- **Edge-to-Edge Jitter** measures timing on data transitions relative to one another in the same way as a timing interval analyzer (TIA).
- **Filtered Jitter** supports ITU-T and SONET measurements.
- **N-cycle vs. N Jitter Plot** shows the rms jitter as a function of the UI spacing and provides a very sensitive way of viewing periodic jitter effects.
- **Jitter Analysis: Rj, Dj, Tj**
  The SDA measures total jitter by extrapolating the histogram of jitter measurements. The ASDA-J option includes the following three methods for determining the random and deterministic components to support all existing standards:
  - *Conventional.* Deterministic jitter is measured directly and Rj is the difference between the total and deterministic parts.
  - *Effective.* BERT-scan method using the bathtub curve to fit a "dual dirac" jitter model.
  - *MJSQ.* Fibre Channel method using two Gaussian curves to fit the extremes of the measured distribution.
- **ISI Plot** displays data dependent jitter contributions to the eye pattern for the second-to-last bit of a bit length, set from 3 to 10, without the need for a repeating bit pattern.

SDA SERIES

The original bit sequence is stored along with the eye pattern, allowing the user to locate the exact bit or bits that caused a mask failure. This type of analysis pinpoints the source of mask failures, speeding up the debugging process. The display can be set to show any number of bits around a specific violation up to the total acquisition so specific bit patterns can be recognized. A table of violations and bit locations is also available.

A Sharp Focus for Eye Patterns

Eye violation location displays individual bits that violate the eye mask boundaries. The SDA measures eye patterns on consecutive unit intervals of the data stream under test. The original waveform is indexed by the software so that the parts of the overall waveform that violate the mask boundaries, when formed into an eye pattern, can be identified by the particular bit that caused them. The signal waveform around the failed bit is displayed, and relationships between the failure and adjacent bits can be easily seen. A second channel from the instrument can also be displayed, and time-aligned with the signal under test, to locate relationships between failures and other signals in the system under test.

Bit Error Rate Analysis

While bit error rate performance can be predicted through signal quality tests on the transmitter, jitter tolerance testing of receivers can only be evaluated through bit error rate analysis. The SDA converts the captured record of consecutive bits to generate a bit stream, using its software clock recovery and a threshold detector. The bit stream is compared to the expected pattern to determine the number of bit errors and the error ratio. Bit error locations can be displayed in a 3-dimensional map that shows the error locations relative to their position within a frame or pattern. This type of display shows the root causes of bit errors by clearly indicating pattern or frame related issues.

- Measures total errors, 1's errors, 0's errors, and error rate.
- Up to 1e-7 BER on a single capture.
- Error map shows locations of bit errors accumulated over multiple signal acquisitions to measure lower bit error rates.
- Reference patterns can be PRBS5 to PRBS23, and arbitrary patterns can be entered into the instrument or stored in a file.

SDA SERIES

SDA-PCIE-G2 – PCI Express Compliance and Development Software Package

The Solution for PCI Express Gen2 Testing and Development The LeCroy PCI Express Compliance and Development Software helps you achieve faster time to market and meet the high demands of PCI Express Gen2. With hightransfer speeds and timebase accuracy for jitter measurements scheduled to increase with Gen2, the SDA 11000 Serial Data Analyzer and PCI Express Compliance and Development software is the ideal solution to meet your needs. This powerful solution, which will be upgraded as the specification evolves, features the ability to measure up to 6.25 Gb/s and 11 GHz bandwidth, and sample 40 GS/s and up to 100 million acquisition points.

The Solution for PCI Express Gen1

LeCroy offers a complete solution to meet the demands of Gen1 with the SDA 6020 and PCIe Compliance and Development software. The SDA 6020 provides the needed bandwidth to ensure highly accurate measurements of Gen1 devices, and has 6 GHz bandwidth measurements, with a sample rate of 20 GS/s.

Complete Checklist for Ultimate Design Verification

The PCI Express software provides you with a complete checklist that leads you step-by-step through functional development tasks, and allows you to run compliance tests, including:

- General measurements, including bit rate, and spread spectrum clocking (SSC) modulation index
- System tests, including system card eye parameters, received detection, and electrical idle transition
- Receiver tests, like Rx AC Voltage, Eye and Jitter, and electrical idle detection
- Add-in card tests, such as transmitted eye, and power consumption limits
- Transmitter tests, including unit interval and transmitted eye parameters

Integrated System for Electrical Design Testing

LeCroy offers exclusive coverage of test assertions in accordance with the PCIe Electrical Design Consideration requirements for Gen1, by using the LeCroy PE*Tracer™* protocol analyzer and PE*Trainer™* traffic generator. The system works together to capture, display, generate and respond to all types of PCIe Gen1 transactions. The host emulation platform provides you with an easy means to control the device under test (DUT).

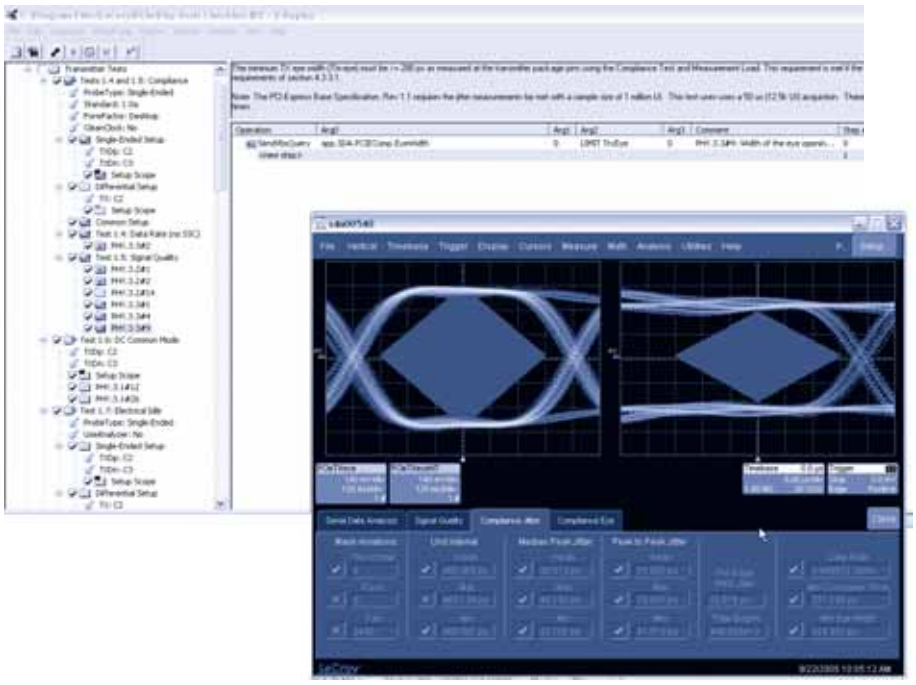
PLL Design Under Your Control

The PCI Express software includes flexible clock recovery options, which allows for simulation of virtually any real receiver Phase-Locked Loops (PLL) configuration. This provides you with the ability to simulate “what if” scenarios. Additionally, Reference Clock and Transmitter Jitter can be measured.

SSC Tracking Made Simple

In the advanced PCIe specifications, the use and deconvolution of the SSC frequency component in transmitted signals is a requirement for measuring Reference Clock (Refclk) jitter. Measurements such as transmitter data, modulation rates, and SSC data tracking must also be verified. Additionally, for the Gen2 spec, there is a 3 pole (repeated pole) Transfer Function for clock recovery with SSC (4.3.3.2) and jitter testing. With its deep memory and powerful analysis library, the LeCroy PCIe solution greatly simplifies this verification process.

SDA SERIES



X-Replay test results clearly indicate the test assertions that pass and fail. In this example, the transition eye amplitude is not enough at the transmitter pins.

Quick Assessments with Comprehensive Reports

The PCI Express software package leaps far beyond existing software tools with X-Replay™, a unique application framework where every saved experimental result (including raw waveform data, clock recovery settings, and eye diagram parameters) resides in a ODBC-compliant database. A report generation engine interfaces with the underlying Microsoft® Access-compatible database to facilitate custom text and graphics based reports.

SDA-PCIE-G2 SPECIFICATIONS

General Measurements
Test 1.1 - Bit Rate PHY.3.1#1
Test 1.2 - SSC Modulation Index PHY.3.1#2, PHY.3.1#3
Test 1.3 - SSC Tracking PHY.3.1#4
Transmitter Tests
Test 1.4 - Non-SSC Transmitter Data Rate PHY.3.3#2
Test 1.5 - Signal Quality PHY.3.2#1, PHY.3.2#2, PHY.3.2#14, PHY.3.3#1, PHY.3.3#4, PHY.3.3#9
Test 1.6 - DC CM Voltage PHY.3.1#12, PHY.3.1#26
Test 1.7 - Electrical Idle PHY.3.1#23, PHY.3.1#24, PHY.3.1#27
Test 1.8 - RX Detect Voltage PHY.3.1#14
Test 1.9 - RX Detect Hi-Z PHY.3.1#17
Text 1.10 - RX Detect Low-Z PHY 3.1#18
Test 1.11 - Lane Skew PHY.3.3#8
Test 1.12 - Rise/Fall PHY 3.3#3
Test 1.15 - Idle Voltage PHY.3.3#6
Test 1.16 - Idle Transition PHY 3.1#19
Test 1.17 - Vdd stability PHY.3.1#30, PHY.3.1#31, PHY.3.1#32, PHY.3.1#33
Test 1.19 - Electrical Idle Exit Detection PHY 3.3#7

SDA SERIES

SDA-PCIE-G2 SPECIFICATIONS (CONTINUED)

Receiver Tests
Test 1.21 - Rx AC Voltage, Eye and Jitter PHY.3.4#1, PHY.3.4#2, PHY.3.4#6, EM.4#22
Test 1.22 - Electrical Idle Detection PHY.3.4#3
Test 1.23 - Rx data within inter lane skew PHY.3.4#9

Add-in Cards
Test 1.5 - Add In Card Transmitted Eye EM.4#19
Test 1.27 - Entering Link Training State EM.2#27
Test 1.28 - x8 Card Operation in x4 Card EM.6#4
Test 1.31 - Power Consumption Limits EM.4#23

ORDERING INFORMATION

PRODUCT CONFIGURATION	PRODUCT CODE
PCI Express Gen2 Design Solution	
11 GHz, 40 GS/s 16 Mpts in 2 Ch Mode Serial Data Analyzer	SDA 11000
PCI Express Development and Compliance Software for Gen1 and Gen2	SDA-PCIE-G2
Differential Probe System for the SDA 11000	D11000PS
PCI Express Gen1 Solution	
6 GHz, 20 GS/s 4 Mpts, 4 Ch Serial Data Analyzer	SDA 6020
PCI Express Development and Compliance Software for Gen1 and Gen2	SDA-PCIE-G2
7 GHz Differential Probe with Small Tip Module	D600ST*
PE*Tracer*/*Trainer* ML x4 Analyzer/Exerciser Bundle	PE002APA-X
PE*Trainer* ML Host Emulation Platform	800-0082-00

GENERAL INFORMATION	
PCI Express Development and Compliance Software for Gen1 and Gen2	SDA-PCIE-G2
Retrofit Kit for PCI Express Development and Compliance Software for Gen1 and Gen2	RK-SDA-PCIE-G2

*For a complete probe, order a WL600 Probe Body with the Probe Tip Module.

SDA-SATA – Gen1/Gen2 Designers Test Package

The SDA-SATA software package provides an extensive set of validation/verification and debug tools written in accordance with SATA Gen1 (1.5 Gb/s) and SATA Gen2 (3 Gb/s) electrical specification. Covered SATA test modes include Internal (1x/2x mode), Short Backplane and External Desktop Applications (1m/2m mode) and Extended, System-to-System Applications.

In addition to standard eye pattern tests for Gen1, the SDA-SATA solution provides a complete set of amplitude and jitter measurements as defined in the Serial ATA Gen2 specification. These robust capabilities make SDA-SATA the only commercially available automated test suite that meets the requirements for both Gen1 and 2 Serial ATA transmitter compliance testing.

Features:

- Extensive support for Gen1 and Gen2 SATA Specifications
- Automated test report generation
- Flexible, powerful suite of test tools for PHY layer
- Amplitude, timing and jitter measurements
- Integrated/open user interface

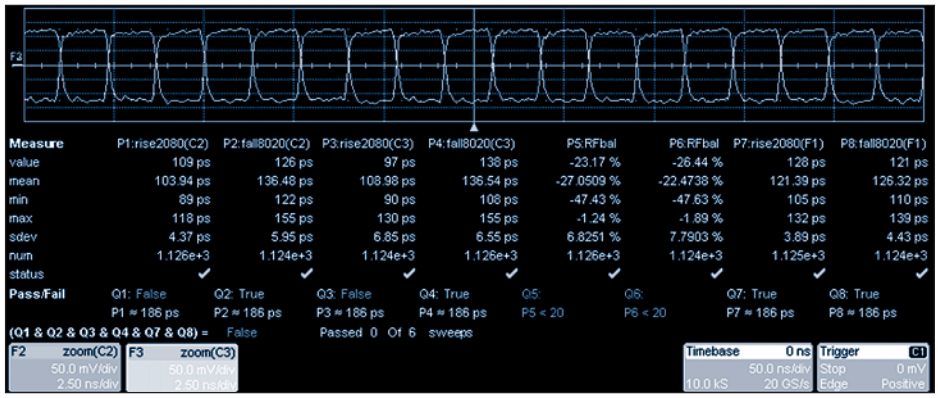
SDA SERIES

- Clock recovery options support all SATA Gen2 jitter requirements
- Data to data jitter measurement mode for SATA Gen1
- Instrument support for Sigtest

Powerful Debugging Tools

The use of spread spectrum clocking (SSC) in transmitted signals is a SATA specification requirement. Measurements such as transmitter data and modulation rates, as well as SSC data tracking, must also be verified per the specification. SDA-SATA software works in conjunction with the deep memory and powerful analysis library of the SDA instrument family to greatly simplify this verification process.

Clock recovery circuitry and clock extraction via Phase-Locked Loops (PLLs) is another significant design consideration. Flexible clock recovery options in the SDA allow for the replication of virtually any real receiver PLL configuration, enabling the simulation of "what if" scenarios. Jitter results can be measured exactly as the receiver would see them.



Comprehensive and Easy to Read Test Reports

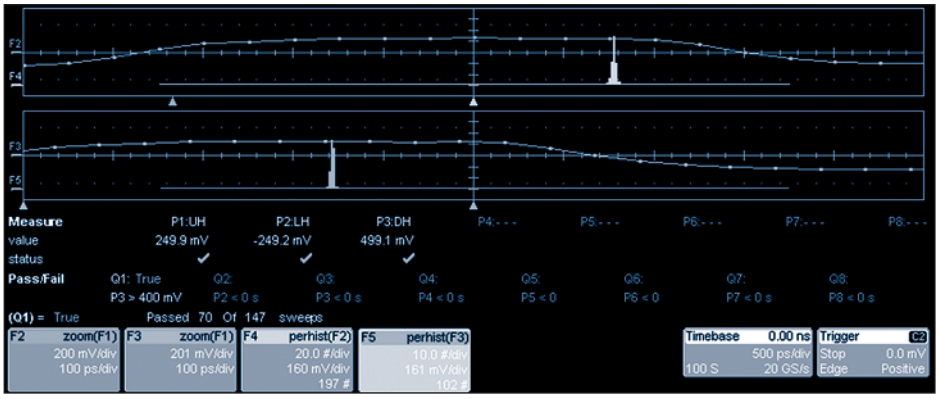
Measurement results often need to be summarized and tabulated to quickly verify specifications. This information, together with instrument and signal acquisition/test condition setups, results in a fully documented record. SDA-SATA streamlines this process by incorporating an automatic HTML report generation engine. The created test reports contain tabulated numerical values for each individual test result, including PASS/FAIL and specification limit columns.

While the SATA specification does not require eye patterns as part of its measurements, SDA-SATA users have a choice of implementing integrated mask testing—featuring an eye mask violation locator—or acquiring waveforms that can be subsequently input to Sigtest software.to obtain eye diagrams.

Advanced Real-Time Jitter and Eye Pattern Analysis

Since its introduction, the SDA has been viewed as a high-performance signal integrity instrument due to its bandwidth, sampling rate, memory depth, and processing capability. LeCroy's SDA 6000A instrument family adds the ability to measure jitter and eye patterns in real time. The SDA-SATA package takes this capability one step further with the inclusion of the Advanced Serial Data Analysis Library. This feature provides ultimate control of PLL design, jitter measurement conditions including detailed Data Dependent Jitter (DDj) breakdown and bit error rate (BER) analysis. The SDA provides pinpoint accuracy for eye mask violation locator, even in the presence of SSC.

SDA SERIES



While the SATA specification does not require eye patterns as part of its measurements, SDA-SATA users have a choice of implementing integrated mask testing—featuring an eye mask violation locator—or acquiring waveforms that can be subsequently input to Sigtest software to obtain eye diagrams.

SDA-SATA SPECIFICATIONS

GENERAL MEASUREMENTS

Test Parameter	Reference Number
Channel Speed	6.2.2.1.1
FBaud	
Tui, Unit Interval	6.2.2.1.3
Ftol, Long Term Frequency Tolerance	6.2.2.1.4
Fssc, SSC Frequency	6.2.2.1.5/6.3.3
SSCtol, SSC Modulation Deviation	6.2.2.1.6/6.3.3
Vcmdc, DC Coupled Common Mode Voltage	6.2.2.1.7
Vcmac, AC Coupled Common Mode Voltage	6.2.2.1.8

TRANSMITTED SIGNAL REQUIREMENTS

Test Parameter	Reference Number
VdiffTx, Tx Differential Output Voltage	6.2.2.3.1
T2080Tx, Rise and Fall Time	6.2.2.3.3
Tskew, Tx Differential Skew	6.2.2.3.4
Vcmactx, Tx AC Common Mode Voltage	6.2.2.3.5
Amp bal, Tx Amplitude Imbalance	6.2.2.3.10
Tj Connector, Data-Data, Gen 1i/1m, 5UI	6.2.2.3.11/6.3
Dj Connector, Data-Data, Gen 1i/1m, 5UI	6.2.2.3.11/6.3
Tj Connector, Data-Data, Gen 1i/1m, 250 UI	6.2.2.3.11/6.3
Dj Connector, Data-Data, Gen 1i/1m, 250 UI	6.2.2.3.11/6.3
Tj Connector, Clock-Data, Gen 2i/2m, fbaud/10	6.2.2.3.12/6.3
Dj Connector, Clock-Data, Gen 2i/2m, fbaud/10	6.2.2.3.12/6.3
Tj Connector, Clock-Data, Gen 2i/2m, fbaud/500	6.2.2.3.12/6.3
Dj Connector, Clock-Data, Gen 2i/2m, fbaud/500	6.2.2.3.12/6.3
Tj After CIC, Clock-Data, Gen 1x/2x, fbaud/1667	6.2.2.3.12/6.3
Dj After CIC, Clock-Data, Gen 1x/2x, fbaud/1667	6.2.2.3.12/6.3

SDA SERIES

SDA-SATA Package Configurations include all the software, test fixtures and accessories required to run SATA Gen1/Gen2 software on the SDA 6000A family. A retrofit kit (RK-SATA-NOASDA) is available for SDA 6000A/6020 users who purchased the Advanced Serial Data Analysis (ASDA/ASDA-J) option. For customers who own a SDA 6000A/6020 but did not order ASDA/ASDA-J, a second retrofit kit (RK-SDA-SATA) is also available.

ORDERING INFORMATION	PRODUCT CODE
PRODUCT CONFIGURATION	
SDA 6000A and SDA 6020	
SATA Gen1/Gen2 Solution Analysis Software Package (includes ASDA-J and TF-SATA)	SDA-SATA
Retrofit Kit for SATA Gen1/Gen2 Solution Analysis Software Package	RK-SDA-SATA
Retrofit Kit for SATA Gen1/Gen2 Solution Analysis Software Package (EXCLUDING ASDA-J)	RK-SDA-SATA-NOASDA
SUPPORTED SYSTEM CONFIGURATION	
SATA Solution System SDA6000A or SDA 6020 (ONLY)	
SDA 6000A 6 GHz Serial Data Analyzer 20 GS/s, 8 Mpts, 2 Ch 10 GS/s, 4 Mpts, 4 Ch with Serial Pattern Trigger	SDA 6000A
SDA 6000A XXL 6 GHz Serial Data Analyzer 20 GS/s, 100 Mpts, 2 Ch 10 GS/s, 50 Mpts, 4 Ch with Serial Pattern Trigger	SDA 6000A XXL
SDA 6020 6 GHz Serial Data Analyzer 20 GS/s, 8 Mpts, 4 Ch	SDA 6020
SATA Gen1/Gen2 Solution Analysis Software Package	SDA-SATA
SATA SA*Tracer*/*Trainer* 3G 1 Port Analyzer/Exerciser System (includes UPAS10K, SA*Tracer* 3G 1 Port Module, SA*Trainer* 3G Traffic Generator Module)	SA005APA-X

ADDITIONAL SOFTWARE OPTIONS (SEE SECTION J)

SDA SERIES

SPECIFICATIONS	SDA 6020	SDA 6000A	SDA 5000A	SDA 3000A
VERTICAL SYSTEM				
Analog Bandwidth @ 50 Ω (-3 dB)	6 GHz	6 GHz	5 GHz	3 GHz
Rise Time (Typical)	75 ps	75 ps	90 ps	150 ps
Input Channels	4	4	4	4
Bandwidth Limiters	25 MHz; 250 MHz; 1 GHz; 3 GHz; 4 GHz			25 MHz; 250 MHz; 1 GHz
Input Impedance	50 Ω ±2.0%			
Input Coupling	DC, GND			
Maximum Input Voltage	±4 Vpeak			
Channel-Channel Isolation	≥ 100:1 at 2 GHz; ≥ 40:1 at 3 GHz; ≥ 20:1 at 4 GHz			
Vertical Resolution	8 bits; up to 11 bits with enhanced resolution (ERES)			
Sensitivity	2 mV – 1 V/div fully variable			
DC Gain Accuracy	±1.5% of full scale			
Offset Range 2 mV	2 mV – 194 mV/div: ±750 mV; 195 mV – 1 V/div: ±4 V			
Offset Accuracy	±(1.5% of full scale + 1.5% of offset value + 2 mV)			
HORIZONTAL SYSTEM				
Timebases	Internal timebase common to 4 input channels; an external clock may be applied at the auxiliary input			
Time/Division Range	20 ps/div – 1000 s/div (10s/div in Auto trigger mode)			
Math and Zoom Traces	8 independent zoom and 8 math/zoom traces standard; 8 math/zoom traces available with XMAP (Master Analysis Software Package) or XMATH (Advanced Math Software Package)			
Clock Accuracy	≤ 1 ppm @ 0–40 °C			
Time Interval Accuracy	≤ 0.06 / SR + (1 ppm * Reading) (rms)			
Sample Rate and Delay Time Accuracy	±1 ppm ≤ 10 s interval			
Jitter Noise Floor	1 ps rms (typical)			
Trigger and Interpolator Jitter	≤ 2.5 ps (typical)			
Channel-Channel Deskew Range	±4.5 ns			
External Timebase Reference	100 MHz; 50 Ω impedance; applied at the rear input			
External Clock	30 MHz – 2 GHz; 50 Ω impedance; applied at the auxiliary input (available on SDA 6020 only)			
ACQUISITION SYSTEM				
Single-Shot Sample Rate/Ch	20 GS/s	10 GS/s	10 GS/s	10 GS/s
2 Channel Max.	20 GS/s	20 GS/s	20 GS/s	20 GS/s
Random Interleaved Sampling (RIS)	200 GS/s for repetitive signals: 20 ps/div – 1 µs/div			
Maximum Trigger Rate	150,000 waveforms/second (in Sequence Mode, up to 4 channels)			
Intersegment Time	≤ 6 µs			

Maximum Acquisition Points/Ch	4 Ch	(2 Ch) / (4 Ch)	Duration @ 20 GS/s	Segments (Sequence Mode)
Standard Memory	8M	8M / 4M	0.4 ms	1000
L – Memory Option	16M	16M / 8M	0.8 ms	5000
VL – Memory Option	32M	32M / 16M	1.6 ms	10,000
XL – Memory Option	48M	48M / 24M	2.4 ms	20,000
XXL – Memory Option	N/A	100M / 50M	5.0 ms	25,000

ACQUISITION PROCESSING	
Averaging	Summed averaging to 1 million sweeps; continuous averaging to 1 million sweeps
Enhanced Resolution (ERES)	From 8.5 to 11 bits vertical resolution
Envelope (Extrema)	Envelope/floor/roof for up to 1 million sweeps

SDA SERIES

TRIGGERING SYSTEM

Modes	Normal/Auto/Single/ and Stop
Sources*	Any input channel, External Ext X10, Ext ÷10, or line; slope and level unique to each source (except line trigger)
Coupling Mode	DC
Pre-trigger Delay	0–100% of horizontal time scale
Post-trigger Delay	0–10,000 divisions
Hold-off by Time or Events	Up to 20 s or from 1 to 99,999,999 events
Internal Trigger Range	±5 div from center
Max. Trigger Frequency	5 GHz w/Edge Trigger; 750 MHz w/SMART Trigger (SDA 3000A = 3 GHz w/Edge Trigger, 750 MHz w/SMART Trigger)
External Trigger Input Range	Aux (±0.4 V); Aux X10 (±0.04 V); Aux/10 (±4 V)
Trigger Sensitivity	(Edge) 3 Divisions @ 5 GHz; 2 Divisions @ 4 GHz; 1.2 Divisions @ 3 GHz (typical)

BASIC TRIGGERS

Edge/Slope/Line	Triggers when signal meets slope and level condition.

SMART TRIGGERS®

State or Edge Qualified	Triggers on any input source only if a defined state or edge occurred on another input source. Delay between sources is selectable by time or events.
Dropout	Triggers if signal drops out for longer than selected time between 2 ns and 20 s.
Pattern†	Logic combination (AND, NAND, OR, NOR) of 5 inputs (4 channels and external trigger input). Each source can be high, low, or don't care. The High and Low level can be selected independently. Triggers at start or end of the pattern.

SERIAL TRIGGER**

Data Rates	50 Mb/s to 2.7 Gb/s
Pattern Length	Up to 32 bits
Clock and Data Outputs	1/2 amplitude AC coupled LVPCL, 400 mV p-p into 50 Ω

SMART TRIGGERS WITH EXCLUSION TECHNOLOGY

Glitch	Triggers on positive or negative glitches with widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Width	Triggers on positive or negative pulse widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Interval	Triggers on intervals selectable between 2 ns and 20 s.

SETUP STORAGE

Front Panel and Instrument Status	Store to the internal hard drive/floppy drive or to a USB-connected peripheral device.

ENVIRONMENTAL

Temperature (Operating)	+5 °C to +40 °C including floppy disk and CD-ROM drives
Temperature (Non-Operating)	-20 °C to +60 °C
Humidity (Operating)	5% to 80% relative humidity (non-condensing) up to +30 °C. Upper limit derates to 25% relative humidity (non-condensing) at +40 °C.
Humidity (Non-Operating)	5% to 95% relative humidity (non-condensing) as tested per MIL-PRF-28800F
Altitude (Operating)	Up to 10,000 ft. (3048 m) at or below +25 °C
Altitude (Non-Operating)	Up to 40,000 ft. (12,192 m)
Random Vibration (Operating)	0.31 grms 5 Hz to 500 Hz 15 minutes in each of three orthogonal axes
Random Vibration (Non-Operating)	2.4 grms 5 Hz to 500 Hz 15 minutes in each of three orthogonal axes
Functional Shock	20 g peak half sine 11 ms pulse, 3 shocks (positive and negative) in each of three orthogonal axes; 18 shocks total

* External trigger not available on the SDA 6000A, SDA 5000A, or SDA 3000A
** Serial trigger not available on SDA 6020
† Maximum of 4 channels on the SDA 6000A, SDA 5000A, and SDA 3000A

SDA SERIES

SPECIFICATIONS (CONTINUED)

PHYSICAL DIMENSIONS

Dimensions (HWD)	264 mm x 397 mm x 491 mm; 10.4" x 15.6" x 19.3" (height excludes feet)

	6020	6000A/ 5000A/ 3000A
Weight	23 kg; 50 lbs.	18 kg; 39 lbs.
Shipping Weight	29 kg; 63 lbs.	24 kg; 53 lbs.

CERTIFICATIONS

CE Approved; UL and cUL listed; Conforms to EN 61326-1; EN 61010-1; UL 3111-1; and CSA C22.2 No. 1010.1

WARRANTY AND SERVICE

3-year warranty; calibration recommended annually. Optional service programs include extended warranty, upgrades, and calibration services.

ORDERING INFORMATION

	PRODUCT CODE
4 Ch; 6 GHz Serial Data Analyzer; 20 GS/s; 8 Mpts/Ch	SDA 6020
4 Ch; 6 GHz Serial Data Analyzer; 10 GS/s; 50 Mpts/Ch; 20 GS/s, 100 Mpts/Ch for 2 or 1 Ch	SDA 6000A XXL
4 Ch; 5 GHz Serial Data Analyzer; 10 GS/s; 50 Mpts/Ch; 20 GS/s, 100 Mpts/Ch for 2 or 1 Ch	SDA 5000A XXL
4 Ch; 3 GHz Serial Data Analyzer; 10 GS/s; 50 Mpts/Ch; 20 GS/s, 100 Mpts/Ch for 2 or 1 Ch	SDA 3000A XXL
4 Ch; 6 GHz Serial Data Analyzer; 10 GS/s; 4 Mpts/Ch; 20 GS/s, 8 Mpts/Ch for 2 or 1 Ch	SDA 6000A
4 Ch; 5 GHz Serial Data Analyzer; 10 GS/s; 4 Mpts/Ch; 20 GS/s, 8 Mpts/Ch for 2 or 1 Ch	SDA 5000A
4 Ch; 3 GHz Serial Data Analyzer; 10 GS/s; 4 Mpts/Ch; 20 GS/s, 8 Mpts/Ch for 2 or 1 Ch	SDA 3000A

INCLUDED WITH STANDARD SDA 6000A, SDA 5000A, AND SDA 6020 CONFIGURATIONS

- ProLink Adapter SMA; 4 each
- ProLink Adapter BNC; 2 each
- Getting Started Manual
- CD-ROM containing Operator's Manual, Remote Control Manual, and Automation Manual
- CD-ROMs containing Utility Software, and Norton Antivirus Software (1 year subscription)
- Floppy Disk Drive
- CD-ROM Drive
- Optical 3-button Wheel Mouse-USB
- Standard Ports; 10/100Base-T Ethernet, Parallel, SVGA Video Output, USB
- Protective Front Cover
- Standard Commercial Calibration and Performance Certificate
- 3-Year Warranty

INCLUDED WITH STANDARD SDA 3000A CONFIGURATIONS

- ProLink Adapter BNC; 5 each
- Getting Started Manual
- CD-ROM containing Operator's Manual, Remote Control Manual, and Automation Manual
- CD-ROMs containing Utility Software and Norton Antivirus Software (1 year subscription)
- Floppy Disk Drive
- CD-ROM Drive
- Optical 3-button Wheel Mouse-USB
- Standard Ports; 10/100Base-T Ethernet, Parallel, SVGA Video Output, USB
- Protective Front Cover
- Standard Commercial Calibration and Performance Certificate
- 3-Year Warranty

MEMORY OPTIONS

48 Mpts/2 Ch, 24 Mpts/Ch Memory Option	SDA-XL
32 Mpts/2 Ch, 16 Mpts/Ch Memory Option	SDA-VL
16 Mpts/2 Ch, 8 Mpts/Ch Memory Option	SDA-L

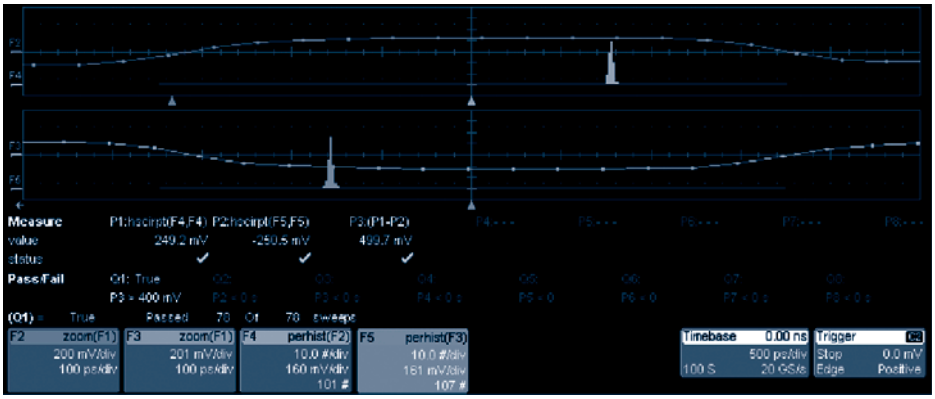
SDA SERIES

ORDERING INFORMATION (CONTINUED)

SOFTWARE OPTIONS	PRODUCT CODE
Advanced Serial Data Analysis Software Package (includes ISI plot, filtered jitter track, eye mask violation locator, bit error rate analysis, and custom clock recovery)	ASDA-J
Advanced Optical Recording Measurement Software Package	AORM
Disk Drive Measurement Software Package	DDM2
Digital Filter Software Package	DFP2
Advanced Customization Software Package	XDEV
Processing Web Editor Software Package for Functions and Parameters	XWEB
Advanced M1 Software Package for Jitter and Timing Measurements (1 seat)	LECROYM1/ADV-1
Advanced M1 Software Package for Jitter and Timing Measurements (4 seats)	LECROYM1/ADV-4
Basic M1 Software Package for Jitter and Timing Measurements (1 seat)	LECROYM1/BASIC
STANDARDS COMPLIANCE SOFTWARE OPTIONS	
PCI Express Development and Compliance Software for Gen1 and Gen2	SDA-PCIE-GEN2
SATA Gen1/Gen2 Solution Software Analysis Package (includes ASDA-J and TF-SATA)	SDA-SATA
Ethernet Test Software Package	ENET
USB 2.0 Compliance Test Software Package	USB2
HARDWARE OPTIONS AND ACCESSORIES	
1 MΩ Adapter includes PP005A Passive Probe	AP-1M
Dual Monitor Display	DMD-1
Keyboard, USB	KYBD-1
ProLink-to-BNC Adapter; 1 each	LPA-BNC
Kit of 4 ProLink BNC Adapters with Case	LPA-BNC-KIT
ProLink-to-SMA Adapter	LPA-SMA
Kit of 4 SMA ProLink Adapters with Case	LPA-SMA-KIT
Oscilloscope Cart with Additional Shelf and Drawer	OC1024
Oscilloscope Cart	OC1021
Rackmount Adapter with 25" (64 cm) Slides	RMA-25
Rackmount Adapter with 30" (76 cm) Slides	RMA-30
Internal Graphics Printer	WM-GP02
Removable Hard Drive Package (includes USB, CD-ROM, removable hard drive, and spare hard drive)	WM-RHD
Additional Removable Hard Drive	WM-RHD-02
Soft Carrying Case	WM-SCC
Hard Transit Case	WM-TC1
PROBES AND PROBE ACCESSORIES	
WaveLink 7.5 GHz Differential Probe with Adjustable Tip Module	D600A-AT*
WaveLink 7 GHz Differential Probe with Small Tip Module	D600ST*
WaveLink 4 GHz, 5 V Differential Probe with Small Tip Module	D350ST*
WaveLink 6 GHz Differential Positioner with Mounted Tip Probe Module	D500PT*
WaveLink ProLink Probe Body	WL600
1 GHz Active Differential Probe (÷1, ÷10, ÷20)	AP034
Optical-to-Electrical Converter, 500–870 nm ProLink BMA Connector	OE525
Optical-to-Electrical Converter, 950–1630 nm ProLink BMA Connector	OE555
7.5 GHz Low Capacitance Passive Probe 500/1000 Ω	PP066
2.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP2500
Probe Deskew and Calibration Test Fixture	TF-DSQ
Ethernet Compliance Test Fixture for 10Base-T	TF-10BT
Telecom Adapter Kit 100 Ω Bal., 120 Ω Bal., 75 Ω Unbal.	TF-ET
Ethernet Compliance Test Fixture for 100Base-T/1000Base-T [Includes a Set of 2 Test Fixtures Signals on Twisted Pair Cables (UTP)]	TF-ENET
Serial ATA Test Fixture (includes pair of SMA cables)	TF-SATA
USB 2.0 Testing Compliance Test Fixture	TF-USB

* For a complete probe, order a WL600 Probe Body with the Probe Tip Module.

INTRODUCTION TO SERIAL DATA STANDARDS



The LeCroy Serial Data Configuration Guide describes the standards-based electronic bus and interfaces covered by LeCroy Serial Data Application Solutions. It relates technological requirements to specifications of important standard bus and interface architectures. This Guide addresses desktop applications (USB and PCI Express™) and system-level, storage oriented interfaces such as Serial ATA and data communication standards such as Ethernet and SONET/SDH.

Table 1 below summarizes the basic amplitude and timing requirements of the standards covered by LeCroy compliance software packages:

Table 1. BASIC ELECTRICAL REQUIREMENTS

	Nominal Amplitude	Bit Rate	Rise Time (20–80%)	CM Max.
ENET1000	±890 mV	125 MS/s	2.5 ns	0
ENET100/10	±1.1 V	125 or 10 Mb/s	3–5 ns (10–90%)	0
USB 2.0	±650 mV	480 Mb/s	500 ps (10–90%)	20 mV
SATA and SATA II	700 mV	Gen1 = 1.5 Gb/s Gen2 = 3 Gb/s	100 ps 67 ps	DC 250 mV–450 mV (Gen1), 0 V Gen2, 3), AC < 2 V
PCIE Gen1	1.4 V	2.5 Gb/s	50 ps	DC < 3.6 V AC < 20 mV CM

OSCILLOSCOPE SELECTION GUIDE

Based on required signal bandwidth, sampling rate, record length and specific standards-dependent measurement requirements, the Serial Data Application packages are supported by the following system configurations:

- ENET (10Base-T/100Base-T/1000Base-T)
- USB 2.0
- SATA Gen1/Gen2
- PCI Express Gen1

	USB	ENET	SATA	PCIE
OSCILLOSCOPE	WP7200A	WP7200A	SDA 6020	SDA 6000A
MEMORY/CH				
Minimum	1M	4M	2M	1M
Recommended	4M	4M	24M	12M
DIFFERENTIAL PROBE	D300A-AT/D350ST	D300A-AT/D350ST	D600A-AT	D600A-AT
COMPLIANCE TEST PACKAGE	USB	ENET	SDA-SATA	SDA-PCIE
JITTER TEST	N/A	N/A	ASDA	N/A

ETHERNET – ENET

Bus Clock Signal: 125 MHz

Theoretical Max. Transfer Rate: 125 MB/s (1000 Mb/s)

Advantages: Most popular networking standard, with high-speed capability and widespread support.

Disadvantages: Slower than PCI

10Base-T/100Base-T has the capability to run at 10 Mb/s and 100 Mb/s, respectively. Transmission takes place over Shielded Twisted Pair (STP) cables or Unshielded Twisted Pair (UTP) (100 ohm) cable which forms the Ethernet architecture. The devices are interconnected via RJ45-type connectors and twisted pair cables and must conform to IEEE802 specification.

This interconnect is point-to-point, commonly in a star topology. Normally this runs out to 100 meters. 10BaseT at a minimum uses "Category 3." 100Base-TX at a minimum uses "Category 5." The (nominally) 100 ohms cable impedance should be between 85 and 115 ohms and have at least 2 twists per foot. The total number of devices on a single chain is 2.

1000Base-T [Gigabit Ethernet] operates up to 100 meters on EIA568, 4-pair [CAT-5] copper wiring. This is backwards compatible with 100Base-T. 1000Base-T also uses Fibre Channel as the physical layer, and runs at 1000 Mb/s.

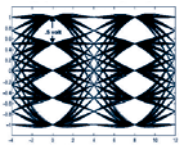
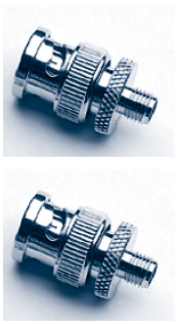
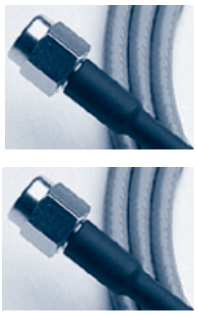
10Base-T	Oscilloscope	Software	Fixture(s)	Active Diff. Probe	Active Probe	Current Probe	Passive Probe
Recommended	WP7200A	ENET	TF-10BT, TF-ENET	D300A-AT/D350ST	HFP2500 (2)	N/A	PP005A (2)
Minimum	WR6030A	ENET	TF-10BT	D300A-AT/D350ST	HFP1500 (2)	N/A	PP006A

Extra Accessories	Item	Qty	Notes
	BNC-M/SMA-F Adapter	2	For WavePro Configuration
	SMA-M/SMA-M Cable, 18 in.	2	For WavePro Configuration
	RJ45 Cable, 1 in.	1	

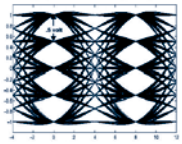
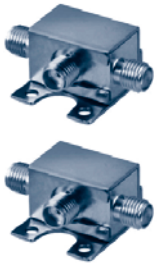
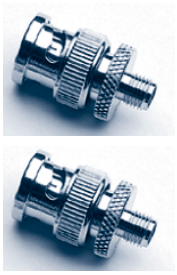
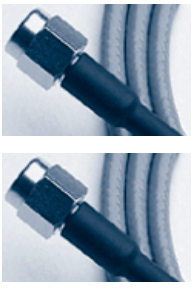
For bundle pricing, please call 1-800-5-LeCroy for details.

ETHERNET – ENET

Minimum Configuration for Ethernet Testing (10Base-T)

				 OR		
350 MHz Oscilloscope	ENET Test Package	1 in. Ethernet Cable	Ethernet Twisted Pair Fixture	(1) Differential Probe with 5V Range, OR (2) Passive Probes	(2) SMA-BNC Adapters	(2) High Quality SMA Cables

Minimum Configuration for Ethernet Testing (100–1000Base-T)

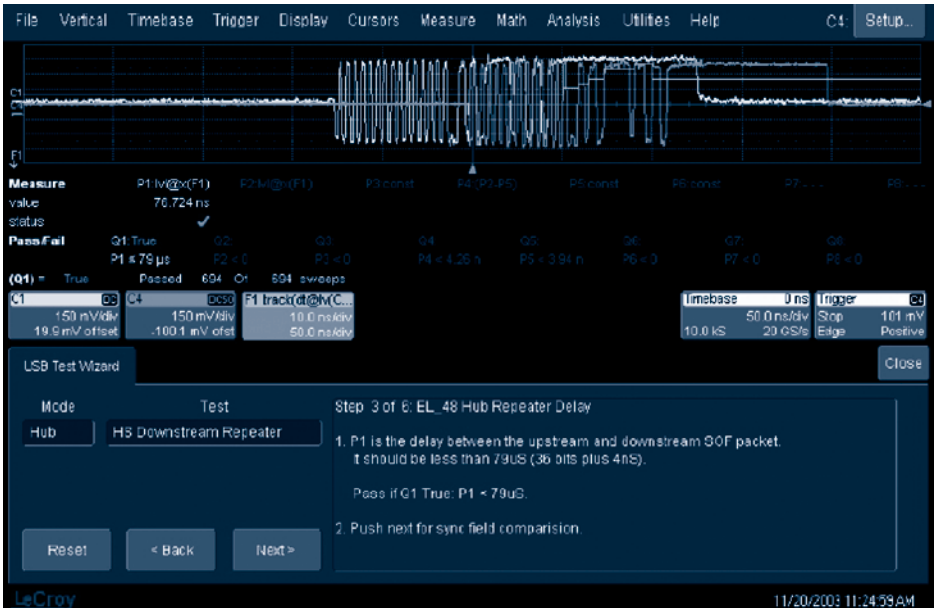
					
1 GHz Oscilloscope	ENET Test Software	Ethernet Test Fixture	(2) SMA Power Splitters (1000Base-T only)	(2) SMA-BNC Adapters	(2) High Quality SMA Cables

100–1000Base-T	Oscilloscope	Software	Fixture(s)	Active Diff. Probe	Active Probe	Current Probe	Passive Probe
Recommended	WP7200A	ENET	TF-ENET, TF-10BT	D300A-AT/D350ST	HFP1500 (2)	N/A	N/A
Minimum	WR6100A	ENET	TF-ENET	D300A-AT/D350ST	HFP1500 (2)	N/A	N/A

Extra Accessories	Item	Qty	Notes
	BNC-M/SMA-F Adapter	2	For WavePro Configuration
	Terminator, SMA, 50 Ω	2	For 1000Base-T Modes 1 and 4
	Directional Splitters	2	For 1000Base-T Modes 1 and 4
	SMA-M/SMA-M Cable, 18 in.	4	For 1000Base-T Modes 1 and 4

For bundle pricing, please call 1-800-5-LeCroy for details.

USB 2.0



Bus Clock Signal: n/a

Theoretical Max. Transfer Rate: 60 MB/s (480 Mb/s) USB 2.0

Advantages:
All the advantages of USB, along with significantly higher speeds, makes it compatible with high-speed peripherals such as data drives and video cameras.

Disadvantages:
Not compatible with older peripherals, still slower than PCI

The USB bus is a differential, bi-directional serial interface cable bus. Differential NRZI data is transmitted between devices (NRZI produces a change in the signal indicating a logic zero, no change indicates a logic one). Data is transferred at three different rates over a maximum cable length of 4 meters (±) over 4 wires, 2 of which carry data on a balanced twisted pair.

A low-speed mode of 1.5 Mb/s is used for devices such as mice. Full-speed mode is used by most devices and allows a transfer rate of 12 Mb/s. High-speed mode [defined by USB 2.0] allows rates of 480 Mb/s. Transmission at the high-speed mode requires the addition of 45 ohm termination resistors between each data line and ground.

- Operation at full-speed mode is 2.8 volts [High] to 0.3 volts [Low].
- Operation at high-speed mode is at 400 mV ±10% [High] to 0 V ±10 mV [Low].
- Cable impedance for both modes is 90 ohms ±15% (differential).

Four different (packet) protocols are used: Control, Interrupt, Isochronous, and Bulk. Each exchange contains 3 packets: a token packet which holds the address, a data packet which holds the data, and a handshake packet which terminates the exchange.

USB Specification 1.1 was designed for low- to medium-speed applications running at less then 12 Mb/s. It is not suited for high-end data transfer such as high-speed back-ups to hard disks or CDs, high resolution color printing, and interactive gaming. The recently released USB Specification 2.0 intends to upgrade the bus for high performance applications. The main difference between Specification 1.1 and 2.0 is that the latter provides for data transfer rates up to 480 Mb/s.

USB 2.0

	Oscilloscope	Software	Fixture	Active Diff. Probe	Active Probe	Current Probe	Passive Probe
Recommended	WP7300A	USB2 + MATLAB	TF-USB	D300A-AT (2) D350ST	HFP2500 (2)	CP015	PP005A
Minimum	WP7200A	USB2	TF-USB	D300A-AT (2) D350ST	HFP2500 (2)	CP015	PP005A

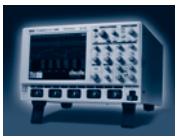
Extra Accessories

Item	Qty	Item	Qty	Item	Qty
HS Self-powered Hub	1	USB Cable, 5m.	6	FS Device (e.g. Webcam)	1
FS Self-powered Hub	5	USB Mouse (LS)	1		

HS = High-speed
FS = Full-speed
LS = Low-speed

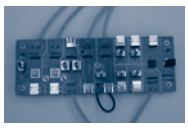
For bundle pricing, please call 1-800-5-LeCroy for details.

Recommended Configuration for USB 2.0 High-speed (HS) Testing (480 Mb/s)

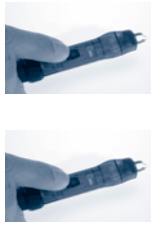


2 GHz Oscilloscope

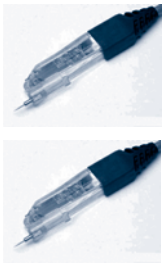
USB 2.0 Test Package + MATLAB



USB Test Fixture



3 GHz Differential Probe (2) D350ST



1.5 GHz Active Probe (2)

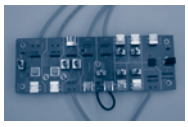
Current Probe

Passive Probe

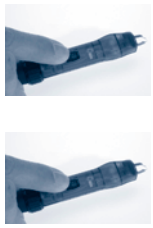
Minimum Configuration for USB 2.0 High-speed (HS) Testing (480 Mb/s)

2 GHz Oscilloscope

USB 2.0 Test Package + MATLAB Runtime Module



USB Test Fixture



3 GHz Differential Probe (2) D350ST

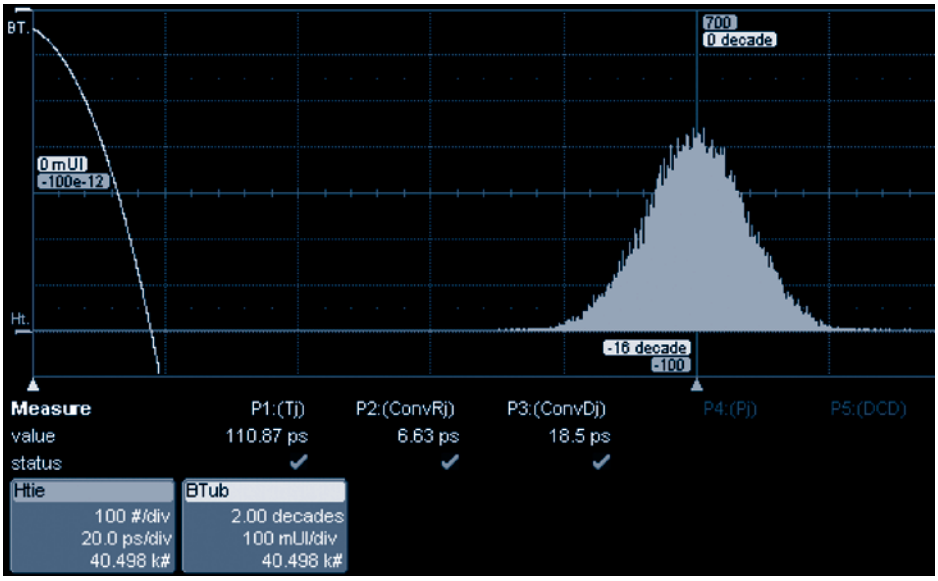
1.5 GHz Active Probe (2)

Current Probe Note: AP-1M needed if using WM or SDA

Passive Probe

Note: Return Loss Measurements require a Function Generator; see USB 2.0 Manual for details.

SATA GEN1/GEN2



Bus Clock Signal:
1/2 Bit period

Theoretical Max. Transfer Rate:
300 MB/s (3000 Mb/s)

Advantages:
Low pin count, low implementation cost, similar to Parallel ATA (PATA), compatible with IDE disk drive software

Disadvantages:
Point-to-Point protocol, only one lane

The Serial ATA [SATA] bus is the serial version of the IDE [PATA] spec. SATA uses a 4 conductor cable with two differential pairs [Tx/Rx], plus an additional three ground pins and a separate power pin. Data runs at 150 MB/s [1.5 GHz] using 8B/10B encoding and 250 mV signal swings, with a maximum bus length of 1 meter. Later enhancements move the data transfer speed to 300 MB/s [Gen2].

Serial ATA uses LVDS with voltages of 250 mV; while parallel ATA is based on TTL signaling levels and rates. Serial ATA is a point-to-point interface where each device is directly connected to the host via a dedicated link. The Bit Encoding used is Non Return to Zero (NRZ) encoding for data communication on a differential two wire bus. The use of NRZ encoding ensures compact messages with a minimum number of transitions and high resilience to external disturbance. The termination resistor is 100 ohms [±5 ohms] differential.

SSC MEMORY REQUIREMENTS:

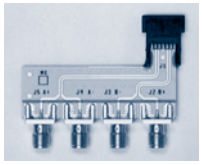
Whenever Spread Spectrum Clocking is used, SSC changes the nominal clock frequency at a rate between 30 and 33 KHz. In order to capture and characterize/track SSC modulation, each modulation cycle requires to acquire 1.2 Mpts of data. A minimum of 4 cycles is required to obtain an accurate measurement.

SATA GEN1/GEN2

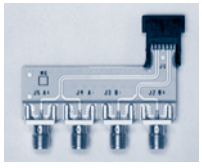
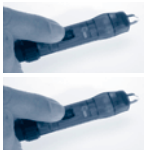
	Oscilloscope	Software	Fixtures	Active Diff. Probe	Probe Body	Analysis Package	Passive Probe
Recommended	SDA 11000	SDA-SATA*	TF-SATA	D600A-AT (2)	WL600 (2)	N/A	N/A
Minimum	SDA 6000A	SDA-SATA*	TF-SATA	D600A-AT (2)	WL600 (2)	N/A	N/A

*ASDA is included in the SDA-SATA
For bundle pricing, please call 1-800-5-LeCroy for details.

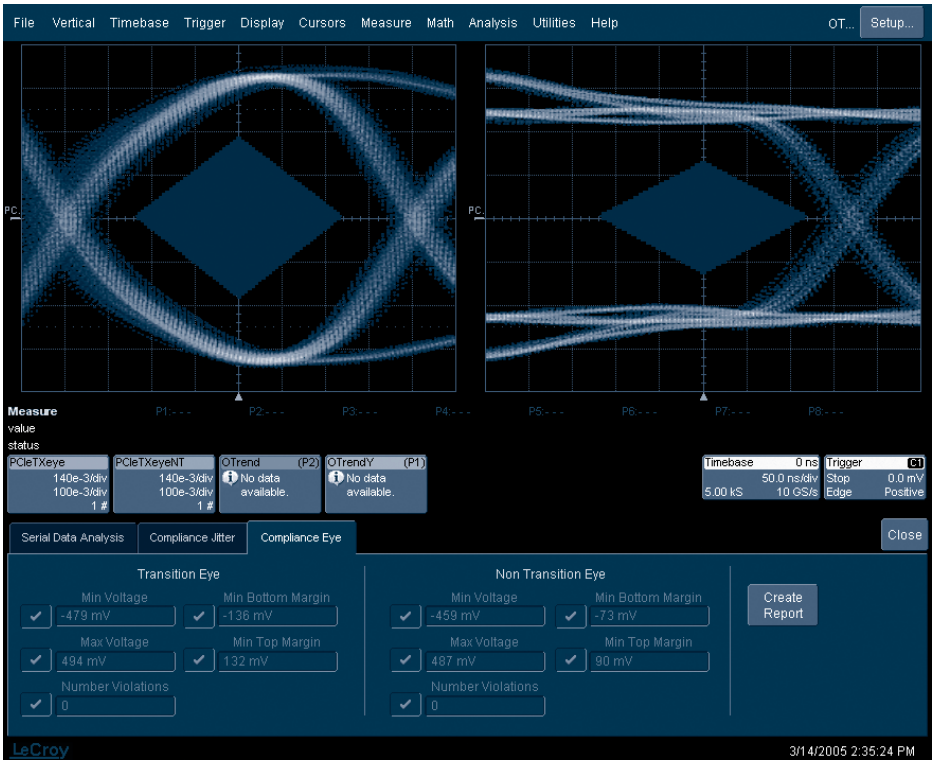
Recommended Configuration for Serial ATA Testing (3.0 Gb/s)

			**OPTIONAL** 
11 GHz, 40 GS/s Oscilloscope	SDA-SATA	Serial ATA Test Fixture	7.5 GHz Differential Probes (2)

Minimum Configuration for Serial ATA Testing (1.5 Gb/s)

			**OPTIONAL** 
6 GHz, 20 GS/s Oscilloscope	SDA-SATA	Serial ATA Test Fixture	7.5 GHz Differential Probes (2)

PCI EXPRESS™ – PCI GEN1/GEN2



Bus Clock Signal:
1/2 Bit period

Theoretical Max. Transfer Rate:
2.5 Gb/s (Gen 1)
5.0 Gb/s (Gen 2)

Advantages:
Supports multiple market segments and emerging applications; unifying standard for desktop, mobile and enterprise platforms; supports existing PCI software

Disadvantages:
Not an interconnect scheme for processors or memory, supports switch architecture but not cluster configurations

The fundamental PCI Express link consists of two low-voltage, differentially driven pairs of signals: a transmit pair and a receive pair. A data clock is embedded using the 8b/10b encoding scheme to achieve very high data rates.

The initial frequency is 2.5 Gb/s in each direction and this is expected to increase with silicon technology advances to 5 Gbps (PCIE Gen2) in each direction.

The physical layer transports packets between the link layers of two PCI Express agents. The bandwidth of a PCI Express link may be linearly scaled by adding signal pairs to form multiple lanes. The physical layer supports x1, x2, x4, x8, x12, x16, and x32 lane widths and splits the byte data. Each byte is transmitted, with 8b/10b encoding, across the lane(s).

SSC MEMORY REQUIREMENTS:

Whenever Spread Spectrum Clocking is used, SSC changes the nominal clock frequency at a rate between 30 and 33 KHz. In order to capture and characterize/track SSC modulation, each modulation cycle requires to acquire 1.2 Mpts of data. A minimum of 4 cycles is required to obtain an accurate measurement.

PCI EXPRESS™ – PCI GEN1/GEN2

	Oscilloscope	Software	Fixtures	Active Diff. Probe	Probe Body	Analysis Package	Passive Probe
Recommended	SDA 11000	SDA-PCIE-G2	CBB+CLB	D11000PS	WL600 (2)	ASDA-J	N/A
Minimum	WM8620	Sigtest	CBB+CLB	D600A-AT (2)	WL600 (2)	N/A	N/A

CBB = Compliance Base Board
CLB = Compliance Load Board

Extra Accessories

Item	Qty
SMA-M/SMA-M Cable, 18 in.	2
Terminator, SMA, 50 Ω	2
PC Power Supply	1

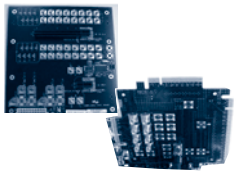
Recommended Configuration for PCI Express Testing (2.5 Gb/s) or 5.0 Gb/s

11 GHz, 40 GS/s Oscilloscope

PCI Express Compliance Test Software Package

OPTIONAL

11 GHz Differential Probe



CBB and CLB Fixtures*

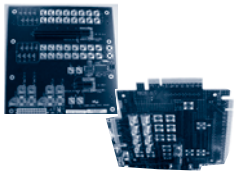
Minimum Configuration for PCI Express Testing (2.5 Gb/s)

6 GHz, 20 GS/s Oscilloscope

PCI Sigtest

OPTIONAL

7.5 GHz Differential Probe

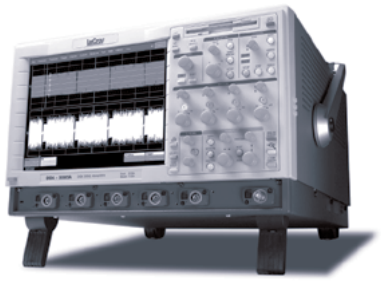


CBB and CLB Fixtures*

* For PCI Express Gen1 Tests Only.

DDA 5005A/DDA 5005A XXL

The DDA 5005A Series is LeCroy's most powerful Disk Drive Analysis toolset. Its X-Stream architecture enables disk drive engineers to quickly and easily measure and analyze disk drive signals. Designed for signal fidelity, it features whole track acquisition and analysis for read channel, media noise analysis, and head parametrics, with the longest memory standard. The DDA 5005A comes standard with enough acquisition memory to capture 2.4 milliseconds of data at 20 GS/s. The DDA 5005A XXL captures 5 milliseconds of data with 100 Mpts per dual-channel memory.



DDA 5005A

Features:

- 5 GHz bandwidth
- 10 GS/s sample rate/channel
- 20 GS/s dual-channel mode
- Up to 100 Mpts in dual-channel mode
- 5 GHz trigger bandwidth
- Intuitive front panel and touch screen interface
- Zoom and Multi-Zoom on disk sectors
- One-button access to Read Channel Emulation, Servo Analysis, Disk Triggers
- Head Equalization, Channel Emulation, and SAM Histograms
- Segmented Memory for sector-by-sector parametric analysis
- Built-in PWxx, amplitude, pulseshape, and ACSN parametric measurements
- Customizable with MATLAB scripts
- Flexible connectivity to networks, peripherals with 100Base-T Ethernet and USB

DDA 3000

The DDA 3000 offers the same measurement capability as the DDA 5005A Series at a lower bandwidth and memory configuration, with the convenience of selectable 50 ohm and Hi-Z inputs.

DDA 3000

Features:

- 3 GHz bandwidth
- 10 GS/s sample rate/channel
- 20 GS/s dual-channel mode
- Up to 48 Mpts in dual-channel mode
- Intuitive front panel and touch screen interface
- Zoom and Multi-Zoom on disk sectors
- One-button access to Read Channel Emulation, Servo Analysis, Disk Triggers
- Segmented Memory for sector-by-sector parametric measurements
- Built-in PWxx, amplitude, pulse shape, and ACSN parametric measurements
- Customizable with MATLAB scripts
- Flexible connectivity to networks, peripherals with 100Base-T Ethernet and USB

DDA 5000A/5000A XXL/DDA 3000

SPECIFICATIONS	DDA 5005A AND DDA 5005A XXL	DDA 3000
VERTICAL SYSTEM		
Analog Bandwidth @ 50 Ω (-3 dB)	5 GHz	3 GHz
Input Channels	4	4
Bandwidth Limiter	20 MHz; 200 MHz; 1 GHz; 3 GHz; 4 GHz	25 MHz, 200 MHz, 1 GHz
Input Impedance	50 Ω ±1.5%	50 Ω; 1 MΩ//11 pF typical (using PP005A probe)
Input Coupling	DC, GND	1 MΩ: AC, DC, GND; 50 Ω: DC
Maximum Input	2.5 V_{rms}; ±4 Vpeak	50 Ω: 5 V_{rms}, 1 MΩ: 100 Vmax (peak AC: ≤ 5 KHz + DC)
Vertical Resolution	8 bits; up to 11 bits with enhanced resolution (ERES)	
Sensitivity	2 mV–1 V/div fully variable; Full bandwidth at ≥ 10mV	50 Ω: 2 mV – 1 V/div fully variable; 1 MΩ: 2 mV – 2 V/div fully variable
Offset Range	2 mV–99 mV/div: ±750 mV; 100 mV–1 V/div: ±4 V±1.5 V @ 5–100 mV/div ±10 V @ .102–1 V/div	50 Ω: ±700 mV @ 2–4.99 mV/div 1 MΩ: ±700 mV @ 2–4.99 mV/div ±1.5 V @ 5–100 mV/div ±20 V @ 0.102–2 V/div
DC Gain Accuracy	±1.5% of full scale; ±1% (typical)	
HORIZONTAL SYSTEM		
Timebases	Internal timebase common to 4 input channels; An external clock may be applied at the auxilary input	
Math and Zoom Traces	8 math/zoom traces	
Clock Accuracy	≤ 1 ppm @ 0–40 °C	≤ 10 ppm @ 0–40 °C
Time Interpolator Resolution	1 ps	
Time Interval Accuracy		≤ .06/SR +(10 ppm*Reading) (rms)
External Clock Frequency	2 GHz maximum, 50 Ω impedance	30 MHz–1 GHz; 50 Ω impedance; applied at the auxiliary input
Roll Mode – Operating Range	Time/div 500 ms–1000 s/div or sample rate < 100 kS/s max	
ACQUISITION SYSTEM		
Single-Shot Sample Rate/Ch	10 GS/s	
2 Channel Max.	20 GS/s	
Maximum Trigger Rate	150,000 waveforms/second (in Sequence Mode- up to 4 channels)	

Maximum Acquisition Points/Ch	100 Mpts/2 Ch, 50 Mpts/4 Ch	4 Ch/2 Ch	Sequence Mode
Standard		4M/8M	1000 segments
L – Memory Option		8M/16M	5000 segments
L – Memory Option		16M/32M	10,000 segments
L – Memory Option		24M/48M	20,000 segments

Random Interleaved Sampling (RIS)	20 ps/div–1 µs/div: 200 GS/s for repetitive signals
Intersegment Time	Typically 5 µs
ACQUISITION PROCESSING	
Averaging	Summed averaging and continuous averaging to 1 million sweeps
Enhanced Resolution (ERES)	From 8.5 to 11 bits vertical resolution
Envelope (Extrema)	Envelope, floor, roof for up to 1 million sweeps
Interpolation	Linear, Sin x/x

DDA 5000A/5000A XXL/DDA 3000

	DDA 5005A AND DDA 5005A XXL	DDA 3000

TRIGGERING SYSTEM

Modes	Normal, Auto, Single, and Stop	
Sources	Any input channel, External, Ext x 10, Ext/10, or line; slope and level unique to each source (except line trigger)	
Coupling Mode	DC	DC 50 Ω, GND, DC1MΩ, AC1 MΩ
Pre-trigger Delay	0–100% of horizontal time scale	
Post-trigger Delay	0–10,000 divisions	
Hold-off by Time or Events	Up to 20 s or from 1 to 99,999,999 events	
Internal Trigger Range	±5 div from center	
Max. Trigger Frequency	5 GHz w/Edge Trigger; 750 MHz w/SMART Trigger	3 GHz w/Edge Trigger; 750 MHz w/Smart Trigger
External trigger input range	Ext ±0.4; Ext x 10 ±0.04; Ext/10 ±4 V	

AUTOMATIC SETUP

Auto Setup	Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals
Vertical Find Scale	Automatically sets the vertical sensitivity and offset for the selected channels to display a waveform with maximum dynamic range

PROBES

Probes	A variety of passive and active probes is optional	(2) PP005A standard; Optional passive and active probes available.
Probe System	ProLink: Automatically detects and supports a variety of compatible probes; Supports ProLink SMA or BNC input adapters	ProBus: Automatically detects and supports a variety of compatible probes
Scale Factors	Automatically or manually selected depending on probe used	

COLOR WAVEFORM DISPLAY

Type	Color 10.4" flat-panel TFT-LCD with high resolution touch panel
Resolution	SVGA; 800 x 600 pixels
Real-time Clock	Dates, hours, minutes, seconds displayed with waveform
Number of Traces	Display a maximum of eight traces. Simultaneously display channel, zoom, memory, and math traces
Grid Styles	Single, Dual, Quad, Octal, XY, Single + XY, Dual + XY
Waveform Styles	Sample dots joined or dots only

ANALOG PERSISTENCE DISPLAY

Analog and Color-Graded Persistence	Variable saturation levels; stores each trace's persistence data in memory
Persistence Selections	Select Analog or color positive
Trace Selection	Activate Analog Persistence on all or any combination of traces
Persistence Aging Time	Select from 500 ms to infinity
Sweeps Displayed	All accumulated or all accumulated with last trace highlighted

ZOOM EXPANSION TRACES

	Display up to 4 Zoom and 4 Math/Zoom traces (8 Math/Zoom traces available with Master Analysis package option)

CPU

Processor	Intel Pentium > 2 GHz with MS Windows Operating System	Intel Pentium >1.7 GHz or better with MS Windows 2000 Operating System
Processing Memory	512 Mbytes	Up to 1 Gbyte

DDA 5000A/5000A XXL/DDA 3000

	DDA 5005A AND DDA 5005A XXL	DDA 3000
INTERNAL WAVEFORM MEMORY		
	M1, M2, M3, M4 Internal Waveform Memory (Store full-length waveforms with 16 bits/data point) Or store to any number of files limited only by data storage media	
SETUP STORAGE		
Front Panel and Instrument Status	Store to the internal hard drive, floppy drive, or to a USB connected peripheral device	
INTERFACE		
Remote Control	Full command set for all front panel controls and internal functions via GPIB or Ethernet using Windows Automation or LeCroy Remote Command Set	
GPIB Port (Optional)	Full control via IEEE – 488.2	
Ethernet Port	10/100Base-T Ethernet interface	
Floppy Drive	Internal, DOS-format, 3.5" high-density	
USB Ports	4 USB ports supports Windows compatible devices	
External Monitor Port Standard	15-pin D-Type SVGA-compatible	
Parallel Port	1 standard	
AUXILIARY OUTPUT		
Signal Types	Select from calibrator or control signals output on front panel	
Calibrator Signal	500 Hz–5 MHz square wave or DC Level	5 Hz–1 MHz square wave or DC level; 0.0 to 5.0 V into 50 Ω (0–1 V into 1 MΩ) or TTL volts (selectable) 0.0 to +0.5 V (Selectable) into 50 Ω
Control Signals	Trigger ready, trigger out, pass/fail status	
AUXILIARY INPUT		
Signal Types	Select from External Trigger or External Clock input on front panel	
GENERAL		
Auto Calibration	Ensures specified DC and timing accuracy is maintained for 1 year minimum	
Power Requirements	100–120 VAC at 50/60/400 Hz; 200–240 VAC at 50/60 Hz; Automatic AC Voltage selection Power consumption: < 800 VA; 940 W Max.	
PHYSICAL DIMENSIONS		
Dimensions (HWD)	264 mm x 397 mm x 491 mm; 10.4" x 15.65" x 19.25" (height excludes feet)	
Weight	18 kg; 39.5 lbs.	
Shipping Weight	24 kg; 53 lbs.	
ENVIRONMENTAL		
Temperature (Operating)	+5 °C to +40 °C including floppy disk and CD-ROM drives	
Temperature (Non-Operating)	-20 °C to +60 °C	
Humidity (Operating)	5% to 80% relative humidity (non-condensing) up to +30 °C Upper limit derates to 25% relative humidity (non-condensing) at +40 °C	
Humidity (Non-Operating)	5% to 95% relative humidity (non-condensing) as tested per MIL-PRF-28800F	
Altitude (Operating)	up to 10,000 ft. (3048 m) at or below +25 °C	
Altitude (Non-Operating)	up to 40,000 ft. (12,192 m)	
Random Vibration (Operating)	0.31 g_{rms} 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes	
Random Vibration (Non-Operating)	2.4 g rms 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes	
Functional Shock	20 g peak, half sine, 11 ms pulse, 3 shocks (positive and negative) in each of three orthogonal axes, 18 shocks total	

DDA 5000A/5000A XXL/DDA 3000

ENVIRONMENTAL (CONTINUED)

CERTIFICATIONS

CE Approved, UL and cUL listed; conforms to EN 61326-1, EN 61010-1, UL 3111-1, and CSA C22.2 No. 1010.1

WARRANTY AND SERVICE

3-year warranty; calibration recommended annually. Optional service programs include extended warranty, upgrades, and calibration services.

Basic Triggers	
Edge/Slope/Line	Triggers when signal meets slope and level condition
SMART Triggers	
State or Edge Qualified	Triggers on any input source only if a defined state or edge occurred on another input source. Delay between sources is selectable by time or events
Dropout	Triggers if signal drops out for longer than selected time between 2 ns and 20 s
Pattern	Logic combination (AND, NAND, OR, NOR) of 5 inputs (4 channels and external trigger input) Each source can be high, low, or don't care. Trigger at start or end of the pattern
SMART Triggers with Exclusion Technology	
Glitch	Triggers on positive or negative glitches with widths selectable from 600 ps to 20 s or on intermittent faults
Signal or Pattern Width	Triggers on positive or negative pulse widths selectable from 600 ps to 20 s or on intermittent faults
Signal or Pattern Interval	Triggers on intervals selectable between 2 ns and 20 s
Disk Drive Triggers	
Sector	Triggers on the n'th sector pulse after index. Index and sector pulse polarity and sector pulse number are selectable
Servo Gate	Triggers on the n'th servo gate after index and every m'th thereafter. Index and servo gate pulse polarity are selectable
PES Trigger	Triggers on Position Error Signal (PES) exceeding an adjustable voltage window. Servo gate can be selected as qualifier
Read Gate Trigger	Triggers on any read gate longer than an adjustable Sector ID filed length

Math Tools

Displays up to eight math function traces (F1-F8); The easy to use graphical interface simplifies setup of up to two operations on each function trace. Function traces can be chained together to perform math-on-math. Capabilitilies include:

absolute value	envelope	log (base e)	rescale (with units)	trend (datalog)
average (summed)	exp (base e)	log (base 10)	roof	Auto-correlation
average (continuous)	exp (base 10)	negate,	Sin x/x,	
difference (-)	FFT	product (x)	square	
differentiate	floor	ratio (/)	square root	
enhanced resolution (to 11 bits vertical)	identity	reciprocal (invert)	sum (+)	
	integrate	resample (deskew)	histogram	

FFT includes: power averaging, power density, real and imaginary components, and frequency domain parameters.

Pass/Fail

Test waveforms by comparing their shape to test templates, and simultaneously check multiple parameters versus selectable parameter or mask limits. Pass or fail conditions can initiate actions including document::local or networked files, or e-mail the image of the failure, save waveforms, or send a GPIB SRQ, or pulse to trigger another device.

DDA 5000A/5000A XXL/DDA 3000

Automated Disk Drive Measurements

TAA	PW50-	Imax	Itbp	Ittp
TAA+	Resolution	Imin	Itmn	Itut
TAA-	Overwrite	Inum	Itmx	NLTS
PW50	Ibase	Ipp	Itot	ACSN
PW50+	Ibsep	Itbe	Itpt	msnr

Standard Automated Measurements

amplitude	duty cycle	peak-to-peak	phase	Δ time from clock to data – (Hold time)
area	duration	period	time @ minimum (min),	18 Histogram parameters
base	falltime	risetime	time @ maximum (max),	
cycles	frequency	rms	Δ delay	
cycle std. deviation	first	std. deviation	Δ time @ level,	
cycle mean	maximum	top	Δ time @ level from trigger	
cycle median	mean	width		
cycle rms	minimum,	last	Δ time from clock to data + (setup time)	
data	+ overshoot	media		
delay	-overshoot	number of points		

Jitter measurement for parameters including: period, cycle-cycle, frequency, and edge@lv, with JitterTrack of up to 200 edges.

Advanced Drive Analysis

Capabilities include: Head Filter/ Equalizer Emulation, Channel Emulation, SAM Histograms, Plot of SAM Values, PES Runout Analysis, Analog Compare.

Additional waveshape analysis capabilities include: FFT capability with power averaging, power density, real and imaginary components, and frequency domain paramters, Parameter Math – add, subtract, multiply, or divide two different parameters, User-definable parameter measurements, User-definable math functions

ORDERING INFORMATION

	PRODUCT CODE
4 Ch; 5 GHz; 10 GS/s; 20 GS/s max.; 100 Mpts Memory (using 1 or 2 Ch)	DDA 5005A XXL
4 Ch; 5 GHz; 10 GS/s; 20 GS/s max.; 48 Mpts Memory (using 1 or 2 Ch)	DDA 5005A
4 Ch; 3 GHz; 10 GS/s; 20 GS/s max.; 8 Mpts Memory (using 1 or 2 Ch) 50 Ω and 1 MΩ Input	DDA 3000

INCLUDED WITH STANDARD CONFIGURATION

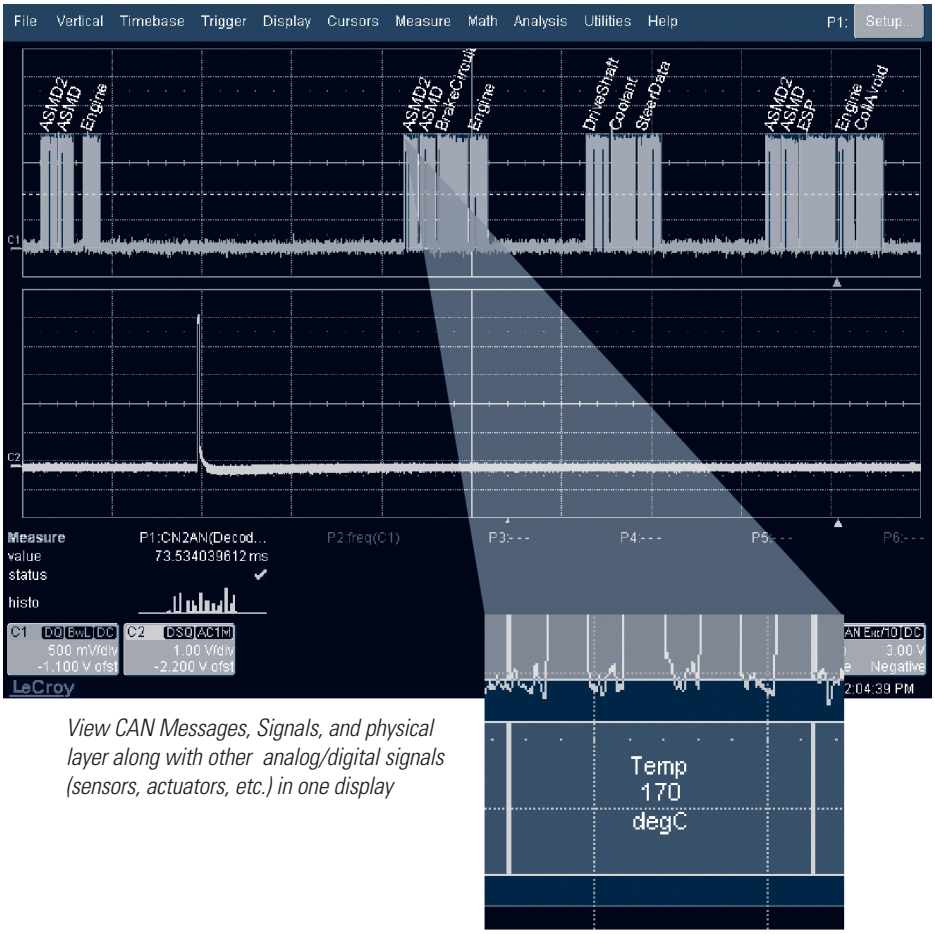
CD-ROM Drive	
10:1 10 MΩ Passive Probes (Qty 2) **(for DDA 3000 only)**	PP005A
LeCroy ProLink Adapter SMA and BNC	
Optical 3-button Wheel Mouse-USB	
Getting Started Manual	
CD-ROM containing Operator's Manual, Remote Control Manual, and Automation Manual	
CD-ROMs containing Utility Software, and Norton Antivirus Software (1 year subscription)	
Protective Front Cover	
Remote Control Manual	
Standard Commercial Calibration and Performance Certificate	
Standard Ports; 10/100BaseT Ethernet, Parallel, SVGA Video Output, USB	
3-Year Warranty	

DDA 5000A/5000A XXL/DDA 3000

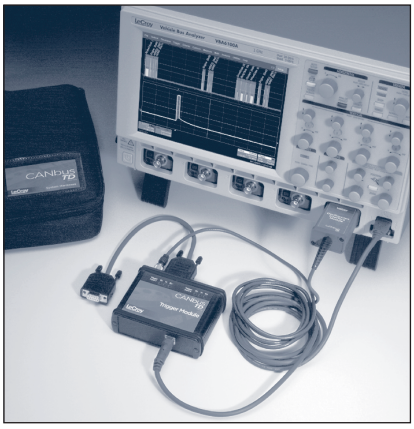
ORDERING INFORMATION	PRODUCT CODE
MEMORY OPTIONS (for DDA 3000 only)	
48 Mpts max.; 24 Mpts/Ch Memory Option	-XL
32 Mpts max.; 16 Mpts/Ch Memory Option	-VL
16 Mpts max.; 8 Mpts/Ch Memory Option	-L
HARDWARE OPTIONS AND ACCESSORIES	
Internal Graphics Printer	GP02
IEEE-488 GPIB Interface	GPIB-1
Removable Hard Drive Package (including USB, CD-ROM, and spare hard drive)	RHD
SOFTWARE OPTIONS	
Digital Filter Software Package	DFP2
Ethernet Test Software Package	ENET
Jitter and Timing Analysis Software Package	JTA2
Advanced M1 Software Package for Jitter and Timing Measurements (1 seat)	LECROYM1/ADV-1
Advanced M1 Software Package for Jitter and Timing Measurements (4 seats)	LECROYM1/ADV-4
Basic M1 Software Package for Jitter and Timing Measurements	LECROYM1/BASIC
Serial Data Mask Software Package	SDM
USB 2.0 Compliance Test Software Package	USB2
Advanced Optical Recording Measurement SoftwarePackage	AORM
Processing Web Editor Software Package for Functions and Parameters	XWEB
HARDWARE OPTIONS AND ACCESSORIES	
IEEE-488 GPIB Control Interface	GPIB-1
Dual Monitor Display	DMD-1
Keyboard, USB	KYBD-1
Rackmount Adapter with 25" (64 cm) Slides	RMA-25
Rackmount Adapter with 30" (76 cm) Slides	RMA-30
Internal Graphics Printer	WM-GP02
Removable Hard Drive Package (includes USB, CD-ROM, Removable Hard Drive, and Spare Hard Drive)	WM-RHD
Additional Removable Hard Drive	WM-RHD-02
Soft Carrying Case	WM-SCC
Hard Transit Case	WM-TC1
Oscilloscope Cart with Additional Shelf and Drawer	OC1024
Oscilloscope Cart	OC1021
USB 2.0 Testing Compliance Test Fixture	TF-USB
PROBES AND PROBE ACCESSORIES	
WaveLink 7.5 GHz Differential Probe with Adjustable Tip Module **(for DDA 5005A only)**	D600A-AT*
WaveLink 4 GHz Differential Probe with Adjustable Tip Module **(for DDA 3000 only)**	D300A-AT*
WaveLink 7 GHz Differential Probe with Small Tip Module **(for DDA 5005A only)**	D600ST*
WaveLink 4 GHz, 5 V Differential Probe with Small Tip Module	D350ST*
WaveLink 6 GHz, Differential Positioner with Mounted Probe Tip Module	D500PT*
WaveLink ProLink Probe Body **(for DDA 5005A only)**	WL600
WaveLink ProBus Probe Body **(for DDA 3000 only)**	WL300
ProLink-to-SMA Adapter	LPA-SMA
ProLink-to-BNC Adapter; 1 each	LPA-BNC
Kit of 4 SMA ProLink Adapters with Case	LPA-SMA-KIT
Kit of 4 ProLink BNC Adapters with Case	LPA-BNC-KIT
1 MΩ Adapter includes PP005A Passive Probe	AP-1M

* For a complete probe, order a WL300 or WL600 Probe Body with the Probe Tip Module.

VEHICLE BUS ANALYZERS



View CAN Messages, Signals, and physical layer along with other analog/digital signals (sensors, actuators, etc.) in one display



VEHICLE BUS ANALYZERS

The Vehicle Bus Analyzer is the first conventional oscilloscope to decode CAN serial data into Symbolic (application layer) text. Now, for the first time, an engineer has both the full range of CAN protocol stack information—symbolic, hex, and electrical signal—and the ability to view additional in-circuit electrical signals (sensors and actuators, voltage levels, transients, etc.) that influence the CAN bus. In addition, up to four different CAN buses can be decoded at one time. Standard and specialized oscilloscope tools can be used to validate and debug designs.

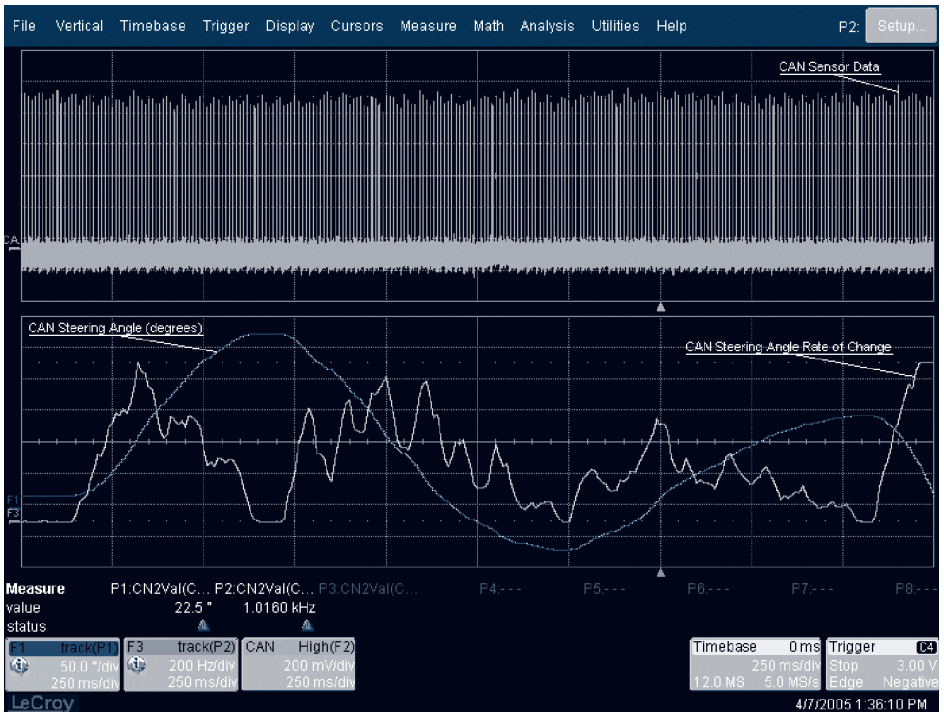
Features:

- Symbolic (Application Layer) decode of up to 4 CAN buses
- Compatible with DBC database format
- Display decoded results above waveform on oscilloscope screen
- CAN triggering with setup in symbolic format
- Gateway timing measurements (CAN message to CAN message across a gateway)
- Capture thousands (seconds) of CAN messages with 4 Mpts of memory (up to 24 Mpts optional)
- All CANbus TDM functionality, including:
  - Timing measurements
  - Bus Load measurements
  - CAN message data extraction
  - CAN message Bit Rate calculation
  - Statistical calculation of timing information for many events, and graphical display
  - Graphs/Plots of CAN message data

VEHICLE BUS ANALYZERS

Eliminate the Barriers to Fast Debug
Direct symbolic decoding and triggering allows fast and intuitive understanding of events. Simply load your existing DBC database file into the oscilloscope (no re-entry of data is required), capture CAN message traffic, and all electrical (signal), protocol (hex) and symbolic (application) layer information is quickly displayed on the oscilloscope screen. Use standard oscilloscope and specialized Vehicle Bus Analyzer tools to find rare events, automatically measure and statistically analyze event timing, and graph/plot information, including extracted CAN message data.

The Single Tool Enhances Productivity
The VBA concentrates all your information in one place. Timing measurements across gateways are now possible. Understanding is fast, intuitive, and in a familiar format. Complete, time-correlated understanding of all ECU or circuit behaviors is simple. Time-consuming workarounds are a thing of the past.



Unique Measurement Tools
The VBA can make many measurements not possible with other instruments. Aside from timing measurements, the VBA can also extract CAN data from a CAN message stream, graphically plot that data on the oscilloscope display, and compare it to other electrical signals. Here, information on the steering angle and steering angle rate of change is extracted from the CAN message acquisition, rescaled to decimal values, and plotted as a time-correlated “Track” on the VBA display.

VEHICLE BUS ANALYZERS

ORDERING INFORMATION

	PRODUCT CODE
VEHICLE SOLUTIONS	
1 GHz, 4 Ch Vehicle Bus Analyzer	VBA6100A
500 MHz, 4 Ch Vehicle Bus Analyzer	VBA6050A

All Vehicle Bus Analyzers are complete with LeCroy's powerful WaveRunner 6000A Series oscilloscope, Vehicle Bus Analyzer software, and CAN bus triggering hardware kit. Reference the WaveRunner 6000A Series brochure for complete information on the 500 MHz (WR6050A) and 1 GHz (WR6100A) oscilloscope available at www.lecroy.com

VEHICLE BUS ANALYZER SOFTWARE CAPABILITIES

- Symbolic (application layer) decode of up to 4 separate CAN buses
- Symbolic CAN trigger setup
- Hexadecimal decode and trigger setup
- Binary trigger setup
- Automated timing measurements, including capability to measure timing across gateways:
  - CAN message to Analog signal
  - Analog signal to CAN message
  - CAN message to CAN message
- Bus Load % measurements (up to 2 billion events)
- CAN message extraction and display in scaled decimal values
- CAN message bit rate calculation
- Statistical calculations of many measurements
- Histogram (graphical) display of statistical data, including timing measurements
- Trend and Track plots of extracted CAN data
- Persistence trace, mean, and sigma functionality
- Complete set of Jitter and Timing (@level) parameters

CAN TRIGGERING HARDWARE CONTENTS

- Trigger Module with TC251-OPTO optically isolated Trigger Coupler installed (and room for one additional Trigger Coupler). Trigger Couplers are interchangeable.
- Oscilloscope Interface Module with 1.0 meter connection cable. Connects Trigger Module to LeCroy oscilloscope ProBus® interface.
- 1.0 meter USB 2.0 cable from LeCroy external CANbus TD Trigger Module to LeCroy oscilloscope
- Black fabric storage case (SAC-01) with foam insert and room for storage of all equipment and two additional Trigger Coupler accessories (not included)
- Quantity 1 (one) 9-pin DSUB socket to 2-wire adapter cable (for ISO 11898-2 CAN)
- Quantity 1 (one) 9-pin DSUB socket to 4-wire adapter cable (dual-use, for ISO 11519 CAN and GM-LAN/J2411 single-wire CAN)
- Quantity 2 (two) 9-pin to 9-pin DSUB 120 ohm terminations
- Quick Reference Guide and Instruction Manual in English
- Quantity 1 (one) Phillips head screwdriver

OPTIONS AND ACCESSORIES

24 Mpts max. (interleaved), 12 Mpts/Ch memory option	VBA-VL
16 Mpts max. (interleaved), 8 Mpts/Ch memory option	VBA-L
8 Mpts max. (interleaved), 4 Mpts/Ch memory option	VBA-M
32 Digital Channel Oscilloscope Mixed Signal Option	MS-32
CANbus TDM Trigger, Decode, and Measure/Graph Testing Option	CANbus TDM
CANbus TD Trigger and Decode Testing Option	CANbus TD
CANbus TDM Trigger, Decode, and Measure/Graph Testing Option with a License for Software to be Used on 5 Oscilloscopes	CANbus TDM-5LIC
CANbus TD Trigger and Decoding Testing Option with a License to Work on 5 Oscilloscopes	CANbus TD-5LIC
CAN 1041 Opto-isolated High-speed Trigger Coupler	TC1041-OPTO
CAN 1050 Opto-isolated High-speed Trigger Coupler	TC1050-OPTO

VEHICLE BUS ANALYZERS

ORDERING INFORMATION	PRODUCT CODE
OPTIONS AND ACCESSORIES (CONTINUED)	
CAN 1054 Opto-isolated Low-speed Trigger Coupler	TC1054-OPTO
CAN 251 Opto-isolated High-speed Trigger Coupler (one is included with CANbus TD)	TC251-OPTO
CAN 5790c Opto-isolated Single-wire Trigger Coupler	TC5790c-OPTO
CAN B10011S Opto-isolated Truck and Bus Trigger Coupler	TC10011-OPTO
CAN Cable Set (ISO 11898-2)	902329-00
CAN Cable Set (ISO 11519, GM-LAN/J2411)	902330-00
CAN Bus Y Connection Cable, 2m with Terminating Resistor	902393-00
1 GHz Active Differential Probe (÷1, ÷10, ÷20)	AP034
500 MHz Active Differential Probe (x10, ÷1, ÷10, ÷100)	AP033
1,400 V, 100 MHz High-Voltage Differential Probe	ADP305
1,400 V, 20 MHz High-Voltage Differential Probe	ADP300
1 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP1000
1.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP1500

CATC™ PROTOCOL ANALYZER SYSTEM

The CATC™ Protocol Analyzer System, also known as the CATC Platform, is the foundation upon which LeCroy's test and verification tools are built. The CATC platform not only supports today's communication protocols but also technologies of the future. With interchangeable plug-ins, field upgradeable firmware, and the ability to link multiple analyzers together for higher bandwidth applications, the CATC platform can evolve, as your protocol analysis needs change.

The CATC platform, with a protocol analyzer and/or exerciser module, is a complete solution for testing and verifying serial-based communications. It offers modularity with interchangeable plug-ins for different protocols, and a real-time recording engine for capturing the traffic that interests you most. It's tightly coupled with the *Tracer*™ software that interprets and explains protocol behavior.

LeCroy offers three versions of the CATC platform—the CATC 2500H for low-speed communication protocols, the CATC 10K for high-speed communications links, and the advanced CATC 100K platform.

SPECIFICATIONS

CATC 100K PLATFORM

Recording Memory Size	4 GB for trace capture, timing, and control information
Host Requirements	Windows 2000, or greater; Intel Pentium II processor or greater; USB port
Power Requirements	90-254 VAC, 47-63 Hz (universal input), 200 W maximum
Connectors	AC power connection, External trigger connection (TRIG IN/OUT, BNC) USB type "B" host computer connection, Breakout Board Data Output Connection (RS232)

INDICATORS

PWR	Lights when power is on
STATUS	Lights during power up of platform; Blinks if self-test fails
Triggered	Lights when triggering an event
Slot 1 Status	Lights when analyzer in slot 1 is recording
Slot 1 Status	Lights when analyzer in slot 2 is recording

SWITCHES

Power	On/Off
Manual Trigger	Forces a trigger event when pressed

PHYSICAL DIMENSIONS

Dimensions	12.2" x 12.2" x 3.5" (311 mm x 311 mm x 89 mm)
Net Weight	3.4 kg (7.5 lbs.)

ENVIRONMENTAL

Temperature: Operating	0 °C to 55 °C (32 °F to 131 °F)
Temperature: Non-Operating	-20 °C to 80 °C (-4 °F to 176 °F)
Humidity: Operating	10% to 90% RH (non-condensing)

CATC 10K PLATFORM

Recording Memory Size	2 GB for trace capture, timing, and control information
Host Requirements	Windows 2000, or greater; Intel Pentium II processor or greater; USB port
Power Requirements	90-254 VAC, 47-63 Hz (universal input), 150 W maximum
Connectors	AC power connection, External trigger connection (TRIG IN/OUT, BNC) USB type "B" host computer connection, Breakout Board Data Output Connection (RS232)

CATC PROTOCOL ANALYZER SYSTEM

INDICATORS	
PWR	Lights when power is on
STATUS	Lights during power up of platform; Blinks if self-test fails

SWITCHES	
Power	On/Off
Manual Trigger	Forces a trigger event when pressed

PHYSICAL DIMENSIONS	
Dimensions	12.2" x 12.2" x 3.5" (311 mm x 311 mm x 89 mm)
Net Weight	3.4 kg (7.5 lbs.)

ENVIRONMENTAL	
Temperature: Operating	0 °C to 55 °C (32 °F to 131 °F)
Temperature: Non-Operating	-20 °C to 80 °C (-4 °F to 176 °F)
Humidity: Operating	10% to 90% RH (non-condensing)

CATC 2500H PLATFORM	
Recording Memory Size	512 MB for trace capture, timing, and control information
Host Requirements	Windows 2000, or greater; Intel Pentium II processor or greater; USB port
Power Requirements	90-254 VAC, 47-63 Hz (universal input), 125 W maximum
Connectors	AC power connection, External trigger connection (TRIG IN/OUT, BNC), USB type "B" host computer connection, Breakout Board Data Output Connection (RS232)

INDICATORS	
PWR	Lights when power is on
STATUS	Lights during initialization; Blinks if self-test fails

SWITCHES	
Power	On/Off
Manual Trigger	Forces a trigger event when pressed

PHYSICAL DIMENSIONS	
Dimensions	12.2" x 12.2" x 3.5" (311 mm x 311 mm x 89 mm)
Net Weight	3.4 kg (7.5 lbs.)

ENVIRONMENTAL	
Temperature: Operating	0 °C to 55 °C (32 °F to 131 °F)
Temperature: Non-Operating	-20 °C to 80 °C (-4 °F to 176 °F)
Humidity: Operating	10% to 90% RH (non-condensing)

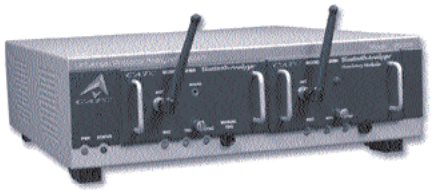
ALL PLATFORMS WARRANTY AND SERVICE	
	3-year warranty. Optional service programs include extended warranty, maintenance, upgrades, trade-ins, and rental services.

ORDERING INFORMATION	PRODUCT CODE
CATC 100K Platform	PT003UXA-X
CATC 10K Platform	PT002UXA-X
CATC 2500H Platform	PT001UXB-X
CATC Platform Breakout Board	800-0031-00
Small Carrying Case (For use with CATC 2500H and 10K Platforms)	AC001XXA-X
Large Carrying Case (For use with CATC 100K Platform)	AC002XXA-X

BLUETOOTH® PROTOCOL SOLUTIONS

BT*Tracer/Trainer*™ Protocol Analyzer and Exerciser

The BT*Tracer/Trainer* system offers you the analysis tools necessary for Bluetooth design and verification. It provides a robust, flexible, and efficient integrated environment for both Bluetooth v1.2 analysis and v1.1 traffic generation. Built on the CATC 2500H platform, the BT*Tracer*™ analyzer can automatically synchronize with the BT*Trainer*™ exerciser to easily capture the results of tests. The BT*Tracer* is also available as an individual module.



BTTRACER/TRAINER

The BT*Tracer/Trainer* and the *Tracer* software system offers you features to ease development and testing of Bluetooth:

- Advanced software provides accurate, reliable, and complete decodes of protocols and profiles, such as Baseband, HCI, LMP, SDP, and PPP.
- The CATC Trace display presents a transaction level view of piconet traffic with accurate time stamps and frequency hop information.
- Powerful triggering capabilities allow you to trigger on various conditions, including protocol packet errors, transaction errors, packet type, destination device, and data patterns.
- Full-featured filtering capabilities isolate areas of interest, and filters out unwanted traffic in order to maximize memory buffer utilization.
- Intelligent traffic reports and summaries track error rates, abnormalities, or timing conditions.
- Script level traffic generation provides programmability to test Bluetooth devices with precision and control.
- Trace files convert into generation scripts to recreate failure scenarios by replaying recorded traffic.
- Sophisticated traffic generation can establish or participate in a piconet, and send or receive data within the piconet.

CATC Platform Specifications (See Page D-1)

SPECIFICATIONS: BT*TRACER/TRAINER* PLUG IN MODULES

Connectors	Headset connection (standard 2.5 mm audio)
Radio	Bluetooth v1.1 qualified, Class 2, FCC, and CE Compliant
HCI Probe	Simultaneous probe and decode RS232, UART, BlueCore, and piconet traffic

INDICATORS (LEDS)

REC (green)	Lights when actively recording
TRG (orange)	Lights when triggering an event or power-on testing
SYNC	Flashes when analyzer tracks defined slave or master device; Lights when analyzer tracks active piconet

PHYSICAL DIMENSIONS

Dimensions (each)	4.5" x 6.7" x 1.3" (113 mm x 170 mm x 32 mm)
Net Weight (each)	0.5 kg (1.0 lb.)

ORDERING INFORMATION	PRODUCT CODE
Bluetooth v1.2 BT*Tracer/Trainer* System	BT004APA-X
Bluetooth v1.2 BT*Tracer/Trainer* Module	BT004MPA-X
Bluetooth v1.2 BT*Tracer* System	BT004AAA-X
Bluetooth v1.2 BT*Tracer* Analyzer Module	BT004MAA-X
Bluetooth v1.2 BT*Tracer* Auxiliary Module	BT005MAA-X

BLUETOOTH PROTOCOL SOLUTIONS

MERLIN II

Merlin™ II Protocol Analyzer

Compatible with Bluetooth v1.2 and EDR-ready, the Merlin II protocol analyzer is a small form factor stand-alone unit with a radio interface that allows you to probe and analyze transactions at the lowest level within the Bluetooth architecture. By creating this probing point within the radio level packet view, you can analyze all levels of the protocol stack. Merlin II works with the *Tracer* software interface for detailed capture and analysis of Bluetooth protocol. For very long recording sessions, the analyzer can spool data to an external disk drive extending the memory capacity.

SPECIFICATIONS: MERLIN II

Host Requirements	Windows 2000, Windows XP or greater; Intel Pentium II Processor or greater; USB port
Recording Memory Size	Internal 32 MB, disk spooling capabilities
Power Requirements	100 V-240 VAC, 50-60 Hz, PS/2 Power Cable: 5 V, 800 mA DC
Connectors	DC Power, Mini DIN, Host Connection (USB Type "B"), Antenna (Reverse Polarity SMA)
Radio	Bluetooth v1.1 qualified, Class 2, FCC, and CE Compliant

INDICATORS (LEDS)

STATUS (blue)	Lights when analyzer is on
SYNC (yellow)	Lights when tracking active piconets
REC (green)	Lights when actively recording

ENVIRONMENTAL

Temperature: Operating	0 °C to 55 °C (32 °F to 131 °F)
Temperature: Non-Operating	-20 °C to 80 °C (-4 °F to 176 °F)
Humidity: Operating	10% to 90% RH (non-condensing)

PHYSICAL DIMENSIONS

Dimensions	6.1" x 3.0" x 1.1" (155 mm x 76 mm x 27 mm)
Net Weight	246 g (8.8 oz.)

WARRANTY AND SERVICE

	3-year warranty. Other service programs include upgrades, trade-ins, and rental services.

ORDERING INFORMATION	PRODUCT CODE
Bluetooth v1.2 BT Merlin II Analyzer	BT006UAA-X
Bluetooth v1.2 BT Merlin II Analyzer Maintenance	BT006UAA-M

FIBRE CHANNEL PROTOCOL SOLUTIONS

The Fibre Channel Protocol Analyzers offer you the advanced analysis tools necessary to speed the testing and deployment of Fibre Channel platforms. The FC*Tracer*™ analyzers uses the *Tracer* display software, which has features to ease time for test and debugging of the Fibre Channel fabric:

- Advanced software provides you with accurate, reliable, and complete decodes of FC-2 and FC-4 levels.
- The CATC Trace display shows captured traffic at the Frame, Sequence, and Exchange levels for chronological and logical viewing of the trace. LinkTracker displays all DWORDS on all channels synchronized to a common clock. FrameTracker shows a summary of all frames in a time-synchronized table.
- Powerful triggering conditions uses two independent sequencers that can track two unrelated series of events in parallel. Each sequencer can separately monitor up to 256 levels of trigger logic with up to six events per level.
- Full-featured filtering capabilities isolate areas of interest and filters out unwanted traffic in order to maximize memory buffer utilization.
- Performance metrics facilitate calculation and display of average throughput, latency, and response time for a specific portion of the traffic.
- Intelligent traffic reports presents summaries on error rates, abnormal bus, or timing conditions. Any of the traffic report data selected for detailed study can be hyperlinked back into the *Tracer* software.
- Sophisticated Verification Script Engine makes custom scripts available to extract information from an FC*Tracer* recording, and is used by test engineers to create automated analysis tests that open and parse actual trace files.

FC*TRACER* 4G

FC*TRACER* 2G

FC*Tracer* 4G Protocol Analyzer

The FC*Tracer* 4G analyzer is a plug-in module for the CATC 10K platform, and supports all transfer rates. You can cascade up to 4 FC*Tracer* systems to display traffic synchronized to a single clock reference (up to 16 links).

FC*Tracer* 2G Protocol Analyzer

The FC*Tracer* 2G analyzer employs a high-impedance, non-intrusive probing technology allowing fully unaltered data pass-through. It supports 2 and 1 Gbps Fibre Channel transfer rates, and provides up to eight transparent taps using active port bypass circuits capable of recording 1 and 2 Gbps traffic at full line rate. By cascading up to four 2G analyzers, you can capture and analyze up to 32 channels of traffic.

CATC PLATFORM SPECIFICATIONS (SEE PAGE D-1)

SPECIFICATIONS: FC*TRACER*/FC*TRACER* 4G PLUG IN MODULE

Basic Trigger Events	Primitives, Data Frames, Disconnect or connect Link, Frame Header, SOF Primitive, EOF Primitive, Basic Link Services, SCSI Operations, Switch Interlink Service Commands
Traffic Summary Reports	Data Frames, Primitives, Connects/Disconnects, Errors, Read/Write Response
Bus Utilization Reports	Pending SCSI, SCSI Response, Latency, Throughput, Frame Length, Data Throughput, Link Utilization, Frame Count
Connectors	Fibre Channel Connection (4)

FIBRE CHANNEL PROTOCOL SOLUTIONS

INDICATORS (LEDS)

REC (green)	Lights when actively recording
TRG (orange)	Lights when triggering an event, or power-on testing
UPLD (green)	Lights when uploading recording memory to the host

PHYSICAL DIMENSIONS: FC*TRACER* 2G

Dimensions	4.5" x 6.7" x 1.3" (113 mm x 170 mm x 89 mm)
Net Weight	.77 kg (1.69 lbs.)

PHYSICAL DIMENSIONS: FC*TRACER* 4G

Dimensions	9.3" x 6.7" x 1.3" (236 mm x 170 mm x 32 mm)
Net Weight	.82 kg (1.8 lbs.)

ORDERING INFORMATION	PRODUCT CODE
FC*TRACER* 4G PRODUCTS	
Fibre Channel FC*Tracer* 4G 2 Ch Analyzer System	FC006AAA-X
Fibre Channel FC*Tracer* 4G 4 Ch Analyzer System	FC007AAA-X
Fibre Channel FC*Tracer* 4G 8 Ch Analyzer System	FC008AAA-X
Fibre Channel FC*Tracer* 4G 16 Ch Analyzer System	FC009AAA-X
Fibre Channel FC*Tracer* 4G 2 Ch Analyzer Module	FC003MAA-X
Fibre Channel FC*Tracer* 4G 4 Ch Analyzer Module	FC004MAA-X
FC*Tracer* 4G 2 Ch Analyzer System Maintenance	FC006AAA-M
FC*Tracer* 4G 4 Ch Analyzer System Maintenance	FC007AAA-M
FC*Tracer* 4G 8 Ch Analyzer System Maintenance	FC008AAA-M
FC*Tracer* 4G 16 Ch Analyzer System Maintenance	FC009AAA-M
FC*Tracer* 4G 2 Ch Analyzer Module Maintenance	FC003MAA-M
FC*Tracer* 4G 4 Ch Module Maintenance	FC004MAA-M
FCTRACER 2G PRODUCTS	
Fibre Channel FC*Tracer* 2G 2 Ch Analyzer System	FC001AAA-X
Fibre Channel FC*Tracer* 2G 4 Ch Analyzer System	FC002AAA-X
Fibre Channel FC*Tracer* 2G 8 Ch Analyzer System	FC003AAA-X
Fibre Channel FC*Tracer* 2G 16 Ch Analyzer System	FC004AAA-X
Fibre Channel FC*Tracer* 2G 32 Ch Analyzer System	FC005AAA-X
Fibre Channel FC*Tracer* 2G 2 Ch Module	FC001MAA-X
Fibre Channel FC*Tracer* 2G 8 Ch Module	FC002MAA-X
FC*Tracer* 2G 2 Ch Analyzer System Maintenance	FC001AAA-M
FC*Tracer* 2G 4 Ch Analyzer System Maintenance	FC002AAA-M
FC*Tracer* 2G 8 Ch Analyzer System Maintenance	FC003AAA-M
FC*Tracer* 2G 16 Ch Analyzer System Maintenance	FC004AAA-M
FC*Tracer* 2G 32 Ch Analyzer System Maintenance	FC005AAA-M
FC*Tracer* 2G 8 Ch Module Maintenance	FC002MAA-M
FIBRE CHANNEL ANALYZER ACCESSORIES	
Multimode Fibre 4 Gbps SFP Connector Kit	FC005ACA-X
Copper 1-2 Gbps SFP Connector Kit	FC001ACA-X
Multimode Fibre 2 Gbps (LC) Transceiver Connector Kit	FC002ACA-X
Multimode Fibre 2 Gbps (SC) Transceiver Connector Kit	FC004ACA-X
Singlemode Optical 1-2 Gbps SFP Connector Kit	FC003ACA-X

1394 PROTOCOL SOLUTIONS

FireInspector™ Analyzer

The LeCroy FireInspector IEEE 1394 Protocol Analyzer offers powerful functionality, flexibility, and user-friendliness for the IEEE 1394-based (FireWire and I.Link) product development and test communities. FireInspector Plus™ includes traffic generation capabilities.

FIREINSPECTOR

SPECIFICATIONS

Basic Events Detected	Bus Conditions, PHY packets, acknowledge packets, transaction codes, data patterns, hardware-detected errors, external signals
Generating Memory Size	64M x 8-bit DRAM
Host Requirements	Windows 2000, Windows XP or greater; Intel Pentium II processor or greater; USB port
Power Requirements	90-264 VAC, 47-63 Hz (universal input), 125 W maximum
Connectors	USB Connection, 1394 Connection (6-pin) (3)

INDICATORS (LEDS)

PWR	Lights when powered on
TRG	Lights when triggering an event or power-on testing
REC	Lights when actively recording

ENVIRONMENTAL

Temperature: Operating	0 °C to 55 °C (32 °F to 131 °F)
Temperature: Non-Operating	-20 °C to 80 °C (-4 °F to 176 °F)
Humidity: Operating	10% to 90% RH (non-condensing)

PHYSICAL DIMENSIONS

Dimensions	10.5" x 10.4" x 2.4" (267 mm x 265 mm x 60 mm)
Net Weight	1.6 kg (3.5 lbs.)

WARRANTY AND SERVICE

	3-year warranty. Other service programs include extended warranty, upgrades, trade-ins and rental services.

ORDERING INFORMATION	PRODUCT CODE
1394 FireInspector Plus Analyzer/Generator	FW001UPA-X
1394 FireInspector Analyzer	FW001UAA-X
1394 FireInspector Reduced Speed Option	FW501SUA-X

INFINIBAND PROTOCOL SOLUTIONS

IB*TRACER* 4X

IB*Tracer*™ 4X Protocol Analyzer

IB*Tracer* 4X protocol analyzer advances validation and compliance testing for next generation InfiniBand silicon, switches, and software. Supporting 4X 2.5 Gb/s dual simplex connections, the IB*Tracer* 4X captures bus traffic and uses the CATC Trace display to show it. The *Tracer* software gives you full access to advanced triggering, search, filtering, and viewing capabilities for quick analysis of your InfiniBand traffic. The analyzer is built on the CATC 10K platform, and can also support 1X.

IB*Tracer* Protocol Analyzer

Installed in the CATC 2500H Platform, the IB*Tracer* analyzer is designed for analysis of InfiniBand 1X traffic.

CATC Platform Specifications (See Page D-1)

IB*TRACER* 4X SPECIFICATIONS

Basic Trigger Conditions	Conditions (Training sequences, Link Packets, Data Packets), Packet Patterns, Errors
Connectors	Recording Channel (8 pair MicroGigaCN)

PHYSICAL DIMENSIONS

Dimensions	4.5" x 6.7" x 1.3" (113 mm x 170 mm x 32 mm)
Net Weight	.77 kg (2 lbs.)

IB*TRACER* SPECIFICATIONS

GENERAL

Basic Trigger Events	Conditions (Training sequences, Link Packets, Data Packets), Packet Patterns, Errors
Connectors	Recording Channel (HSSDC2)
Status Indicator	Lights when power is on

PHYSICAL DIMENSIONS

Dimensions	4.5" x 6.7" x 1.3" (113 mm x 170 mm x 32 mm)
Net Weight	0.5 kg (1.0 lb.)

ORDERING INFORMATION	PRODUCT CODE
InfiniBand IB*Tracer* 4X Analyzer System	IB002AAA-X
InfiniBand IB*Tracer* 4X Analyzer Module	IB002MAA-X
InfiniBand IB*Tracer* Software Version 2.3 (SPEC 1.1)	IB003SNA-X
InfiniBand IB*Tracer* 1X Analyzer System	IB001AAA-X
InfiniBand IB*Tracer* 1X Analyzer Module	IB001MAA-X

PCI EXPRESS™ PROTOCOL SOLUTIONS

The PCI Express Protocol Analyzers and Exercisers offer you the advanced analysis tools necessary to speed the development and testing of PCI Express IP cores, semiconductors, bridges, switches, boards, and systems.

PE*TRACER* EML

The *Tracer* software offers you many features to ease time to market for PCI Express Solutions:

- Advanced software provides accurate, reliable, and complete decodes of Transaction Layer Packets (TLPs), Data Link Layer Packets (DLLPs), and all PCI Express ordered sets.
- The CATC Trace display shows captured traffic at the packet, link transaction and split transaction levels for chronological and logical viewing of the trace.
- Link Tracker™ displays all DWORDS on all channels synchronized to a common clock.
- Powerful triggering conditions allow for you to trigger on Error, Link, TLP, DLLP, or any user-defined data pattern or multiple events in the traffic.
- Full-featured filtering capabilities isolate areas of interest, and filters out unwanted traffic in order to maximize memory buffer utilization.
- Performance metrics facilitate calculation and display of timing, bus utilization, and data throughput.
- Intelligent traffic reports and summaries illustrate the occurrence of errors, TLP, DLLP, and link conditions. Any of the traffic report data selected for detailed study can be hyperlinked back into the *Tracer* software.

When used with a LeCroy protocol exerciser, the software assists you with analyzing and exercising PCI Express components:

- Script level traffic generation provides programmability to test PCI Express components with precision and control.
- Trace files convert into generation scripts to recreate failure scenarios by replaying recorded traffic.
- Programmable transaction layer defines arbitrary sequence of transactions, payload generation, and conditional repeat of transactions.
- Programmable data link layer gives you the ability to modify flow control, ACK/NAK, and retry behaviors.

PE*Tracer*™ EML Protocol Analyzer

The PE*Tracer* EML analyzer allows for full bi-directional support of x16, x8, x4, x2, and x1 PCI Express links and employs a high-impedance, non-intrusive probing technology allowing fully unaltered data pass-through. The PE*Tracer* EML analyzer is built upon the CATC 100K Platform, which supports PCI Express Gen1 at the full speed of 2.5 GHz per lane. Two probe options are available for advanced analysis: the x16 Slot Interposer Probe for capturing signals between a motherboard and an add-in card, and the Mid-Bus Probe for capturing inter-chip signaling on a PCI Express Board.

PE*Trainer*™ EML Protocol Exerciser

The PE*Trainer* EML exerciser is a PCI Express system that is capable of generating and responding to all types of PCI Express transactions. Built on the CATC 100K platform, the exerciser is available in either x16 or x8 configurations, though you may configure each to a narrower lane width as desired. Two probe options are available for testing both the host and the device sides of a PCI Express link: the x16 Device Emulation Interposer for connecting to a PCI Express motherboard and the Host Emulation platform for testing PCI Express add-on cards.

PCI EXPRESS PROTOCOL SOLUTIONS

PE*TRACER* ML

PE*Tracer* ML Protocol Analyzer

With the CATC 10K Platform as its chassis, a single PE*Tracer* ML analyzer supports bi-directional x4, x2, and x1 links, as well us unidirectional x8 PCI Express link data capture and analysis. You can have full bi-directional decode and capture of a x8 link by combining two analyzer systems. Two probe options are available for advanced analysis: the Slot Interposer Probe (available in x8, x4, or x1) for capturing signals between a motherboard and an add-in card, and the Mid-Bus Probe for capturing inter-chip signaling on a PCI Express Board.

PE*Trainer* ML Protocol Exerciser

The PE*Trainer* ML exerciser, using the CATC 10K platform, is a multi-lane PCI Express system that supports both x4 and x1 links. It will assist you with early validation of designs along with error injection and stress testing in preparation for compliance testing. Two probe options are available for testing both the host and the device sides of a PCI Express link: the Device Emulation Interposer (available in both x4 and x1) for connecting to a PCI Express motherboard and the Host Emulation platform for testing PCI Express add-on cards.

CATC Platform Specifications (See Page D-1)

SPECIFICATIONS: PE*TRACER/TRAINER*™ EML PLUG IN MODULE

Basic Trigger Events	TLP Header, DLLP Message, Link Condition, Payload, Errors
Reporting/Statistics	Transaction Layer Packet (TLP), Data Link Layer Packet, Link Transactions, Split Transactions, Error Reports
Breakout Board	Pattern match on 4 bit user I/O
Connectors	Probe Data Connection (2)
	High Speed Expansion Ports (2)

INDICATORS (LEDS)

Activity	Lights when traffic is on link
Cable Setup	Lights when cable is connected to interposer

PHYSICAL DIMENSIONS

Dimensions (each)	9.16" x 6" x 1.25" (233 mm x 152 mm x 32 mm)
Net Weight (each)	1.58 kg (3.5 lbs.)

PCI EXPRESS PROTOCOL SOLUTIONS

SPECIFICATIONS: PE*TRACER* ML PLUG IN MODULE

Basic Trigger Events	TLP Header, DLLP Message, Link Condition, Payload, Errors
Reporting/Statistics	Transaction Layer Packet (TLP), Data Link Layer Packet, Link Transactions, Split Transactions, Error Reports
Breakout Board	Filter in/out capabilities
Connectors	Probe Data Connection (2)

INDICATORS (LEDS)

REC (green)	Lights when actively recording
TRG (orange)	Lights when triggering an event
UPLD (green)	Lights when uploading data to host
Status (Tracer) (green)	Lights when traffic is on the link
Connect (Trainer)	Lights when cabling is correct

PHYSICAL DIMENSIONS

Dimensions (each)	9.3" x 6.7" x 1.3" (236 mm x 170 mm x 32 mm)
Net Weight (each)	0.77 kg (1.7 lbs.)

ORDERING INFORMATION: PE*TRACER/TRAINER* EML	PRODUCT CODE
PCI Express *PETracer* EML x8 Analyzer System	PE009AAA-X
PCI Express *PETracer* EML x8 Analyzer Module Kit	PE009MAA-X
PCI Express *PETrainer* EML x8 Exerciser System	PE009AGA-X
PCI Express *PETrainer* EML x8 Exerciser Module Kit	PE009MGA-X
PCI Express *PETracer/Trainer* EML x8 Analyzer/Exerciser Bundle	PE009APA-X
PCI Express *PETracer* EML x16 Upgrade from EML x8	PE008SUA-X
PCI Express *PETracer* EML x16 Analyzer System	PE008AAA-X
PCI Express *PETracer* EML x16 Analyzer Module Kit	PE008MAA-X
PCI Express *PETrainer* EML x16 Exerciser System	PE008AGA-X
PCI Express *PETrainer* EML x16 Exerciser Module Kit	PE008MGA-X
PCI Express *PETracer/Trainer* EML x16 Analyzer/Exerciser Bundle	PE008APA-X
PCI Express *PETracer* EML x16 Slot Interposer	PE001UIA-X
PCI Express *PETrainer* EML x16 Device Emulation Interposer	PE001UEA-X
PCI Express *PETrainer* EML Host Emulation Platform	PE002UEA-X
PCI Express *PETracer/PETrainer* EML Cable Assembly	PE003UCA-X
PCI Express *PETracer* EML x8 Analyzer System Maintenance	PE009AAA-M
PCI Express *PETracer* EML x8 Analyzer Module Maintenance	PE009MAA-M
PCI Express *PETrainer* EML x8 Exerciser System Maintenance	PE009AGA-M

PCI EXPRESS PROTOCOL SOLUTIONS

ORDERING INFORMATION: PE*TRACER/TRAINER* EML (CONTINUED)	PRODUCT CODE
PCI Express *PETracer* EML x8 Exerciser Module Maintenance	PE009MGA-M
PCI Express *PETracer/Trainer* EML x8 System Maintenance	PE009APA-M
PCI Express *PETracer* EML x16 Analyzer System Maintenance	PE008AAA-M
PCI Express *PETracer* EML x16 Analyzer Module Maintenance	PE008MAA-M
PCI Express *PETrainer* EML x16 Exerciser System Maintenance	PE008AGA-M
PCI Express *PETrainer* EML x16 Exerciser Module Maintenance	PE008MGA-M
PCI Express *PETracer/Trainer* EML x16 System Maintenance	PE008APA-M

PE*TRACER/TRAINER* ML	
PCI Express PE*Tracer* ML x4 Analyzer System	PE002AAB-X
PCI Express PE*Tracer* ML x4 Analyzer Module Kit	PE002MAB-X
PCI Express PE*Trainer* ML x4 Exerciser System	PE002AGA-X
PCI Express PE*Trainer* ML x4 Exerciser Module Kit	PE002MGA-X
PCI Express PE*Tracer/Trainer* ML x4 Analyzer/Exerciser Bundle	PE002APA-X
PCI Express PE*Tracer* ML x8 Analyzer System	PE003AAB-X
PCI Express PE*Tracer* ML Analyzer x4 Upgrade to x8	PE007AAB-X
PCI Express PE*Tracer* ML x1 Slot Interposer	800-0079-00
PCI Express PE*Tracer* ML x4 Slot Interposer	800-0069-00
PCI Express PE*Tracer* ML x8 Slot Interposer	800-0068-00
PCI Express PE*Trainer* ML x1 Device Emulation Interposer	800-0084-00
PCI Express PE*Trainer* ML x4 Device Emulation Interposer	800-0083-00
PCI Express PE*Trainer* ML Host Emulation Platform	800-0082-00
PCI Express PE*Tracer* ML x4 Cable Assembly	180-0068-00
PCI Express PE*Tracer* ML x8 Cable Assembly	180-0066-00
PCI Express PE*Tracer* ML x4 Analyzer System Maintenance	PE002AAB-M
PCI Express PE*Tracer* ML x4 Analyzer Module Maintenance	PE002MAB-M
PCI Express PE*Trainer* ML x4 Exerciser System Maintenance	PE002AGA-M
PCI Express PE*Trainer* ML x4 Exerciser Module Maintenance	PE002MGA-M
PCI Express PE*Tracer/Trainer* ML x4 System Maintenance	PE002APA-M
PCI Express PE*Tracer* ML x8 Analyzer System Maintenance	PE003AAB-M
PCI Express PETracer ML x1 Analyzer System Maintenance	PE001AAD-M
PCI Express PE*Tracer* ML x1 Analyzer Module Maintenance	PE001MAD-M

MISC. *TRACER/TRAINER* ACCESSORIES	
PCI Express Mid-Bus Probe Test Interposer	PE005UIA-X
PCI Express ExpressCard Interposer	PE006UIA-X
PCI Express PE*Tracer* x1 Slot Interposer	800-0079-00
PE*Tracer* Mid-Bus Probe Pod	PE001UAA-X
PCI Express PE*Tracer* Mid-Bus Probe	PE001ACA-X
PE*Tracer* Mid-Bus Probe Header Cable	PE002ACA-X
PE*Tracer* Mid-Bus Probe Header-Custom	PE003ACA-X
PE*Tracer* EML x1-x8 Mid-Bus Probe Cable	PE003ADA-X
PCI Express x16 to x8 Card Edge Adapter	PE002UIA-X
PCI Express x16 to x4 Card Edge Adapter	PE003UIA-X
PCI Express x16 to x1 Card Edge Adapter	PE004UIA-X

SAS/SATA PROTOCOL SOLUTIONS

The Serial Attached SCSI (SAS) and Serial Attached ATA (SATA) Protocol Analyzers and Exercisers offer you the advanced analysis tools necessary to speed the development and testing of SAS and SATA semiconductors, devices, and systems. Systems are available to capture and generate SAS traffic—with the ability to also capture SATA traffic (SA*Tracer*/*Trainer*™), or to transmit just SATA traffic (SA*Tracer*/*Trainer*™). Individual *Tracer* modules are also available for both protocols. These products operate at 3 and 1.5 Gbps speeds.

SAS*TRACER*

The *Tracer* software offers you many features to ease time to market for SAS/SATA Solutions:

- Advanced software provides accurate, reliable, and complete decodes of transport layer, STP, SATA, and SMP transactions.
- The CATC Trace display shows captured traffic at the Command and FIS levels for chronological and logical viewing of the trace. Link Tracker displays all DWORDS on all channels synchronized to a common clock. Frame Tracker™ shows a summary view of transport level events in a time-synchronized table format.
- Powerful triggering conditions allow for you to trigger on out of band signals, commands, primitives, errors, or FISs from specific ports. It can monitor up to 256 levels of condition trigger logic with up to three events per level.
- Full-featured filtering capabilities isolate areas of interest, and filters out unwanted traffic in order to maximize memory buffer utilization.
- Performance metrics facilitate calculation and display of average throughput, latency, and response time for a specific portion of the traffic.
- Intelligent traffic reports and summaries provide high-level abstraction of events, operations, and errors for each link under analysis. Any of the traffic report data selected for detailed study can be hyperlinked back into the *Tracer* software.

When used with a LeCroy protocol exerciser, the software assists you with analyzing and exercising SAS/SATA components:

- Script level traffic generation provides programmability to test SAS and SATA systems with precision and control.
- Trace files convert into generation scripts to recreate failure scenarios by replaying recorded traffic.
- Advanced handshaking allows for the system to automatically reply to out of band and speed negotiation signals; it can open connections, acknowledge frames, and react to any inbound SAS or SATA frame or pattern.

SAS/SATA PROTOCOL SOLUTIONS

SATRACER/TRAINER

SAS*Tracer*™ Protocol Analyzer

Utilizing the CATC 10K platform, the SAS*Tracer* analyzer combines non-intrusive, multi-port recording with an intuitive display of bus traffic. Multiple SAS*Tracer* systems can be cascaded together to provide a time-synchronized display of traffic across 8 or 16 links. The SAS*Tracer* analyzer has 4 sets of connectors that can capture and display traffic from single lane, 2- or 4-wide port configurations or from up to 8 points along a complex topology. The SAS*Tracer* can also be used as a SATA protocol analysis tool.

SAS*Tracer/Trainer* Protocol Analyzer and Exerciser

When configured with the SAS*Trainer*™ exerciser option, the system can transmit a single link of 3 or 1.5 Gbps traffic while providing 1 or 2 recording channels. LeCroy's Compliance Test Suite for SAS accompanies the SAS*Trainer*™, and can uncover latent compliance problems before a device or system enters production. The CTS software includes specific scripts for testing initiator, target, and expander device compliance. The test suite addresses portions of the protocol that establish connections, perform discovery, manage arbitration as well as perform error recovery at the SSP transport layer. The SAS*Tracer/Trainer* system can be used as a SATA protocol analysis and traffic generation system as well.

SA*Tracer* 3G Protocol Analyzer

The SA*Tracer*™ analyzer, installed in the CATC 10K platform, utilizes production level transceiver silicon designed to be fully compatible with SATA. It triggers and records the critical out-of-band signaling, supports spread spectrum clocked signals, and displays SATA link speeds. Available with 1, 2 or 4 recording channels, the SA*Tracer* 3G analyzer can also be cascaded with multiple LeCroy systems to provide a synchronized display of SATA traffic across 8 or 16 links.

SA*Tracer/Trainer* 3G Protocol Analyzer and Exerciser

The SA*Tracer/Trainer* system is an all in one test tool for SATA traffic analysis and generation. Built on the CATC 10K platform, the SA*Trainer*™ module transmits traffic to emulate host or device side SATA communications.

SA*Tracer* and SA*Tracer/Trainer* 1.5G Protocol Analyzer and Exerciser

Versions of the SA*Tracer* analyzer and the SA*Tracer/Trainer* system are also available for the 1.5 Gbps speed, and are based on the CATC 2500H platform.

CATC Platform Specifications (See Page D-1)

SPECIFICATIONS: SAS*TRACER*/SA*TRACER* PLUG IN MODULE

Basic Trigger Events	Primitives, Bus Conditions, FISs, Errors, ATA Commands, SATA Commands, External Signals Vendor FIS, SCSI Operations (SAS*Tracer*)
Traffic Summary Reports	Errors, Primitives, FIS, Commands
Bus Utilization Reports	Average data throughput, Hold Primitives per Sequence, Idle Time, Errors per Command, Data Count, Hold Count per Command, Average time between payload frames

SAS/SATA PROTOCOL SOLUTIONS

CONNECTORS

	1-Port Model: Single Pair of Internal Connectors or Single Pair of External Connectors 2-Port Model: Dual Pair of Internal Connectors or Dual Pair of External Connectors 4-Port Model: Four Pairs of Internal Connectors or Four Pairs of External Connectors

INDICATORS (LEDS)

REC (green)	Lights when unit is actively recording
TRG (orange)	Lights when triggering an event or during power-on testing
UPLD (green)	Lights when uploading data to host

PHYSICAL DIMENSIONS

Dimensions	4.5" x 6.7" x 1.3" (113 mm x 170 mm x 89 mm)
Net Weight	.77 kg (1.9 lbs.)

SPECIFICATIONS: SAS *TRAINER*/SATA *TRAINER* PLUG IN MODULE

Connectors	Single Initiator and Target connectors (for transmission only)

INDICATORS (LEDS)

TARGET	Lights during target emulation
ACTIVE	Lights when traffic is active
INITIATOR	Lights during initiator emulation

PHYSICAL DIMENSIONS

Dimensions	4.5" x 6.7" x 1.3" (113 mm x 170 mm x 89 mm)
Net Weight	.77 kg (1.9 lbs.)

ORDERING INFORMATION: SAS *TRACER/TRAINER* PRODUCTS	PRODUCT CODE
Serial Attached SCSI *SASTracer* 3G 1 Port Analyzer System	SS001AAA-X
Serial Attached SCSI *SASTracer* 3G 1 Port Analyzer Module	SS001MAA-X
Serial Attached SCSI *SASTracer* 3G 1 Port External Connector Analyzer System	SS004AAA-X
Serial Attached SCSI *SASTracer* 3G 1 Port External Connector Analyzer Module	SS004MAA-X
Serial Attached SCSI *SASTracer* 3G 4 Port External Connector Analyzer Upgrade Key	SS004SUA-X
Serial Attached SCSI *SASTracer* 3G 2 Port Analyzer System	SS002AAA-X
Serial Attached SCSI *SASTracer* 3G 2 Port Analyzer Module	SS002MAA-X
Serial Attached SCSI *SASTracer* 3G 2 Port External Connector Analyzer System	SS005AAA-X
Serial Attached SCSI *SASTracer* 3G 2 Port External Connector Analyzer Module	SS005MAA-X
Serial Attached SCSI *SASTracer* 3G 4 Port Analyzer System	SS003AAA-X
Serial Attached SCSI *SASTracer* 3G 4 Port Analyzer Module	SS003MAA-X
Serial Attached SCSI *SASTracer* 3G 4 Port External Connector Analyzer System	SS006AAA-X
Serial Attached SCSI *SASTracer* 3G 4 Port External Connector Analyzer Module	SS006MAA-X
Serial Attached SCSI *SASTracer/Trainer* 3G 1 Port Analyzer and Exerciser System	SS001APA-X
Serial Attached SCSI *SASTracer/Trainer* 3G 2 Port Analyzer and Exerciser System	SS002APA-X
Serial Attached SCSI *SASTrainer* 3G Exerciser Module	SS001MGA-X
SAS 4 Wide External Octopus Cable - 1m	SS004UCA-X
SAS/SATA Probe Adapter	SS001UCA-X
SAS 4 Wide Internal Octopus Cable - 2m	SS002UCA-X
SAS 4 Wide Internal Octopus Cable - 1m	SS003UCA-X
SAS 1M HDD Cable	SS005UCA-X
SAS 1M Backplane (A to B) Cable	SS006UCA-X
SAS 4X External "1B" Cable - 1m	SS00 p7UCA-X
SASTracer 3G 1 Port Analyzer System Maintenance	SS001AAA-M
SASTracer 3G 1 Port Analyzer Module Maintenance	SS001MAA-M
SASTracer 3G 1 Port External Connector Analyzer System Maintenance	SS004AAA-M
SASTracer 3G 1 Port External Connector Analyzer Module Maintenance	SS004MAA-M

SAS/SATA PROTOCOL SOLUTIONS

ORDERING INFORMATION: SAS *TRACER/TRAINER* PRODUCTS (CONTINUED)	PRODUCT CODE
SASTracer 3G 2 Port Analyzer System Maintenance	SS002AAA-M
SASTracer 3G 2 Port Analyzer Module Maintenance	SS002MAA-M
SASTracer 3G 2 Port Analyzer Upgrade Key Maintenance	SS001SUA-M
SASTracer 3G 2 Port External Connector Analyzer System Maintenance	SS005AAA-M
SASTracer 3G 2 Port External Connector Analyzer Module Maintenance	SS005MAA-M
SASTracer 3G 4 Port Analyzer System Maintenance	SS003AAA-M
SASTracer 3G 4 Port Analyzer Module Maintenance	SS003MAA-M
SASTracer 3G 4 Port External Connector Analyzer System Maintenance	SS006AAA-M
SASTracer 3G 4 Port External Connector Analyzer Module Maintenance	SS006MAA-M
SASTracer/Trainer 3G 1 Port Analyzer/Exerciser System Maintenance	SS001APA-M
SASTracer/Trainer 3G 2 Port Analyzer/Exerciser System Maintenance	SS002APA-M
SASTrainer 3G Exerciser Module Maintenance	SS001MGA-M
SA *TRAINER/TRACER* PRODUCTS	
SATA *SATracer/Trainer* 1.5G Analyzer/Generator System (w/SSC and DC option)	SA004APA-X
SATA *SATracer* 1.5G Analyzer System (w/SSC and DC option)	SA004AAA-X
SATA *SATrainer* 1.5G Generator Module	SA001MGA-X
SATA *SATracer* 1.5G Analyzer Module (w/SSC and DC option)	SA004MAA-X
SATA *SATracer* 3G 1 Port Analyzer System	SA005AAA-X
SATA *SATracer* 3G 1 Port Analyzer Module	SA005MAA-X
SATA *SATracer* 3G 4 Port External Connector Analyzer System	SA010AAA-X
SATA *SATracer* 3G 4 Port External Connector Analyzer Module	SA010MAA-X
SATA *SATracer* 3G 2 Port Analyzer System	SA006AAA-X
SATA *SATracer* 3G 2 Port Analyzer Module	SA006MAA-X
SATA *SATracer* 3G 2 Port Analyzer Upgrade Key	SA002SUA-X
SATA *SATracer* 3G 2 Port External Connector Analyzer System	SA009AAA-X
SATA *SATracer* 3G 2 Port External Connector Analyzer Module	SA009MAA-X
SATA *SATracer* 3G 4 Port Analyzer System	SA007AAA-X
SATA *SATracer* 3G 4 Port Analyzer Module	SA007MAA-X
SATA *SATracer* 3G 1 Port External Connector Analyzer System	SA008AAA-X
SATA *SATracer* 3G 1 Port External Connector Analyzer Module	SA008MAA-X
SATA *SATracer/Trainer* 3G 1 Port Analyzer/Exerciser System	SA005APA-X
SATA *SATracer/Trainer* 3G 2 Port Analyzer/Exerciser System	SA006APA-X
SATA *SATrainer* 3G 1 Port Exerciser Module	SA005MGA-X
SATA *SATracer* 3G SAS Software License Maintenance	SA001SUA-X
SATA 1M Backplane (A to B) Cable	SA001UCA-X
SATracer 3G 1 Port Analyzer System Maintenance	SA005AAA-M
SATracer 3G 1 Port Analyzer Module Maintenance	SA005MAA-M
SATracer 3G 4 Port External Connector Analyzer System Maintenance	SA010AAA-M
SATracer 3G 4 Port External Connector Analyzer Module Maintenance	SA010MAA-M
SATracer 3G 2 Port Analyzer System Maintenance	SA006AAA-M
SATracer 3G 2 Port Analyzer Module Maintenance	SA006MAA-M
SATracer 3G 2 Port External Connector Analyzer System Maintenance	SA009AAA-M
SATracer 3G 2 Port External Connector Analyzer Module Maintenance	SA009MAA-M
SATracer 3G 4 Port Analyzer System Maintenance	SA007AAA-M
SATracer 3G 4 Port Analyzer Module Maintenance	SA007MAA-M
SATracer 3G 1 Port External Connector Analyzer System Maintenance	SA008AAA-M
SATracer 3G 1 Port External Connector Analyzer Module Maintenance	SA008MAA-M
SATracer/Trainer 3G 1 Port Analyzer/Exerciser System Maintenance	SA005APA-M
SATracer/Trainer 3G 2 Port Analyzer/Exerciser System Maintenance	SA006APA-M
SATracer 3G 1 Port Exerciser Module Maintenance	SA005MGA-M
SATracer 3G SAS Software License Maintenance	SA001SUA-M

SAS/SATA PROTOCOL SOLUTIONS

SAS Infusion™ and SATA Infusion™

The SAS InFusion and SATA InFusion error injector and traffic modifier systems are the first of its kind. It allows you to inject errors and modify traffic in order to verify real world fault handling. While sitting in the data path on a live system, it alters or corrupts traffic.

The InFusion traffic modifier is designed to verify recovery characteristics within a sub-system. In just minutes, an easy-to-use wizard-based interface allows you to create test scenarios. You can change any field, within any frame, as the data moves across the bus. Any primitive or data pattern can be intercepted and changed to a different pattern you specify. This allows for corner case and protocol level error injection for SAS and SATA traffic.

The InFusion system supports a single 3.0G or 1.5G SAS or SATA link and monitors traffic from both directions. Once an InFusion session starts, the system automatically passes the boot up sequence and preserves protocol handshaking between devices. It silently monitors the line while transmitting a faithful copy of the original data stream. The system will wait for a specific time interval or count a particular event that you designate before it begins modifying frames or injecting errors. It can send either a single error or inject multiple errors.

When modifying the contents of a frame, the InFusion traffic modifier will preserve the outbound frame structure, including recalculating the CRC if needed. The response transmitted from the test will pass through the InFusion system, without modification. This allows true end-to-end system testing. And, the InFusion system will maintain a log that contains a summary of the exchange.

SAS/SATA INFUSION

SAS INFUSION/ SATA INFUSION SPECIFICATIONS

Power	100-200 volts. Internal power supply with detachable cord.
Connectors	Two external SATA connectors with external to internal conversion cables
LCD	LCD control panel allows instrument to operate as standalone device
Memory	32 MB internal flash for storage of up to 10 preconfigured test scenarios
Firmware	Field Upgradeable Firmware
Interface to Host	RJ45 10/100 Ethernet connector for communication to host
Supported Configuration	Operate in any topology with any upper level SATA or SAS protocol including SSP, SMP, STP, or native SATA

PHYSICAL DIMENSIONS

Dimensions	2.25" x 6" x 8" (57.2 mm x 152.4 mm x 203 mm)
Net Weight	1.42 kg (3.2 lbs.)

WARRANTY AND SERVICE

	3-year warranty. Optional service programs include extended warranty, maintenance, upgrades, trade-ins, and rental services.

ORDERING INFORMATION	PRODUCT CODE
SAS InFusion 1 Port System	IF001UTA-X
SATA InFusion 1 Port System	IF002UTA-X
SAS InFusion 4 System Bundle	IF003UTA-X
SAS InFusion 1 Port Software Maintenance	IF001UTA-M
SATA InFusion 1 Port Software Maintenance	IF002UTA-M
SAS InFusion 4 Port Software Maintenance	IF003UTA-M

USB PROTOCOL SOLUTIONS

USB *Tracer/Trainer*™ Protocol Analyzer and Exerciser

The USB *Tracer/Trainer* system is LeCroy's total solution for cutting edge USB 2.0 and On-the-Go (OTG) development and analysis. Based upon our CATC 2500H, you have the option of choosing either the *Tracer/Trainer* system or the *Tracer* module only. Both modules are fully supported by our industry leading CATC Trace™ software, which will enhance your ability to develop and debug USB devices.

- Advanced software provides accurate, reliable, and complete decodes of bus packets, transactions, split transactions, and transfers.
- Powerful triggering conditions allow for you to trigger on high-speed PIDs and split transaction special tokens, such as ERR, SPLIT, PINK, MYET, DATA1, AND MDATA.
- Full-featured filtering capabilities isolate areas of interest, and filters out unwanted traffic in order to maximize memory-recording capacity.
- Intelligent traffic reports and summaries give you a quick review of error rates, abnormal bus or timing conditions. Any of the traffic report data selected for detailed study can be hyperlinked back into the CATC Trace.
- Traffic generation providing host and device emulation capabilities.
- Script level traffic generation provides programmability to test USB devices with precision and control.
- Trace files convert into generation scripts to recreate failure scenarios by replaying recorded traffic.
- Intelliframe mode actively searches for a response from the device under test and issues the next appropriate packet.

CATC Platform Specifications (See Page D-1)

USB PROTOCOL SOLUTIONS

SPECIFICATIONS

USB*TRACER*™ PLUG IN MODULE

Connectors	Dual Recording Channels (USB, types "A" and "B")
Basic Trigger Events	Packet Identifiers, Token Patterns, Frame Patterns, Device Request, Data Pattern, Bus Conditions, Errors, Transactions, Splits
Reporting/Statistics	Packet Level, Transaction Level, Transfer Level, Error Reports

INDICATORS (LEDS)

REC (green)	Lights when unit is recording
TRG (orange)	Lights when triggering an event or power-on testing
UPLD (green)	Lights when uploading recording memory to the PC

PHYSICAL DIMENSIONS

Dimensions	4.5" x 6.7" x 1.3" (113 mm x 170 mm x 32 mm)
Net Weight	0.5 kg (1.0 lb.)

USB*TRAINER*™ PLUG IN MODULE

Generating Memory Size	256 Mbytes for trace traffic pattern buffering
Connectors	Dual Generating Channels (USB, type "A")
Switches	Start/Stop allows for manual Trace capture

INDICATORS (LEDS)

HighSpeed (green)	Lights when high-speed is being generated
Classic (orange)	Lights when full or low-speed is being generated
Intelli Frame (green)	Lights when Intelliframe traffic is being generated

PHYSICAL DIMENSIONS

Dimensions	4.5" x 6.7" x 1.3" (113 mm x 170 mm x 32 mm)
Net Weight	0.5 kg (1.0 lb.)

ORDERING INFORMATION	PRODUCT CODE
USB*Tracer/Trainer* All Speed Analyzer/Generator System	US005APB-X
USB*Tracer* All Speed Analyzer System	US005AAB-X
USB*Tracer* All Speed Analyzer CATC Platform Module with OTG	US006MAA-X
USB*Trainer* Generator CATC Platform Module with Device Emulation	US006MGA-X
USB*Trainer* Generator CATC Platform Module	US006MGB-X
USB Device Emulation Software Upgrade	US002SUA-X
USB High-speed Slow Clock Upgrade	US005SNA-X

USB PROTOCOL SOLUTIONS

USB*MOBILE* HS

USB*Mobile*™ HS Portable Analyzer

The USB*Mobile* HS module is a highly portable bus and protocol analyzer that connects through your computer's PCMCIA port. This PC card size analyzer offers advanced triggering, multi-level sequencing, sophisticated viewing, and intelligent searching to accurately and efficiently debug, test, and verify USB devices. The USB*Mobile* HS analyzer supports the USB 2.0 and OTG standards, and is fully compatible with the CATC *Trace* software.

USB*MOBILE* HS

USB Advisor™ Protocol Analyzer

The Advisor protocol analyzer is a cost effective solution for those developing USB 2.0 devices. Like our other analyzers it captures, displays, and analyzes bus traffic. This stand-alone unit works in conjunction with the *Tracer* software to provide a full range of capture and analysis tools. The graphical display software shows bus packets, transactions, split transaction, and transfers. It will also detect and alert you to every potential bus error, protocol violation, and combinations thereof. The Advisor analyzer supports the USB 2.0 standard.

USB CHIEF

USB Chief™ and Chief Plus™ Protocol Analyzer

The USB Chief analyzer captures, decodes, and analyzes full and low speed USB traffic. It boasts a high impedance, non-intrusive probe that acts strictly as a "sniffer." The USB Chief Plus analyzer offers the same features as the Chief, but with the added value of USB traffic generation. Both analyzers work with the *Tracer* software to enhance your ability to record and analyze USB bus traffic. The software uses color-coded schemes to represent the USB Packet, Transfer, and Transaction layers.

USB PROTOCOL SOLUTIONS

SPECIFICATIONS: USB*MOBILE* HS

Host Requirements	Windows 2000, Windows XP or greater; Intel Pentium II processor or greater; with a PCMCIA port
Basic Trigger Events	Packet Identifiers, Token Patterns, Frame Patterns, Device Request, Data Pattern, Bus Conditions, Errors, Transactions, Data Length, Splits
Reporting and Statistics	Packet Level, Transaction Level, Transfer Level, Error Reports
Generating Memory Size	64 MB
Power Consumption	Idle: 500 mA (typical), Active: 560 mA (typical)
Connectors	16-bit Type II PC card, 2 Mini-AB USB receptacles

ENVIRONMENTAL

Temperature: Operating	0 °C to 55 °C (32 °F to 131 °F)
Temperature: Non-Operating	-20 °C to 80 °C (-4 °F to 176 °F)
Humidity: Operating	10% to 90% RH (non-condensing)

PHYSICAL DIMENSIONS

Dimensions	5.3" x 2.1" x 0.4" (135 mm x 54 mm x 10.5 mm)
Net Weight	51 g (1.8 oz.)

WARRANTY AND SERVICE

	3-year warranty. Optional service programs include extended warranty, upgrades, trade-ins, and rental services.

SPECIFICATIONS: ADVISOR

Host Requirements	Windows 2000, Windows XP or greater; Intel Pentium II processor or greater; with a USB port
Generating Memory Size	128 M DRAM for traffic capture, timing, and other data
Power Consumption	90-254 VAC, 47-63 Hz (universal input), 165 W
Connectors	AC Power Connection, External Clock Input (EXT CLK, BNC), Host Connection (USB, type “B”), Data Connection (Data In/Out, 9-pin DB)

SWITCHES

Power	On/Off
Manual Trigger	Forces a trigger event
Detach Device	Detaches the device from the host

INDICATORS (LEDS)

PWR	Lights when analyzer is powered on
REC	Lights when analyzer is actively recording data
TRG	Lights when triggering an event or during power-on testing
UPLD	Lights when uploading data to host

ENVIRONMENTAL

Temperature: Operating	0 °C to 55 °C (32 °F to 131 °F)
Temperature: Non-Operating	-20 °C to 80 °C (-4 °F to 176 °F)
Humidity: Operating	10% to 90% RH (non-condensing)

PHYSICAL DIMENSIONS

Dimensions	9.2" x 8.4" x 2.5" (234 mm x 213 mm x 64 mm)
Net Weight	1.3 kg (2.8 lbs.)

WARRANTY AND SERVICE

	3-year warranty. Optional service programs include extended warranty, upgrades, trade-ins, and rental services.

USB PROTOCOL SOLUTIONS

SPECIFICATIONS: USB CHIEF

Basic Events Detected	Bus Conditions, Token Packets, Setup Transactions, Data Pattern, Hardware Detected Errors, Software-analyzed Errors, External Signals
Generating Memory Size	128M DRAM for traffic data capture, timing, and other data
Host Requirements	Windows 2000, Windows XP or greater; Intel Pentium II processor or greater; with a USB port
Power Requirements	90-254 VAC, 47-63 Hz (universal input), 165 W maximum
Connectors	AC Power Connection, BNC Connection (Reserved), Host Connection (USB, type "B"), Data Connection (Data In/Out, 37-pin DB), USB Connections for recording (Secondary Record, Record & Generate, type "A" and type "B")

SWITCHES

Power	On/Off
Manual Trigger	Forces a trigger event
Detach Device	Detaches the device from the host

INDICATORS (LEDS)

PWR	Lights when powered on
REC	Lights when actively recording data
TRG	Lights when triggering an event
UPLD	Lights when uploading recording memory to the host

ENVIRONMENTAL

Temperature: Operating	0 °C to 55 °C (32 °F to 131 °F)
Temperature: Non-Operating	-20 °C to 80 °C (-4 °F to 176 °F)
Humidity: Operating	10% to 90% RH (non-condensing)

PHYSICAL DIMENSIONS

Dimensions	9.2" x 8.4" x 2.5" (234 mm x 213 mm x 64 mm)
Net Weight	1.3 kg (2.9 lbs.)

WARRANTY AND SERVICE

3-year warranty. Optional service programs include extended warranty, upgrades, trade-ins, and rental services.

ORDERING INFORMATION	PRODUCT CODE
USB*Mobile* HS USB 2.0 All Speed Protocol Analyzer	US008UAA-X
USB Advisor All Speed Analyzer	US004UAA-X
USB Chief Plus Classic Analyzer/Generator	US003UPA-X
USB Chief Classic Analyzer	US003UAA-X
USB Parametric Probe	US006UTA-X

ULTRA WIDEBAND PROTOCOL SOLUTIONS

UWB*Tracer*™ MPI Protocol Analyzer

As the industry's first ultra-wideband protocol analyzer, the UWB*Tracer* MPI system is designed to accelerate development of WUSB devices. Built on the CATC 10K platform, the UWB*Tracer* captures and decodes traffic using the current WiMedia/MBOA and certified Wireless USB specifications. By recording the data stream between MAC and PHY, the UWB*Tracer* provides packet level visibility to MPI header fields, including Beacon frames with full decoding of distributed reservation information.

UWB*TRACER* MPI

The UWB*Tracer* MPI analyzer allows you to:

- Capture traffic between WiMedia MAC and PHY ICs to help resolve integration and interoperability issues
- Display hierarchical views of WiMedia and USB-IF Wireless USB (WUSB) protocol layers using the CATC Trace™ display. At the lowest layer, the software provides a sequential view of MPI packets and conditions. At the WUSB packet layer, the software displays the logical WiMedia equivalents for Token, Data, and Handshake packets.
- Isolate specific areas of interest with comprehensive searching for MPI and Wireless USB events
- Provide quick glance bus activity using a real time statistics display
- Gather highly accurate timing information for analysis of WiMedia flow control and channel efficiency
- View tooltips that contain extensive information about participating MAC and PHY device capabilities, and includes information about the specifications.

CATC PLATFORM SPECIFICATIONS (SEE PAGE D-1)

SPECIFICATIONS: UWB*TRACER* MPI PLUG IN MODULE

Frame and Packet Types	PHY conditions, Micro-scheduled Management Commands (MMC's), IN and OUT data, Handshakes, and Device Notifications
Real-Time Statistics	Frame Occurences, RSSI
MAC PHY Connectors	External Breakout Board, IDE Cable – for connection to link between MAC – PHY
REC (green)	Lights when actively recording

PHYSICAL DIMENSIONS

Dimensions (each)	236 mm x 170 mm x 32 mm (9.3" x 6.7 " x 1.3")
Net Weight (each)	0.77 kg (1.7 lbs.)

ORDERING INFORMATION	PRODUCT CODE
UWB*Tracer* MPI Protocol Analyzer System	UW001AAA-X
UWB*Tracer* MPI Protocol Analyzer Module	UW001MAA-X

EXPERT ANALYTICAL SYSTEMS

The Auditor software application is a post processing analysis tool developed by Expert Analytical Systems™ in cooperation with LeCroy. Designed to work with SAS*Tracer* and FC*Tracer* analyzers, the Auditor software can be configured to automatically perform architectural compliance assessment on the contents of a trace file captured by our analyzers. This automated tool significantly accelerates engineering qualification as well as regression testing of SAS and Fibre Channel silicon, firmware, software, and subsystems.

The Auditor software uses a 'rules' based verification engine developed using the architectural documents within the standard to provide a clear Pass/Fail analysis for numerous aspects of operational behavior and compliance at the logical level. It generates a series of reports that evaluate and highlight possible issues at the PHY, Link, Transport, and application layers.

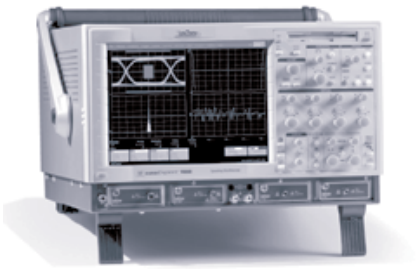
The Auditor software can be opened from within the SAS*Tracer* and FC*Tracer* software environments with a few keystrokes. It can selectively verify traffic between up to 4 source or destination addresses and provides a systematic and repeatable assessment of compliance that significantly reduces the amount of detailed architectural knowledge required by test engineers.

The Auditor test suite can be customized to verify user specified subsets of rules. Individual rule-sets can be hidden from the reports to narrow the scope of the analysis. In addition to architectural compliance, the Auditor software provides a number of protocol specific thresholds that can be manually set by the user including command completion times and link layer timeouts values.

ORDERING INFORMATION	PRODUCT CODE
EXPERT ANALYTICAL SYSTEMS FC-AUDITOR SOFTWARE	
Auditor Install Kit	FC001STA-X
FC Auditor Base 2-4 Ch Software Key	FC002STA-X
FC Auditor Base 8 Ch Software Key	FC003STA-X
FC Auditor FC-AL-2 Module Software Key	FC004STA-X
FC Auditor FCP Module Software Key	FC005STA-X
FC Auditor FC-AL-2 and FCP Suite Software Key	FC006STA-X
Maintenance FC Auditor Base Software 4 Ch	FC002STA-M
Maintenance FC Auditor Base Software 8 Ch	FC003STA-M
Maintenance FC Auditor FC-AL-2 Add-on Module	FC004STA-M
Maintenance FC Auditor FCP Add-on Module	FC005STA-M
Maintenance FC Auditor FC-AL-2 and FCP Suite	FC006STA-M
EXPERT ANALYTICAL SYSTEMS SAS-AUDITOR SOFTWARE	
Auditor Install Kit	FC001STA-X
SAS Auditor Base 2 Port Software Key	SS002STA-X
SAS Auditor Base 4 Port Software Key	SS003STA-X
SAS Auditor STP Module Software Key	SS004STA-X
SAS Auditor SMP and Expander Module Software Key	SS005STA-X
SAS Auditor STP, SMP, and Expander Suite Software Key	SS006STA-X
Maintenance SAS Auditor Base Software 2 Port	SS001STA-M
Maintenance SAS Auditor Base Software > 2 Port	SS002STA-M
Maintenance SAS Auditor STP Add-on Module	SS003STA-M
Maintenance SAS Auditor SMP and Expander Add-on Module	SS004STA-M
Maintenance SAS Auditor STP, SMP, and Expander Suite	SS005STA-M

WAVEEXPERT™ SERIES

The WaveExpert™ NRO 9000 and SDA 100G are the first instruments to combine the high bandwidth and accuracy of a sampling oscilloscope with the speed and flexibility of a real-time instrument. These are the first products in the new instrument class called Near Real Time Oscilloscopes (NRO), which eliminate most of the constraints of traditional sampling scopes. The WaveExpert family features high acquisition speed, a responsive GUI and a powerful suite of analysis tools. Enabled by another new LeCroy technology — Accelerated Throughput Architecture (ATA), WaveExpert offers up to 100 GHz bandwidth, signal acquisition speeds 100 times faster, and memory depths 125,000 times deeper than conventional sampling scopes. In addition to much higher throughput, LeCroy ATA allows for signal analysis algorithms that rival capabilities found only in real-time oscilloscopes.



WE 9000

NRO 9000

SDA 100G

Features:

- 100 GHz bandwidth
- 10 MS/s acquisition rate
- 512 Mpts waveform memory
- < 600 fs rms timebase jitter
- Jitter and eye pattern measurement software
- Real-time oscilloscope interface including a full set of math functions and parameters
- < 20 ps TDR rise time
- Integrated 12.5 Gb/s serial pattern generator

Underlying the ATA technology is the LeCroy exclusive Coherent Interleaved Sampling mode. The CIS timebase (patent pending) permits the capture and display of very long serial data waveforms without the need for an external pattern trigger. The WaveExpert and SDA 100G have an acquisition rate of up to 10 MS/s, which is a 100 times improvement over existing instruments in this class.

The WaveExpert and SDA 100G are modular instruments that can accommodate up to (4) acquisition modules. Additionally, the oscilloscopes have an optional source module, which generates PRBS sequences in commonly used pattern lengths and bit rates that can be used for component testing. An additional acquisition module can output a TDR pulse with < 20 ps rise time, which is 30% faster than existing instruments, making them the tools of choice for time-domain-reflectometry (TDR) measurements.

The Most Convenient Sampling Oscilloscope

The WaveExpert uses LeCroy's award-winning user interface pioneered in the WaveMaster® Series of real-time oscilloscopes. This interface provides access to dozens of measurements and math functions that can be combined to give an unparalleled level of analysis. More in-depth analysis is possible using custom functions that can be created using MATLAB, Mathcad, Excel, or any other Windows®-compatible programming language.

The automatic pattern-lock capability in the coherent interleaved timebase, makes it possible to capture voltage vs. time waveforms without a pattern trigger. With the optional clock recovery module, an external clock is not required, making the WaveExpert ideal for analyzing high-speed serial data signals.

Coherent Interleaved Sampling

The unique and powerful analysis capabilities of the WaveExpert are due to the development of an entirely new method of sampling known as Coherent Interleaved Sampling (CIS). This sampling method employs a phase-locked sampling strobe that is referenced to a user-supplied or recovered clock. The sampling clock is locked to the bit clock of the signal under test, so trigger jitter is eliminated.

When the signal under test consists of a repeating data pattern, the CIS timebase can be set to pattern lock on the signal, resulting in a voltage-vs.-time waveform. The waveform can be processed in many ways, similar to a waveform from a real-time oscilloscope. Processing includes convolution, FFT, and filtering.

WAVEEXPERT SERIES

Jitter-free Clock Recovery
A common limitation of electrical clock recovery circuits used to supply trigger signals to sampling oscilloscopes is that they add to the trigger jitter, thus increasing the overall measurement inaccuracy. The CIS timebase, with its phase-locked loop, maintains the same jitter performance whether clock recovery is used or not.

Integrated Data Source
The analysis capability of the WaveExpert is further enhanced by the first-ever internal data generator. This serial data generator operates at bit rates up to 12.5 Gb/s and features a < 30 ps rise time and support for 2^7, 2^{10}, 2^{15}, 2^{23}, and 2^{31} PRBS patterns. The unit plugs into any available module slot in the main frame and includes differential data outputs, a clock output, and clock input. The generator's internal clock provides bit rates of 2.45 to 2.87, 4.9 to 5.75, and 9.8 to 11.5 Gb/s. An external clock input is available to allow other data rates. The data generator is ideal for testing backplanes, circuit boards, amplifiers, and other modules that require a PRBS signal input.

Clock Recovery
Both optical and electrical clock recovery modules are available when a symbol clock is not. The electrical clock recovery module plugs into any available main frame slot and supports both differential and single-ended signal types. An internal passive power divider allows the signal under test to be looped through the clock recovery module so that external power dividers are unnecessary. The module recovers clock signals of data streams from 622 MHz through 13.5 GHz.

Optical clock recovery is available using an external module for data rates from 12.5 MHz to 2.7 GHz and 9.95 through 12.5 Gb/s. The optical signal loops through the clock recovery, and the recovered clock is electrically coupled to the instrument's trigger input. The form factor of this clock recovery module allows for an overall smaller system height, minimizing space requirements in rack mount configurations.

Eye Pattern Analysis — Fast and Accurate
The traditional eye pattern view of serial data signals continues to be the most widely used measurement of signal integrity. The WaveExpert eye pattern mode uses a standard persistence display with the acquisition triggered by an external or recovered clock. The optional coherent timebase and Jitter Analysis software (standard in the SDA 100G) measures a complete voltage-vs.-time waveform, which is then "folded" to create the eye pattern. This dramatically improves measurement throughput and enables the display of specific symbols within the data pattern that cause mask violations. Compliance masks are included for most common standards, and additional masks can be easily created for new and emerging standards.

Complete Jitter Analysis
Jitter measurement has become a critical component of serial data analysis for systems and components. Traditionally, sampling oscilloscopes have measured jitter by determining the peak-to-peak and rms values of histograms on eye diagrams. Previously, this method was simple and reliable. However, current serial data standards require more detailed jitter analysis including the total jitter at a specific bit error rate, as well as the random and deterministic components. The Jitter Analysis software, available on the WaveExpert NRO 9000 and SDA 100G, measures the total jitter as well as the breakdown of random and deterministic sources. A summary display is provided that shows the eye pattern along with several views of jitter.

Fastest TDR Step
The WaveExpert contains the fastest TDR step available in any instrument. The 20 ps rise time allows the measurement of even the smallest feature sizes. TDR traces can be scaled in volts, reflectance, or ohms. The capacitive or inductive reactance of specific portions of the trace can also be displayed by placing markers around the section of the trace of interest. The instrument supports both single-ended and differential TDR as well as TDT measurements.

WaveExpert Series

SPECIFICATIONS

TIMEBASE

Trigger Input	
Input Channels	1
Input Connector	2.92 mm
Frequency Range	DC to 5 GHz
Input Impedance	50 Ω nominal
Input Amplitude	±1 V
Max. Input Voltage	±2.5 V
Coupling	DC only
Threshold Range	±1 V
Threshold Resolution	2 mV
Trigger Sensitivity	-10 dBm at 100 MHz, -5 dBm at 5 GHz

PRESCALER INPUT	
Input Channels	1
Input Connector	2.92 mm
Frequency Range	125 MHz† to 14 GHz
Input Impedance	50 Ω nominal
Input Amplitude	0.0 dBm ±6 dBm
Max. Input Voltage	±2.5 V
Coupling	AC coupled
Prescaler Sensitivity	-5 dBm

SEQUENTIAL TIMEBASE	
Minimum Time Per Division	1 ps
Time Resolution	100 fs
Timebase Delay Time Range	25 ns to 10 ms
Time Interval Accuracy	±1 ps ±0.1% of reading
Long Term Sample Rate and Delay Time Accuracy	±1 ppm
Maximum Record Length	16k samples – Std., 100k L option
Sample Rate	1 MS/s
Jitter	1.8 ps rms (typical) ±1 ppm * delay

CIS TIMEBASE	
Frequency Ranges	62.5 MHz to 100 GHz
Frequency Stability	Determined by the stability of the trigger prescaler signal
Jitter	600 fs rms (typical)
Timebase Range	1 ps/div to 500 ns/div (4M memory)
Timebase Delay Time Range	±1 pattern
Time Interval Accuracy	Determined by trigger/prescaler signal
Sample Rate	10 MS/s
Maximum Record Length	4M Std., 64M - L, 128M - VL, 256M - XL, 512M - XXL

† 1 ns maximum rise time

WaveExpert Series

Electrical Sampling Modules

ST-20 – 20 GHz/TDR	
Connector Type	2.92 mm
Rise Time	18 ps
Bandwidth	20 GHz
Input Voltage Range	2 $V_{pk\text{-}pk}$
DC Vertical Voltage Accuracy (worst case)	±1% (800 $mV_{p\text{-}p}$ signal)
Aberrations	First 40 ps: ±10%, 40 ps to 200 ps: ±5%, 200 ps – 10 ns ±2%
RMS Noise	700 µV max. (500 µV typical)
TDR Step Voltage	250 mV
Incident Rise Time	20 ps (typical)
Offset Range	±1 V
TDR Pulse Rate	1 MHz
Offset Range	±1 V

SE-30 – 30 GHz	
Connector Type	2.92 mm
Rise Time	12 ps
Bandwidth	30 GHz
Input Voltage Range	2 $V_{pk\text{-}pk}$
DC Vertical Voltage Accuracy	±1% (800 $mV_{p\text{-}p}$ signal)
Aberrations	First 40 ps: ±10%, 40 ps to 200 ps: ±5%, 200 ps – 10 ns ±2%
RMS Noise	1 mV (max.)
Offset Range	±1 V

SE-50 – 50 GHz	
Connector Type	2.4 mm
Rise Time	8 ps
Bandwidth	50 GHz
Input Voltage Range	2 $V_{pk\text{-}pk}$
Aberrations	First 40 ps: ±10%, 40 ps to 200 ps: ±5%, 200 ps – 10 ns ±2%
RMS Noise	2 mV (max.)
Offset Range	±1 V

SE-70 – 70 GHz	
Connector Type	1.85 mm
Rise Time	5 ps
Bandwidth	70 GHz
Input Voltage Range	2 $V_{pk\text{-}pk}$
Aberrations	First 40 ps: ±10%, 40 ps to 200 ps: ±5%, 200 ps – 10 ns ±2%
RMS Noise	3 mV (max.)
Offset Range	±1 V

WaveExpert Series

ELECTRICAL SAMPLING MODULES (CONTINUED)

SE-100 – 100 GHz	
Connector Type	1 mm
Rise Time	4 ps
Bandwidth	100 GHz
Input Voltage Range	2 Vpk-pk
Aberrations	First 40 ps: ±10%, 40 ps to 200 ps: ±5%, 200 ps – 10 ns ±2%
RMS Noise	3 mV (max.)
Offset Range	±1 V

OPTICAL SAMPLING MODULES

SO-50 – 50 GHz	
Optical Bandwidth	50 GHz
FWHM (50%)	8.5 ps (typical), 8.8 ps (max.)
Wavelength Range	1280 to 1620 nm
Responsivity	17 V/W (typical) 15 V/W (min.) @ 1564 nm, 11 V/W (typical) 9 V/W (min.) @ 1310 nm
Maximum Peak Optical Input	50 mW (+17 dBm)
Maximum Average Optical Input	20 mW (+13 dBm)
Noise Equivalent Power	83 µW (-11 dBm) @ 50 GHz bandwidth with 150 MHz IF bandwidth
Optical Power Monitor	-30 dBm to +10 dBm ±5%
Optical Return Loss	> 25 dB @ 1550 nm

SO-25 – 28 GHz	
Optical Bandwidth	28 GHz
FWHM (50%)	15 ps
Wavelength Range	1280 to 1620 nm
Responsivity	17 V/W (typical) 15 V/W (min.) @ 1564 nm, 11 V/W (typical) 9 V/W (min.) @ 1310 nm
Maximum Peak Optical Input	50 mW (+17 dBm)
Maximum Average Optical Input	20 mW (+13 dBm)
Noise Equivalent Power	47 µW (-13.2 dBm) @ 28 GHz bandwidth with 150 MHz IF bandwidth
Optical Power Monitor	-30 dBm to +10 dBm ±5%
Optical Return Loss	> 25 dB @ 1550 nm

SO-10 – 10 GHz	
Optical Bandwidth	9 GHz (min.) 10 GHz (typical)
FWHM (50%)	40 ps (max.) 35 ps (typical)
Wavelength Range	750 to 1650 nm
Responsivity	450 V/W (typical) 425 V/W (min.) @ 1310 nm, 425 V/W (typical) 400 V/W (min.) @ 1565 nm, 225 V/W (typical) 200 V/W (min.) @ 850 nm
Maximum Peak Optical Input	5 mW
Optical Return Loss	-22 dB (SM), -14 dB (MM)
Noise Equivalent Power	3 µW (max.) 2 µW (typical) @ 10 GHz optical bandwidth into 150 MHz IF bandwidth
Sensitivity	-15 dBm 10.7 Gb/s 1550 SM, -14 dBm 12.5 Gb/s 1550 SM

WaveExpert Series

Optical Reference Receiver Filters for SO-10 Module

Individual Filters

155 Mb/s	REF-00155	3.320 Gb/s	REF-03320
622 Mb/s	REF-00622	4.250 Gb/s	REF-04250
1.063 Gb/s	REF-01063	9.953 Gb/s	REF-09950
1.250 Gb/s	REF-01250	10.31 Gb/s	REF-10310
2.125 Gb/s	REF-02125	10.52 Gb/s	REF-10520
2.48832 Gb/s	REF-02488	10.66 Gb/s	REF-10660
2.5 Gb/s	REF-02500	10.71 Gb/s	REF-10710
3.125 Gb/s	REF-03125	11.1 Gb/s	REF-11100
3.188 Gb/s	REF-03188		

Filter Kits

REFKIT-TELCO – SONET/SDH Kit	Includes: REF-00155, REF-00622, REF-2488, REF-09950, REF-10660, REF-10710, REF-03320
REFKIT-SBUS – Serial Bus Kit	Includes: REF-01063, REF-01250, REF-02125, REF-02500, REF-03125, REF-03188, REF-04250, REF-09950, REF-10310, REF-11100

Clock Recovery and Source Optical/Electrical Modules

Clock Recovery Modules

CDR-E135

Configuration	Electrical differential data input/output (passive loop-through) with single-ended clock output
Frequency Range	622 Mb/s to 8 Gb/s (13.5 Gb/s with option 001)
Input Sensitivity	100 mV to 2 V_{p-p}
Input Return Loss	> -10 dB
Max. Input Level	2 V_{p-p}
Clock Out Level	> .5 V_{p-p}
Output Clock Rise/Fall Time	30 ps
Output Clock Jitter	< 800 fs rms
PLL Loop Bandwidth	6 MHz

CDR-O125

Configuration	External optical clock recovery with multi mode optical input/output and single-ended electrical clock output
Frequency Range	155 Mb/s to 2.7 Gb/s, 9.95 Gb/s to 12.5 Gb/s
Wavelength Range	750 nm to 1650 nm
Phase-Locked Loop Bandwidth	300 kHz and 4 MHz, user selectable
Clock Outputs	350 mV_{p-p} (9.95 to 12.5 Gb/s), 500 mV_{p-p} (155 Mb/s to 2.7 Gb/s)
Recovered Clock Jitter	.007 UI rms max.
Optical Signal Level Range	-10 dBm to +5 dBm
Optical Connector	Diamond MAS series 62.5 µm fiber with FC-PC
Input Return Loss	-15 dB
Input Insertion Loss	-3 dB

WaveExpert Series

PULSE PATTERN GENERATOR

PPG-E135	
Configuration	Differential data output, single-ended clock output with external clock input
Frequency Range	2.45 to 2.875 Gb/s, 4.9 to 5.75 Gb/s, 9.8 to 11.5 Gb/s
Data Patterns	PRBS 7, 10, 15, 23, 31
Mark Density	0.5, 0.25, 0.125
Data Output Voltage	500 mV_{p-p}
Data Output Jitter	< 1 ps rms
Data Output Rise/Fall Time (20–80%)	30 ps
Clock Out Level	> 0 dBm
Clock Input Level	> 0 dBm
Frequency Accuracy	±3 ppm

POWER REQUIREMENTS

	100-200 V_{rms} (±10%) at 50/60 Hz; 115 V_{rms} (±10%) at 400 Hz, Automatic AC Voltage Selection Installation Category: 300V CAT II; Max Power Consumption: 400 VA (400 W)

ENVIRONMENTAL

Temperature (Operating)	+5 ˚C to +40 ˚C including floppy disk and CD-ROM drives
Temperature (Non-Operating)	-20 ˚C to +60 ˚C
Humidity (Operating)	5% to 80% relative humidity (non-condensing) up to +30 ˚C. Upper limit derates to 25% relative humidity (non-condensing) at +40 ˚C
Altitude (Operating)	Up to 10,000 ft. (3048 m) at or below +25 ˚C
Altitude (Non-Operating)	Up to 40,000 ft. (12,192 m)
Random Vibration (Operating)	.31 g_{rms} 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Random Vibration (Non-Operating)	2.4 g_{rms} 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Functional Shock	20 g_{peak}, half sine, 11 ms pulse, 3 shocks (positive and negative) in each of three orthogonal axes, 18 shocks total

PHYSICAL DIMENSIONS

Dimensions (HWD) (height excludes feet)	264 mm x 397 mm x 491 mm; 10.4" x 15.6" x 19.3"
Weight	36 lbs.; 16 kg
Shipping Weight	48 lbs.; 22 kg

CERTIFICATIONS

	CE Compliant, UL and cUL listed; Conforms to EN 61326; EN 61010-1; UL 61010-1; and CSA C22.2 No. 61010-1

WAVEEXPERT™ SERIES

ORDERING INFORMATION	PRODUCT CODE
WAVEEXPERT 9000 MAINFRAME	
Standard 4-slot Mainframe	WE 9000
100k/Channel Memory	WE9K-L
Gated Trigger	WE9K-GT
WAVEEXPERT NRO MAINFRAME	
NRO 4-slot Mainframe (Includes CIS timebase)	NRO 9000
Serial Data Package (Jitter and Hi-Throughput Eye-Pattern Analysis)	NRO-SDA
64M (1 Ch), 32M (2 Ch), 16M (4 Ch) Waveform Memory	NRO-L
128M (1 Ch), 64M (2 Ch), 32M (4 Ch) Waveform Memory	NRO-VL
256M (1 Ch), 128M (2 Ch), 64M (4 Ch) Waveform Memory	NRO-XL
512M (1 Ch), 256M (2 Ch), 128M (4 Ch) Waveform Memory	NRO-XXL
Gated Trigger	NRO-GT
WAVEEXPERT SDA MAINFRAME	
SDA 4-slot Mainframe (Includes CIS timebase, Serial Data Analysis Package)	SDA 100G
High Stability CIS Timebase < 200 fs RMS Jitter	SDA 100G-HCIS
64M (1 Ch), 32M (2 Ch), 16 M (4 Ch) Waveform Memory	SDA 100G-L
128M (1 Ch), 64M (2 Ch), 32M (4 Ch) Waveform Memory	SDA 100G-VL
256M (1 Ch), 128M (2 Ch), 64M (4 Ch) Waveform Memory	SDA 100G-XL
512M (1 Ch), 256M (2 Ch), 128M (4 Ch) Waveform Memory	SDA 100G-XXL
Gated Trigger	SDA 100G-GT
SOFTWARE OPTIONS	
Digital Filter Software Package	WE9K-DFP2
Advanced Customization Software Package	WE9K-XDEV
Advanced Math Software Package	Included in standard configuration
Processing Web Editor Software Package for Functions and Parameters	WE9K-XWEB
ELECTRICAL SAMPLING MODULES	
100 GHz Electrical Sampling Module	SE-100
70 GHz Electrical Sampling Module	SE-70
50 GHz Electrical Sampling Module	SE-50
30 GHz Electrical Sampling Module	SE-30
20 GHz Electrical Sampling Module with TDR	ST-20
OPTICAL SAMPLING MODULES	
High Sensitivity 10 GHz Optical Sampling Module with Plug-in Reference Receivers	SO-10
28 GHz Optical Sampling Module	SO-25
50 GHz Optical Sampling Module	SO-50

WAVEEXPERT™ SERIES

ORDERING INFORMATION	PRODUCT CODE
REFERENCE RECEIVER FILTERS FOR SO-10	
155 Mb/s Reference Receiver Filter for SO-10	REF-00155
622 Mb/s Reference Receiver Filter for SO-10	REF-00622
1.063 Gb/s Reference Receiver Filter for SO-10	REF-01063
1.250 Gb/s Reference Receiver Filter for SO-10	REF-01250
2.125 Gb/s Reference Receiver Filter for SO-10	REF-02125
2.488 Gb/s Reference Receiver Filter for SO-10	REF-02488
2.5 Gb/s Reference Receiver Filter for SO-10	REF-02500
3.125 Gb/s Reference Receiver Filter for SO-10	REF-03125
3.188 Gb/s Reference Receiver Filter for SO-10	REF-03188
3.32 Gb/s Reference Receiver Filter for SO-10	REF-03320
4.25 Gb/s Reference Receiver Filter for SO-10	REF-04250
9.950 Gb/s Reference Receiver Filter for SO-10	REF-09950
10.31 Gb/s Reference Receiver Filter for SO-10	REF-10310
10.52 Gb/s Reference Receiver Filter for SO-10	REF-10520
10.66 Gb/s Reference Receiver Filter for SO-10	REF-10660
10.71 Gb/s Reference Receiver Filter for SO-10	REF-10710
11.1 Gb/s Reference Receiver Filter for SO-10	REF-11100
Optical Reference Receiver Kit – Serial Bus	REFKIT-SBUS
Optical Reference Receiver Kit – SONET/SDH	REFKIT-TELCO
HARDWARE OPTIONS AND ACCESSORIES	
1.5 Meter Module Extender Cable	ME-15
IEEE-488 GPIB Control Interface	GPIB-1
Dual Monitor Display	DMD-1
Keyboard, USB	KYBD-1
Oscilloscope Cart with Additional Shelf and Drawer	OC1024
Oscilloscope Cart	OC1021
Rackmount Adapter with 25" (64 cm) Slides	RMA-25
Rackmount Adapter with 30" (76 cm) Slides	RMA-30
Removable Hard Drive Package	WE9K-RHD
Additional Removable Hard Drive (Includes USB, CD-ROM, and Spare Hard Drive)	WE9K-RHD-02
2.92 mm F-F Adapter	ADAPT-292
2.92 – SMA F-F Adapter	ADAPT-292-SMA
1.85 mm F-F Adapter	ADAPT-185
1 mm F-F Adapter	ADAPT-100
1 mm – 1.85 mm F-F Adapter	ADAPT-100-185
4 in.-lb. Torque Wrench	TW-4
8 in.-lb. Torque Wrench	TW-8
OPTICAL CLOCK RECOVERY MODULES	
Optical Clock Recovery Module (12.5 MHz to 2.5 Gb/s, 9.95 Gb/s to 12.5 Gb/s)	CDR-O125
Electrical Clock Recovery Module (622 MHz to 8 GHz)	CDR-E135
Extend Frequency Range of CDR-E135 to 13.5 Gb/s	CDR-E135-001
PULSE PATTERN GENERATOR	
PRBS Source 10 Gb/s, 5 Gb/s, 2.5 Gb/s	PPG-E135

WAVEMASTER 8000A

WAVEMASTER® 8000A SERIES

The LeCroy WaveMaster® oscilloscope offers a unique combination of high bandwidth, fast sampling speeds, and long memory capture, ideal for digital and communications systems. Equipped with our patented X-Stream technology, its fast data transfer and processing system delivers unprecedented measurement capabilities, at speeds 10-100 times faster than conventional oscilloscopes. Providing true WaveShape Analysis, its high-performance capabilities are changing the way engineers think about design and testing.

Features:

- High bandwidth from 3 GHz to 6 GHz
- Fast sampling speeds – to 20 GS/s on 4 channels
- Full sampling speed maintained over entire memory length
- Standard memory up to 2 Mpts/Ch
- High signal integrity with an SiGe amplifier, ADC, and trigger circuit
- Intuitive GUI for easier WaveShape Analysis
- 10-100x faster processing speeds
- A wide array of standard math tools
- Optional math and measurement packages

Measurement Accuracy

Superior timebase performance and very low jitter noise floor make WaveMaster a truly remarkable instrument. Delivering extremely stable and precise measurements, its high level of accuracy includes:

- 1 ps rms jitter noise floor
- Timebase stability of ±1 ppm clock accuracy
- Low trigger jitter < 2.5 ps
- Rise time as fast as 75 ps captures the fastest signal edges

Exceptional Trigger Performance

WaveMaster offers a comprehensive array of triggers for maximum performance. The SiGe trigger circuit offers a 5 GHz edge trigger bandwidth for capturing fast signals with superior sensitivity. The versatile SMART Trigger® captures a variety of signals, including glitches and pulse widths down to 600 ps. The logic trigger makes it easy to capture a pattern of up to 5 inputs, or to qualify on 4 signal inputs and trigger on the 5th.

Deep Memory Calculations with Unprecedented Speed

LeCroy's proprietary X-Stream technology offers users the ability to see deep memory calculations updated quickly on the screen. With waveform processing at speeds 10-100 times faster than conventional oscilloscope technology, users can now easily:

- Capture and analyze long records quickly
- Use advanced tools such as XMATH Advanced Math and XDEV Advanced Customization software packages with long records
- Display unique analysis views, such as XMATH's processing web, 3-dimensional displays, and histicons

WAVEMASTER 8000A SERIES

True Customization

LeCroy offers the ability to modify parameter measurements or math functions in the scope's interface for true customization. Users simply add proprietary functionality like MATLAB, Mathcad or Excel, just as in a LeCroy-installed function. The results are displayed on the screen. Since the resulting waveform is inserted back into the processing flow, the scope's cursors, measurements, and math can be performed on it. This feature adds a robust dimension to WaveMaster's capabilities, creating much more flexibility than a simple export of data to a third-party program.

Familiar Controls for Ease of Use

The user interface is designed to be familiar, intuitive, and efficient. The easily recognizable scope controls on the front panel combine with a natural, context-sensitive graphical user interface that react quickly to user commands. A flexible selection of cursors can be positioned by knobs dedicated to specific functions that can be accessed from the front panel or the GUI. A high-resolution (800x600 pixel) display and 20% larger viewing area keeps signal images crisp and clear.

Standard Math Tools

Display up to four math function traces (F1–F4). The easy-to-use graphical interface simplifies setup of up to two operations on each function trace, and function traces can be chained together to perform math-on-math.

absolute value
Auto-correlation function
average (summed)
average (continuous)
cubic interpolation function
derivative
deskew (resample)
difference (–)
enhanced resolution (to 11 bits vertical)
envelope
exp (base e)
exp (base 10)
fft (power spectrum, magnitude, phase, up to 25 Mpts)
floor
histogram of 2 billion events
integral
invert (negate)
log (base e)
log (base 10)
parameter math (+,-,*,/ of two different parameters)
product (x)
ratio (/)
reciprocal
rescale (with units)
roof
(sinx)/x
sparse function
square
square root
sum (+)
track graphs
trend (datalog) of 1 million events
zoom (identity)

Standard Measure Tools

Displays any 8 parameters together with statistics, including their average high, low, and standard deviations. Histicons provide a fast, dynamic view of parameters and wave shape characteristics.

amplitude
area
base
cycles
delay
Δ delay
duty cycle
duration
falltime (90–10%, 80–20% @level)
frequency
first
histogram parameters
last
level@ x
maximum
mean
median
minimum
narrowband power measurements
number of points
+overshoot
–overshoot
peak-to-peak
period
phase
risetime (10–90%, 20–80% @level)
rms
std. deviation
top
width
time@minimum (min.)
time@maximum (max.)
Δ time@level
Δ time@level from trigger
x@max
x@min

WAVEMASTER 8000A SERIES

SPECIFICATIONS	WAVEMASTER 8620A	WAVEMASTER 8600A	WAVEMASTER 8500A	WAVEMASTER 8300A	WAVEMASTER 8100A XXL
VERTICAL SYSTEM*					
Analog Bandwidth @ 50 Ω (-3 dB)	6 GHz	6 GHz	5 GHz	3 GHz	1 GHz
Rise Time (typical)	75 ps	75 ps	90 ps	150 ps	400 ps
Input Channels	4	4	4	4	4
Bandwidth Limiters	25 MHz; 250 MHz; 1 GHz; 3 GHz; 4 GHz			25 MHz; 250 MHz; 1 GHz	25 MHz; 250 MHz
Input Impedance	50 Ω ±2.0%				
Input Coupling	DC, GND				
Maximum Input Voltage	±4 Vpeak				
Channel-Channel Isolation	≥ 100:1 at 2 GHz; ≥ 40:1 at 3 GHz; ≥ 20:1 at 4 GHz				
Vertical Resolution	8 bits; up to 11 bits with enhanced resolution (ERES)				
Sensitivity	2 mV–1 V/div fully variable				
DC Gain Accuracy	±1.5% of full scale				
Offset Range	2 mV–194 mV/div: ±750 mV; 195 mV–1 V/div: ±4 V				
Offset Accuracy	±(1.5% of full scale + 1.5% of offset value + 2 mV)				
HORIZONTAL SYSTEM					
Timebase System	Internal timebase common to 4 input channels; an external clock may be applied at the auxiliary input				
Time/Division Range	Real Time -200 ps–10 s/div to (1,000 s/div in Normal and Single mode); RIS mode: 20 ps -1 µs/div				
Clock Accuracy	≤ 1 ppm @ 0–50 °C				
Time Interval Accuracy	≤ 0.06 / SR + (1 ppm * Reading) (rms)				
Sample Rate and Delay Time Accuracy	±1 ppm ≤ 10 s interval				
Jitter Noise Floor	1 ps rms (typical)				
Trigger and Interpolator Jitter	≤ 2.5 ps (typical)				
Channel-Channel Deskew Range	±9 x time/div. setting, or 25.0 ns, whichever is larger				
External Timebase Reference	100 MHz; 50 Ω impedance; applied at the rear input				
External Clock	30 MHz–2 GHz; 50 Ω impedance; applied at the auxiliary input				
ACQUISITION SYSTEM					
Single-Shot Sample Rate/Ch	20 GS/s	10 GS/s	10 GS/s	10 GS/s	10 GS/s
2 Channel Max.	N/A	20 GS/s	20 GS/s	20 GS/s	20 GS/s
Maximum Trigger Rate	150,000 waveforms/second (in Sequence Mode, up to 4 channels)				
Intersegment Time	≤ 6 µs				

	8620A	8600A / 8500A / 8300A	8100A XXL		
Maximum Acquisition Points/Ch	4 Ch	(2 Ch) / (4 Ch)	(2 Ch) / (4 Ch)	Duration @ 20 GS/s	Segments (Sequence Mode)
Standard	2M	4M/2M	N/A	0.1 ms	500 Segments
M – Memory Option	8M	8M/4M	N/A	0.4 ms	1,000 Segments
L – Memory Option	16M	16M/8M	N/A	0.8 ms	5,000 Segments
VL – Memory Option	32M	32M/16M	N/A	1.6 ms	10,000 Segments
XL – Memory Option	48M	48M/24M	N/A	2.4 ms	20,000 Segments
XXL – Memory Option	N/A	100M/48M	100M / 48M	5.0 ms	25,000 Segments

*8620A and 8600A bandwidth and rise time specifications are for sample speeds at 20 GS/s.

WAVEMASTER 8000A SERIES

COLOR WAVEFORM DISPLAY

Type	Color 10.4" flat-panel TFT-LCD with high resolution touch screen
Resolution	SVGA; 800x600 pixels
Number of Traces	Display a maximum of 8 traces. Simultaneously display channel, zoom, memory, and math traces.
Grid Styles	Auto, Single, Dual, Quad, Octal, XY, Single + XY, Dual + XY
Waveform Styles	Sample dots joined or dots only

PROBES

Probes	A variety of optional active, optical, and passive probes is available. AP-1M required to support high impedance passive probes.
Probe System: ProLink with ProBus®	Automatically detects and supports a variety of compatible probes; supports ProLink-SMA and ProLink-BNC input adapters.
Scale Factors	Automatically or manually selected depending on probe used.

ZOOM EXPANSION TRACES

	Display up to 4 Zoom and 4 Math/Zoom traces; 8 Math/Zoom traces available with XMAP (Master Analysis software package) or XMATH (Advanced Math software package).

TRIGGERING SYSTEM

Modes	Normal, Auto, Single, and Stop
Sources	Any input channel, External, Ext X10, Ext/10, or line; slope and level unique to each source (except line trigger)
Coupling Mode	DC
Pre-trigger Delay	0–100% of horizontal time scale
Post-trigger Delay	0–10,000 divisions
Hold-off by Time or Events	Up to 20 s or from 1 to 1,000,000,000 events
Internal Trigger Range	±5 div from center

	8620A, 8600A, 8500A	8300A	8100A XXL
Trigger Sensitivity (edge, typical)	3 div < 5 GHz	2 div < 3 GHz	2 div < 1 GHz
(Ch 1–4 & Eternal)	2 div < 4 GHz	1.2 div < 1.8 GHz	1.2 div < 750 MHz
	1.2 div < 3 GHz		

Max, SMART Trigger Freq.	750 MHz
External Trigger Input Range	Aux (±0.4 V); Aux x10 (±0.04 V); Aux / 10 (±4 V)
Trigger Sensitivity (Edge)	3 Divisions @ 5 GHz, 2 Divisions @ 4 GHz, 1.2 Divisions @ 3 GHz (typical)

BASIC TRIGGERS

Edge	Triggers when signal meets slope and level condition.

SMART TRIGGERS

State or Edge Qualified	Triggers on any input source only if a defined state or edge occurred on another input source. Delay between sources is selectable by time or events.
Dropout	Triggers if signal drops out for longer than selected time between 2 ns and 20 s.
Pattern	Logic combination (AND, NAND, OR, NOR) of 5 inputs (4 channels and external trigger input). Each source can be high, low, or don't care. The High and Low level can be selected independently. Triggers at start or end of the pattern.

ANALOG PERSISTENCE DISPLAY

Analog and Color-Graded Persistence	Variable saturation levels; stores each trace's persistence data in memory.
Persistence Selections	Select analog, color, or three-dimensional.
Trace Selection	Activate persistence on all or any combination of traces.
Persistence Aging Time	Select from 500 ms to infinity.
Sweeps Displayed	All accumulated, or all accumulated with last trace highlighted.

WAVEMASTER 8000A SERIES

INTERNAL WAVEFORM MEMORY

	M1, M2, M3, M4 Internal Waveform Memory (store full-length waveforms with 16 bits/data point), or store to any number of files limited only by data storage media.

SETUP STORAGE

Front Panel and Instrument Status	Store to the internal hard drive, floppy drive, or to a USB-connected peripheral device.

ACQUISITION PROCESSING

Averaging	Summed or Continuous Averaging to 1 million sweeps
Enhanced Resolution (ERES)	From 8.5 to 11 bits vertical resolution
Envelope (Extrema)	Envelope, floor, or roof for up to 1 million sweeps
Interpolation	Linear or Sin x/x

SMART TRIGGERS® WITH EXCLUSION TECHNOLOGY

Glitch	Triggers on positive or negative glitches with widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Width	Triggers on positive or negative pulse widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Interval	Triggers on intervals selectable between 2 ns and 20 s.

AUTOMATIC SETUP

Auto Setup	Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals.
Vertical Find Scale	Automatically sets the vertical sensitivity and offset for the selected channels to display a waveform with maximum dynamic range. 3-year warranty; calibration recommended annually. Optional service programs include extended warranty, upgrades, and calibration services.

CPU

Processor	Intel Pentium 4 @ 2.53 GHz or better
Processing Memory	Up to 2 Gbytes
Realtime Clock	Dates, hours, minutes, seconds displayed with waveform. SNTP support to synchronize to precision internet clocks.

INTERFACE

Remote Control	Via Windows Automation or via LeCroy Remote Command Set
GPIB Port (Optional)	Supports IEEE-488.2
Ethernet Port	10/100Base-T Ethernet interface
Floppy Drive	Internal, DOS-format, 3.5" high-density
USB Ports	4 USB 2.0 ports support Windows-compatible devices
External Monitor Port Standard	15-pin D-Type SVGA compatible
Parallel Port	1 standard

AUXILIARY OUTPUT

Signal Types	Select from calibrator, control signals, or Off.
Calibrator Signal	5 Hz–5 MHz square wave or DC Level; 0.0 to 0.5 V into 50 Ω (0–1 V into 1 MΩ), or TTL Volts (selectable).
Control Signals	Trigger enabled, trigger out, pass/fail status.

AUXILIARY INPUT

Signal Types	Select from External Trigger or External Clock input on front panel.

WAVEMASTER 8000A SERIES

GENERAL

Auto Calibration	Ensures specified DC and timing accuracy is maintained for 1 year minimum.
Power Requirements	100–240 V rms (±10%) at 50/60 Hz; 115 V rms (±10%) at 400 Hz, Automatic AC Voltage Selection Installation Category: 300V CAT II; Max. Power Consumption: 650 VA/650 W; 800 VA/800 W for WM8620A

ENVIRONMENTAL

Temperature (Operating)	+5 ˚C to +40 ˚C including CD-ROM drive
Temperature (Non-Operating)	-20 ˚C to +60 ˚C
Humidity (Operating)	5% to 80% relative humidity (non-condensing) up to +30 ˚C. Upper limit derates to 25% relative humidity (non-condensing) at +40 ˚C.
Humidity (Non-Operating)	5% to 95% relative humidity (non-condensing) as tested per MIL-PRF-28800F
Altitude (Operating)	Up to 10,000 ft. (3048 m) at or below +25 ˚C
Altitude (Non-Operating)	Up to 40,000 ft. (12,192 m)
Random Vibration (Operating)	0.31 g rms 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Random Vibration (Non-Operating)	2.4 g rms 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Functional Shock	20 g peak, half sine, 11 ms pulse, 3 shocks (positive and negative) in each of three orthogonal axes, 18 shocks total

PHYSICAL DIMENSIONS

Dimensions (HWD)	264 mm x 397 mm x 491 mm; 10.4" x 15.6" x 19.3" (height excludes feet)

	8620A	8100A XXL / 8300A / 8500A / 8600A
Weight	23 kg; 49 lbs.	18 kg; 39 lbs.
Shipping Weight	29 kg; 63 lbs.	24 kg; 53 lbs.

CERTIFICATIONS

CE Compliant, UL and cUL listed;
Conforms to EN 61326-1; EN 61010-1; UL 3111-1; and CSA C22.2 No. 1010.1

WARRANTY AND SERVICE

3-year warranty; calibration recommended annually.
Optional service programs include extended warranty, upgrades, and calibration services.

WAVEMASTER 8000A SERIES

ORDERING INFORMATION			PRODUCT CODE
WAVEMASTER DIGITAL OSCILLOSCOPES			
4 Ch 6 GHz; 20 GS/s; 2 Mpts/Ch			WaveMaster 8620A
4 Ch 6 GHz; 10 GS/s; 2 Mpts/Ch; 4 Mpts 20 GS/s using 2 or 1 Ch			WaveMaster 8600A
4 Ch 5 GHz; 10 GS/s; 2 Mpts/Ch; 4 Mpts 20 GS/s using 2 or 1 Ch			WaveMaster 8500A
4 Ch 3 GHz; 10 GS/s; 2 Mpts/Ch; 4 Mpts 20 GS/s using 2 or 1 Ch			WaveMaster 8300A
MEMORY OPTIONS	**8620A**	**8600A / 8500A / 8300A**	
	48M (4 Ch)	48M/24M (2 Ch/4 Ch)	WM-XL
	32M (4 Ch)	32M/16M (2 Ch/4 Ch)	WM-VL
	16M (4 Ch)	16M/8M (2 Ch/4 Ch)	WM-L
	8M (4 Ch)	8M/4M (2 Ch/4 Ch)	WM-M
LONG MEMORY MODELS			
4 Ch; 6 GHz; 10 GS/s; 50 Mpts/Ch; 20 GS/s and 100 Mpts/Ch max. using 2 or 1 Ch			WaveMaster 8600A XXL
4 Ch; 5 GHz; 10 GS/s; 50 Mpts/Ch; 20 GS/s and 100 Mpts/Ch max. using 2 or 1 Ch			WaveMaster 8500A XXL
4 Ch; 3 GHz; 10 GS/s; 50 Mpts/Ch; 20 GS/s and 100 Mpts/Ch max. using 2 or 1 Ch			WaveMaster 8300A XXL
4 Ch; 1 GHz; 10 GS/s; 50 Mpts/Ch; 20 GS/s and 100 Mpts/Ch max. using 2 or 1 Ch			WaveMaster 8100A XXL

INCLUDED WITH STANDARD 8620A, 8600A, AND 8500A CONFIGURATIONS

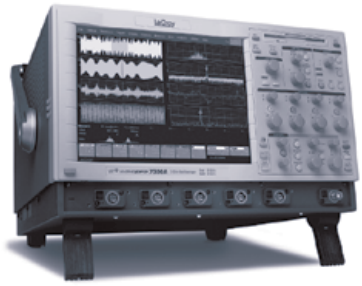
- ProLink Adapter SMA; 4 each
- ProLink Adapter BNC; 2 each
- Optical 3-button Wheel Mouse-USB
- Protective Front Cover
- Printed Operator's Manual
- Printed Getting Started Manual
- Printed Remote Control Manual
- Product Manual Set on CD-ROM
- Software Option Manual on CD-ROM
- Norton AntiVirus Software (1 year subscription)
- Microsoft Windows License Agreement
- Standard Commercial Calibration with Performance Certificate
- Power Cable for the Destination Country
- 3-Year Warranty

INCLUDED WITH STANDARD 8100A XXL AND 8300A CONFIGURATIONS

- ProLink Adapter BNC; 5 each
- Optical 3-button Wheel Mouse-USB
- Protective Front Cover
- Printed Operator's Manual
- Printed Getting Started Manual
- Printed Remote Control Manual
- Product Manual Set on CD-ROM
- Software Option Manual on CD-ROM
- Norton AntiVirus Software (1 year subscription)
- Microsoft Windows License Agreement
- Standard Commercial Calibration with Performance Certificate
- Power cable for the destination country
- 3-Year Warranty

WAVEMASTER 8000A SERIES

ORDERING INFORMATION	PRODUCT CODE
SOFTWARE OPTIONS	
Advanced Math Software Package	XMATH
Master Analysis Package (Includes JTA2, XMATH, XDEV)	XMAP
Processing Web Editor Software Package for Functions and Parameters	XWEB
Digital Filter Software Package	DFP2
Advanced Customization Software Package	XDEV
Jitter and Timing Analysis Software Package	JTA2
Advanced M1 Software Package for Jitter and Timing Measurements (1 seat)	LECROYM1/ADV-1
Advanced M1 Software Package for Jitter and Timing Measurements (4 seats)	LECROYM1/ADV-4
Basic M1 Software Package for Jitter and Timing Measurements (1 seat)	LECROYM1/BASIC
Serial Data Mask Software Package	SDM
Ethernet Test Software Package	ENET
USB 2.0 Compliance Test Software Package	USB2
Disk Drive Measurement Software Package	DDM2
Advanced Optical Recording Measurement Software Package	AORM
PROBES OPTIONS AND ACCESSORIES	
2.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP2500
WaveLink 7.5 GHz Differential Probe with Adjustable Tip Module	D600A-AT*
WaveLink 7 GHz Differential Probe with Small Tip Module	D600ST*
WaveLink 4 GHz, 5 V Differential Probe with Small Tip Module	D350ST*
WaveLink 6 GHz, Differential Positioner with Mounted Tip Module	D500PT*
WaveLink ProLink Probe Body	WL600
7.5 GHz Low Capacitance Passive Probe 500/1000 Ω	PP066
1 GHz Active Differential Probe (÷1, ÷10, ÷20)	AP034
Optical-to-Electrical Converter, 500–870 nm ProLink BMA Connector	OE525
Optical-to-Electrical Converter, 950–1630 nm ProLink BMA Connector	OE555
1 MΩ Adapter includes PP005A Passive Probe	AP-1M
* For a complete probe, order a WL600 Probe Body with the Probe Tip Module	
HARDWARE OPTIONS AND ACCESSORIES	
IEEE-488 GPIB Control Interface	GPIB-1
Dual Monitor Display	DMD-1
Keyboard, USB	KYBD-1
ProLink-to-BNC Adapter; 1 each	LPA-BNC
Kit of 4 ProLink BNC Adapters with Case	LPA-BNC-KIT
ProLink-to-SMA Adapter	LPA-SMA
Kit of 4 SMA ProLink Adapters with Case	LPA-SMA-KIT
Oscilloscope Cart with Additional Shelf and Drawer	OC1024
Oscilloscope Cart	OC1021
Rackmount Adapter with 25" (64 cm) Slides	RMA-25
Rackmount Adapter with 30" (76 cm) Slides	RMA-30
Video Trigger Module	VT75
Internal Graphics Printer	WM-GP02
Removable Hard Drive Package (Includes USB, CD-ROM, Removable Hard Drive, and Spare Hard Drive)	WM-RHD
Additional Removable Hard Drive	WM-RHD-02
CD-ROM Read/Write Upgrade	WM-CDRW
Soft Carrying Case	WM-SCC
Hard Transit Case	WM-TC1
USB 2.0 Testing Compliance Test Fixture	TF-USB
Probe Deskew and Calibration Test Fixture	TF-DSQ



WAVEPRO 7000A

WAVEPRO® 7000A SERIES

The WavePro® 7000A Series brings fast and accurate measurement capability, from 1 GHz to 3 GHz bandwidth applications, at an extremely attractive price. Faster, more accurate, more confident measurements are achieved.

Features:

- Excellent signal integrity from SiGe amplifiers and ADCs
- 10 GS/s single-shot sample rate on all channels (20 GS/s maximum) to capture signal details
- Acquisition of up to 48 million data points to maintain high sampling rates and complex signals
- High Impedance Input – all WavePro Oscilloscope channels can be used at either 50 Ω or 1 MΩ, both selectable on the screen.
- 2 ps jitter noise floor
- Unique processing chain with the ability to add customized measurements inside
- Fast WaveShape Analysis

Proprietary X-Stream Technology eliminates the trade-offs between long record lengths and quick processing, enabling the WavePro to conduct WaveShape Analysis 10–100 times faster than any other oscilloscope in the 1 GHz–3 GHz bandwidth class.

Additional Features:

- Measurement of complex signals with confidence
- Deep Memory – 1 Mpts per channel standard memory. Options extend all the way to an industry-best 48 Mpts.
- Display – Large 10.4" SVGA touch screen has 20% larger waveform display area than comparable oscilloscopes.
- Advanced Windows® – based operating system offers robust system performance, with an intuitive and informative user interface.
- Auto Setup – One button automatically calls up a signal on the display.
- Analog Persistence – Switches between analog view and digital view to fully explore the signal's modulation.
- QuickZoom – Automatically displays 10x magnified traces of all signals on multi-grids.
- Wavepilot – Controls give easy access to powerful signal analysis capabilities to trace problems directly to their source.

WAVEPRO 7000A SERIES

Standard Math Tools

Display up to four math function traces (F1–F4). The easy-to-use graphical interface simplifies setup of up to two operations on each function trace, and function traces can be chained together to perform math-on-math.

absolute value
Auto-correlation function
average (summed)
average (continuous)
cubic interpolation function
derivative
deskew (resample)
difference (–)
enhanced resolution (to 11 bits vertical)
envelope
exp (base e)
exp (base 10)
fft (power spectrum, magnitude, phase, up to 25 Mpts)
floor
histogram of 2 billion events
integral
invert (negate)
log (base e)
log (base 10)
parameter math (+,-,*,/ of two different parameters)
product (x)
ratio (/)
reciprocal
rescale (with units)
roof
(sinx)/x
sparse function
square
square root
sum (+)
track graphs
trend (datalog) of 1 million events
zoom (identity)

Standard Measure Tools

Display any 8 parameters together with statistics, including their average, high, low, and standard deviations. Histicons provide a fast, dynamic view of parameters and wave shape characteristics.

amplitude
area
base
cycles
delay
Δ delay
duty cycle
duration
falltime (90–10%, 80–20% @level)
frequency
first
histogram parameters
last
level@ x
maximum
mean
median
minimum
narrowband power measurements
number of points
+overshoot
–overshoot
peak-to-peak
period
phase
risetime (10–90%, 20–80% @level)
rms
std. deviation
top
width
time@minimum (min.)
time@maximum (max.)
Δ time@level
Δ time@level from trigger
x@max
x@min

Pass/Fail Testing

Simultaneously test multiple parameters against selectable parameter limits or pre-defined masks. Pass or fail conditions can initiate actions including document to local or networked files, e-mail the image of the failure, save waveforms, send a pulse out at the front panel auxiliary BNC output, or (with the GPIB option) send a GPIB SRQ.

Jitter and Timing

Parametric Measurements:

- period@level
- width@level
- duty@level
- frequency@level
- TIE@level
- edge@level

Statistical Analysis:

- Jitter Track
- Jitter Trend (1000 pts)
- Histograms (1000 pts)

WAVEPRO 7000A SERIES

WAVEPRO SOFTWARE OPTIONS – OFFER EXTENDED CAPABILITIES

The WavePro 7000A Series takes WaveShape Analysis options to a new level. The following software packages dramatically expand the capabilities of WavePro oscilloscopes and enable engineers to trouble-shoot circuits in more productive ways.

ADVANCED MATH AND WAVESHAPE ANALYSIS

Master Analysis Software Package (XMAP)

This package provides maximum capability and flexibility, and includes all the functionality present in XMATH, XDEV, and JTA2

Advanced Math Software Package (XMATH)

This package provides a comprehensive set of signal WaveShape Analysis tools providing insight into the wave shape of complex signals. Additional capability provided by XMATH includes:

- Parameter math – add, subtract, multiply, or divide two different parameters. Invert a parameter and rescale parameter values.
- Histograms expanded with 19 histogram parameters and up to 2 billion events
- Trend (datalog) of up to 1 million events
- Track graphs of any measurement parameter
- FFT capability added to include: power averaging, power density, real and imaginary components, frequency domain parameters, and FFT on up to 24 Mpts.
- Narrow-band power measurements
- Auto-correlation function
- Sparse function
- Cubic Interpolation function

Advanced Customization Software Package (XDEV)

This package provides a set of tools to modify the scope and customize it to meet your unique needs. Additional capability provided by XDEV includes:

- Creation of your own measurement parameter or math function, using third-party software packages, and display the result in the scope. Supported third-party software packages include:
  - VBScript
  - MATLAB
  - Excel
  - Mathcad
- CustomDSO – create your own user interface in a scope dialog box.
- Addition of macro keys to run VBScript files
- Support for plug-ins

Jitter and Timing Analysis Software Package (JTA2)

This package provides jitter timing and analysis using time, frequency, and statistical views for common timing parameters, and also includes other useful tools. JTA2 includes:

- Jitter and timing parameters, with "Track" graphs of

– Cycle-Cycle Jitter	– Frequency	– Time Interval Error	– Duty Cycle
– N-Cycle	– Period	– Setup	– Duty Cycle Error
– N-Cycle with start selection	– Half Period	– Hold	
	– Width	– Skew	

- Edge@lv parameter (counts edges)
- Histograms expanded with 19 histogram parameters and up to 2 billion events
- Trend (datalog) of up to 1 million events
- Track graphs of all parameters
- Persistence histogram, persistence trace (mean, range, sigma)

WAVEPRO 7000A SERIES

ADVANCED MATH AND WAVESHAPE ANALYSIS (CONTINUED)

Digital Filter Software Package (DFP2)

LeCroy's Digital Filter Package (DFP2) implements a set of linear-phase Finite Impulse Response (FIR) filters and IIR filters. It enhances the user's ability to examine important signal components by filtering out undesired spectral components such as noise. With the custom design feature, corrupted signals can be reconstructed by applying matched (mirror) filters to compensate for known distortions.

The DFP2 option has a broad range of applications:

- System Identification
- Prediction
- Noise Cancellation
- Low-pass Filters
- Band-stop Filters
- Band-pass Filters
- High-pass Filters
- Raised Cosine, Raised Root Cosine, and Gaussian Filters

APPLICATION SPECIFIC TEST AND ANALYSIS PACKAGE

Power Measure Analysis Package (PMA2)

This package provides exceptional ability to measure and analyze the operating characteristics of power conversion devices and circuits.

- Automatic setup and display of relevant waveforms and parameters
- Waveforms scaled and displayed in volts, amps, watts, ohms, etc.
- Power device performance analyzed in-circuit
- Measure and view time domain response of the entire control loop
- Pre-compliance line harmonic testing to EN 61000-3-2
- Complete solutions available including probes and differential amplifiers

Advanced Optical Recording Measurements (AORM)

The AORM option in our new-generation X-Stream oscilloscope environment provides a completely updated user interface and improved debug tools written to support ever-increasing read/write data rates and larger media capacity required for the latest CD and DVD implementations. Typical applications include game box technology and high-capacity DVD Read/Write.

The unique combination of deep acquisition memory available in LeCroy oscilloscopes and the flexibility of AORM in adapting to optical recording standards provides the user with ultimate measurement accuracy and 2-dimensional correlation of recording parameters.

Note: *AORM is supported in WavePro 7200A oscilloscopes and higher.*

WAVEPRO 7000A SERIES

APPLICATION SPECIFIC TEST AND ANALYSIS PACKAGE (CONTINUED)

Parameter Definition Table

Timing Analysis Parameters		Amplitude Analysis Parameters	
deltap2c	Data edge shift referred RF signal	paa	Average amplitude of to clock
deltap2cs	Standard deviation of deltap2c	pasym	Asymmetry of RF signal
edgsh	Pit or space width difference from ideal value	pbase	Base of pit or space
period	Period of each cycle of clock	pmax	Maximum of pit or space
pnum	Number of pit or space pair	pmidl	Middle voltage of pit or space
pwid	Width of pit or space pairs	pmin	Minimum of pit or space
t@pit	Delay of pit or space from trigger	pmoda	Modulation of RF signal
timj	Standard deviation of edgsh	pres	Resolution of RF signal
		ptop	Top of pit or space

Disk Drive Measurements Package (DDM2)

This package provides disk drive parameter measurements and related mathematical functions for performing disk drive WaveShape Analysis.

Disk Drive Parameters are as follows

amplitude assymetry	local time at minimum	pulse width 50–
local base	local time at maximum	pulse width 50+
local baseline separation	local time peak-trough	resolution
local maximum	local time over threshold	track average amplitude
local minimum	local time trough-peak	track average amplitude–
local number	local time under threshold	track average amplitude+
local peak-peak	narrow band phase	auto-correlation s/n
local time between events	narrow band power	non-linear transition shift
local time between peaks	overwrite	
local time between troughs	pulse width 50	

- Correlation function
- Trend (datalog) of up to 1 million events
- Histograms expanded with 18 histogram parameters and up to 2 billion events

ADDITIONAL SOFTWARE OPTIONS (SEE SECTION J)

WAVEPRO 7000A SERIES

SPECIFICATIONS	WAVEPRO 7300A	WAVEPRO 7200A	WAVEPRO 7100A
VERTICAL SYSTEM			
Analog Bandwidth (-3 dB, 50 Ω ≥ 10 mV/div)	3 GHz	2 GHz	1 GHz
Rise Time (Typical)	150 ps	225 ps	400 ps
Input Channels	4		
Bandwidth Limiters	25 MHz; 200 MHz		
Input Impedance	50 Ω or 1 MΩ || 15 pF; 10 MΩ || 11 pF with PP005A Probe		
Input Coupling	1 MΩ: AC, DC, GND; 50 Ω: DC		
Maximum Input Voltage	50 Ω: 5 Vrms, 1 MΩ: 100 Vmax (peak AC: ≤ 5 kHz + DC)		
Channel-Channel Isolation	250:1 at same V/div setting, 40:1 at 3 GHz		
Vertical Resolution	8 bits; up to 11 bits with enhanced resolution (ERES)		
Sensitivity	50 Ω: 2 mV – 1 V/div fully variable; 1 MΩ: 2 mV – 2 V/div fully variable		
DC Gain Accuracy	±1.5% of full scale; (±1% typical)		
Offset Range	50 Ω: ±700 mV @ 2–4.99 mV/div ±1.5 V @ 5–100 mV/div ±10 V @ 0.102-1 V/div 1 MΩ: ±700 mV @ 2–4.99 mV/div ±1.5 V @ 5–100 mV/div ±20 V @ 0.102–2 V/div		
Offset Accuracy	±(1.5% of full scale + 0.5% of offset value + 2 mV)		
HORIZONTAL SYSTEM			
Timebase	Internal timebase common to 4 input channels; an external clock may be applied at the auxiliary input		
Time/Division Range	200 ps/div – 10 s/div; RIS mode: to 20 ps/div; Roll mode: up to 1,000 s/div		
Clock Accuracy	≤ 10 ppm @ 0–40 °C		
Time Interval Accuracy	≤ 0.06 / SR + (5 ppm * Reading) (rms)		
Sample Rate and Delay Time Accuracy	±5 ppm ≤ 10 s interval		
Jitter Noise Floor	1 ps rms @ 100 mV/div (typical)		
Trigger and Interpolator Jitter	≤1 ps rms (typical)		
Channel-Channel Deskew Range	±9 x time/div. setting, 100 ms max., each channel		
External Clock	30 MHz – 1 GHz; 50 Ω impedance; applied at the auxiliary input		
ACQUISITION SYSTEM			
Single-Shot Sample Rate/Ch	10 GS/s		
2 Channel Max.	20 GS/s		
Random Interleaved Sampling (RIS)	200 GS/s for repetitive signals: 20 ps/div – 1 µs/div		
Maximum Trigger Rate	150,000 waveforms/second (in Sequence Mode, up to 4 channels)		
Intersegment Time	≤ 6 µs		
Maximum Acquisition Points/Ch	(4 Ch / 2 Ch)		
Standard	2M/4M; Sequence Mode 500 segments		
M – Memory Option	4M/8M; Sequence Mode 1,000 segments		
L – Memory Option	8M/16M; Sequence Mode 5,000 segments		
VL – Memory Option	16M/32M; Sequence Mode 10,000 segments		
XL – Memory Option	24M/48M; Sequence Mode 20,000 segments		

WAVEPRO 7000A SERIES

ACQUISITION PROCESSING

Averaging	Summed or continuous averaging up to 1 million sweeps
Enhanced Resolution (ERES)	From 8.5 to 11 bits vertical resolution
Envelope (Extrema)	Envelope, floor, or roof for up to 1 million sweeps
Interpolation	Linear or Sin x/x

TRIGGERING SYSTEM

Modes	Normal, Auto, Single, and Stop
Sources	Any input channel, External, Ext X10, Ext/10, or line; slope and level unique to each source (except line trigger)
Coupling	DC
Pre-trigger Delay	0–100% of memory size (adjustable in 1% increments of 100 ns)
Post-trigger Delay	0–10,000 divisions in real time mode, limited at slower time/div settings or in roll mode
Hold-off by Time or Events	2 ns to 20 s or from 1 to 99,999,999 events
Internal Trigger Range	±5 div from center

	7300A	7200A	7100A
Trigger Sensitivity (edge)	2 div < 3 GHz	2 div < 2 GHz	2 div < 1 GHz
(Ch 1-4 and External)	1 div < 2 GHz	1 div < 1.8 GHz	1 div < 750 MHz

Max. Trigger Frequency, SMART Trigger 750 MHz

BASIC TRIGGERS

Edge	Triggers when signal meets slope (positive or negative) and level condition.

SMART TRIGGERS®

Glitch and Pulse Width	Triggers on positive or negative glitches with widths selectable from 600 ps to 20 s or on intermittent faults (subject to bandwidth limit of oscilloscope).
Signal or Pattern Interval	Triggers on intervals selectable between 2 ns and 20 s.
Timeout (State/Edge Qualified)	Triggers on any source if a given state (or transition edge) has occurred on another source. Delay between sources is 2 ns to 20 s, or 1 to 99,999,999 events.
Exclusion Triggering	Trigger on intermittent faults by specifying the normal width or period.

SMART TRIGGERS WITH EXCLUSION TECHNOLOGY

Glitch	Triggers on positive or negative glitches with widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Width	Triggers on positive or negative pulse widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Interval	Triggers on intervals selectable between 2 ns and 20 s.

AUTOMATIC SETUP

Auto Setup	Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals.
Vertical Find Scale	Automatically sets the vertical sensitivity and offset for the selected channels to display a waveform with maximum dynamic range.

PROBES

Probes	(4) PP005A ÷10, 10 MΩ passive probes
Probe System: Probus	Automatically detects and supports a variety of compatible probes
Scale Factors	Automatically or manually selected depending on probe used

WAVEPRO 7000A SERIES

COLOR WAVEFORM DISPLAY

Type	Color 10.4" flat-panel TFT-LCD with high resolution touch screen
Resolution	SVGA; 800 x 600 pixels
Number of Traces	Display a maximum of 8 traces. Simultaneously display channel, zoom, memory, and math traces
Grid Styles	Auto, Single, Dual, Quad, Octal, XY, Single + XY, Dual + XY
Waveform Styles	Sample dots joined or dots only

ANALOG PERSISTENCE DISPLAY

Analog and Color-Graded Persistence	Variable saturation levels; stores each trace's persistence data in memory.
Persistence Selections	Select analog, color, or 3-dimensional
Trace Selection	Activate persistence on all or any combination of traces
Persistence Aging Time	Select from 500 ms to infinity
Sweeps Displayed	All accumulated, or all accumulated with last trace highlighted

ZOOM EXPANSION TRACES

Display up to 4 Zoom and 4 Math/Zoom traces; 8 Math/Zoom traces available with XMAP (Master Analysis software package) or XMATH (Advanced Math software package)

CPU

Processor	Processor Intel® Pentium® 4 @ 2.54 GHz (or better) with MS Windows® XP Professional
Processing Memory	Up to 2 Gbytes
Realtime Clock	Dates, hours, minutes, seconds displayed with waveform SNTP support to synchronize to precision internet clocks

INTERNAL WAVEFORM MEMORY

M1, M2, M3, M4 Internal Waveform Memory (store full-length waveforms with 16 bits/data point) or store to any number of files limited only by data storage media

SETUP STORAGE

Front Panel and Instrument Status	Store to the internal hard drive, over a network or to a USB-connected peripheral device

INTERFACE

Remote Control	Via Windows Automation, or via LeCroy Remote Command Set
GPIB Port (Optional)	Supports IEEE – 488.2
Ethernet Port	10/100Base-T Ethernet interface
USB Ports	USB 2.0 ports support Windows compatible devices
External Monitor Port Standard	15-pin D-Type SVGA-compatible
Parallel Port	1 standard

AUXILIARY INPUT

Signal Types	Selected from External Trigger or External Clock input on front panel
Coupling	50 Ω: DC; 1 MΩ: AC, DC, GND
Max. Input Voltage	50 Ω: 5 V rms; 1 MΩ 250 V (Peak AC < 10 kHz + DC)

AUXILIARY OUTPUT

Signal Types	Select from calibrator, control signals or Off
Calibrator Signal	5 Hz – 5 MHz square wave or DC level; 0.0 to 5.0 V into 50 Ω (0–1 V into 1 MΩ) or TTL volts (selectable)
Control Signals	Trigger enabled, trigger out, pass/fail status

WAVEPRO 7000A SERIES

GENERAL

Auto Calibration	Ensures specified DC and timing accuracy is maintained for 1 year minimum
Power Requirements	100–120 VAC at 50/60/400 Hz; 200–240 VAC at 50/60 Hz; Automatic AC Voltage selection Max. power consumption: 650 W/650 VA

ENVIRONMENTAL

Temperature (Operating)	+5 ˚C to +40 ˚C including CD-ROM drives
Temperature (Non-Operating)	-20 ˚C to +60 ˚C
Humidity (Operating)	5% to 80% relative humidity (non-condensing) up to +30 ˚C Upper limit derates to 25% relative humidity (non-condensing) at +40 ˚C
Humidity (Non-Operating)	5% to 95% relative humidity (non-condensing) as tested per MIL-PRF-28800F
Altitude (Operating)	up to 10,000 ft. (3048 m) at or below +25 ˚C
Altitude (Non-Operating)	up to 40,000 ft. (12,192 m)
Random Vibration (Operating)	0.31 g rms 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Random Vibration (Non-Operating)	2.4 g rms 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Functional Shock	20 g peak, half sine, 11 ms pulse, 3 shocks (positive and negative) in each of three orthogonal axes, 18 shocks total

PHYSICAL DIMENSIONS

Dimensions (HWD)	264 mm x 397 mm x 491 mm; 10.4" x 15.6" x 19.3" (height excludes feet)
Weight	18 kg; 39 lbs.
Shipping Weight	24 kg; 53 lbs.

CERTIFICATIONS

CE Compliant, UL and cUL listed; conforms to EN 61326-1, EN 61010-1, UL 3111-1, and CSA C22.2 No. 1010.1

WARRANTY AND SERVICE

3-year warranty; calibration recommended annually
Optional service programs include extended warranty, upgrades, and calibration services

WAVEPRO 7000A SERIES

ORDERING INFORMATION	PRODUCT CODE
4 Ch 3 GHz; 10 GS/s; 2 Mpts/Ch; 4 Mpts/Ch 20 GS/s using 2 or 1 Ch; 50 Ω and 1 MΩ Input	WavePro 7300A
4 Ch 2 GHz; 10 GS/s; 2 Mpts/Ch; 4 Mpts/Ch 20 GS/s using 2 or 1 Ch; 50 Ω and 1 MΩ Input	WavePro 7200A
4 Ch 1 GHz; 10 GS/s; 2 Mpts/Ch; 4 Mpts/Ch 20 GS/s using 2 or 1 Ch; 50 Ω and 1 MΩ Input	WavePro 7100A

INCLUDED WITH STANDARD CONFIGURATION	
÷10 500 MHz 10 MΩ Passive Probe (Qty. 4)	PP005A
Optical 3 button wheel mouse, USB	
Protective Front Cover	
Printed Operator's Manual	
Printed Getting Started Guide	
Printed Remote Control Manual	
Product Manual Set on CD-ROM	
Software Option Manual CD-ROM	
Norton Anti-virus Software (1 year subscription)	
Microsoft XP Pro License	
Commercial Calibration with Performance Certificate	
Power Cable for the Destination Country	
3-Year Warranty	

MEMORY OPTIONS	
8 Mpts/2 Ch, 4 Mpts/Ch	-M
16 Mpts/2 Ch, 8 Mpts/Ch	-L
32 Mpts/2 Ch, 16 Mpts/Ch	-VL
48 Mpts/2 Ch, 24 Mpts/Ch	-XL

SOFTWARE OPTIONS	
Advanced Math and WaveShape Analysis Software Packages	
Advanced Math Software Package	XMATH
Advanced Customization Software Package	XDEV
Jitter and Timing Analysis Software Package	JTA2
Master Analysis Software Package (Includes JTA2, XMATH, and XDEV)	XMAP
Processing Web Editor Software Package for Functions and Parameters	XWEB
Digital Filter Software Package	DFP2
Communications Testing Software Packages	
Serial Data Mask Software Package	SDM
Ethernet Test Software Package	ENET
USB 2.0 Compliance Test Software Package	USB2
Application Specific Test and Analysis Packages	
Disk Drive Measurement Software Package	DDM2
Advanced Optical Recording Measurement Software Package	AORM*
PowerMeasure Analysis Software Package	PMA2
CANbus Trigger TDM, Decode, and Measure/Graph Testing Option	CANbus TDM**
CANbus TD Trigger and Decode Testing Option	CANbus TD**

* For WP7200A and WP7300A model oscilloscopes.
** Reference the Automotive section on page I-1 for a complete listing of CANbus TDM/TD accessories.

SELECTED PROBES AND SIGNAL CONDITIONERS	
÷10 500 MHz 10 MΩ Passive Probes	PP005A
SMT Probing Accessories for PPE Series, PP005A and PP065 Surface Mount Technology Products	PK106
2.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP2500
1.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP1500

WAVEPRO 7000A SERIES

ORDERING INFORMATION	PRODUCT CODE
SELECTED PROBES AND SIGNAL CONDITIONERS (CONTINUED)	
WaveLink 4 GHz Differential Probe with Adjustable Tip Module	D300A-AT*
WaveLink 7 GHz Differential Probe with Small Tip Module	D600ST*
WaveLink 4 GHz 5 V Differential Probe with Small Tip Module	D350ST*
WaveLink 6 GHz, Differential Positioner with Mounted Tip Module	D500PT*
WaveLink ProBus Probe Body	WL300
1 GHz Active Differential Probe (÷1, ÷10, ÷20)	AP034
500 MHz Active Differential Probe (x10, ÷1, ÷10, ÷100)	AP033
Optical-to-Electrical Converter, 500–870 nm ProBus BNC Connector	OE425
Optical-to-Electrical Converter, 950–1630 nm ProBus BNC Connector	OE455
30 A; 100 MHz Current Probe – AC/DC; 30 A rms; 50 A Peak Pulse	CP031
30 A; 50 MHz Current Probe – AC/DC; 30 A rms; 50 A Peak Pulse	CP030
150 A; 10 MHz Current Probe – AC/DC; 150 A rms; 500 A Peak Pulse	CP150
500 A; 2 MHz Current Probe – AC/DC; 500 A rms; 700 A Peak Pulse	CP500
30 A; 50 MHz Current Probe – AC/DC; 30 A rms; 50 A Peak Pulse	AP015
1 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A
1,400 V, 100 MHz High-Voltage Differential Probe	ADP305
1,400 V, 20 MHz High-Voltage Differential Probe	ADP300

* For a complete probe, order WL300 Probe Body with Probe Tip Module

HARDWARE OPTIONS AND ACCESSORIES	
IEEE-488 GPIB Control Interface	GPIB-1
Dual Monitor Display	DMD-1
Keyboard, USB	KYBD-1
Rackmount Adapter with 25" (64 cm) Slides	RMA-25
Rackmount Adapter with 30" (76 cm) Slides	RMA-30
Hard Transit Case	WM-TC1
Oscilloscope Cart with Additional Shelf and Drawer	OC1024
Oscilloscope Cart, Basic	OC1021
Additional Graphic Printer Paper (10 Rolls Pkg.)	GPR10
Video Trigger Module	VT75
Telecom Adapter Kit, 100 Ω Bal., 120 Ω Bal., 75 Ω Unbal.	TF-ET
Ethernet Compliance Test Fixture for 10Base-T	TF-10BT
Ethernet Compliance Test Fixture for 100Base-T/1000Base-T [Includes a Set of 2 Test Fixtures for Testing Ethernet Signals on Twisted Pair Cables (UTP)]	TF-ENET
USB 2.0 Testing Compliance Test Fixture	TF-USB
Internal Graphics Printer	WM-GP02
Additional Removable Hard Drive	WM-RHD-02
CD-ROM Read/Write Upgrade	WM-CDRW

WAVERUNNER® 6000A SERIES

The WaveRunner® 6000A Series is the best scope available for everyday signal testing. Advanced acquisition technology delivers exceptionally accurate measurements, while out-of-the-box capabilities and outstanding timing resolution rival that of oscilloscopes at twice the cost. The WaveRunner 6000A Series is powered by the same SiGe chipset used in LeCroy's WaveMaster oscilloscopes.

WAVERUNNER 6000A

Features:

- Bandwidths from 350 MHz to 2 GHz
- Sample rates of 2.5 to 10 GS/s
- Standard memory 2 Mpts
- All channels expandable to 12 Mpts
- Up to 24 Mpts when interleaved
- High sample rate to capture high frequency transients and sharp edges
- Very low residual jitter (2 ps typical)
- Ultra-stable clock (±5 ppm)

The WaveRunner 6000A's SMART Trigger technology provides the flexibility to quickly trigger and locate the specific signal characteristic or pattern you want at the touch of a button.

Capabilities:

- Exclusion/inclusion feature to trigger on signals outside or within a specific range of pulse widths.
- Multiple threshold levels and pulse widths to quickly catch the waveform for viewing and measuring.
- Memory retains thousands of acquired events for viewing at your leisure.
- Replay signal history, scan, and search from sweep to sweep.

An Outstanding Scope Experience

WaveRunner lets you focus on understanding your signal rather than setting up your scope. The WaveRunner 6000A's uniquely efficient interface is the result of input received from hundreds of scope users about features and functionality that would facilitate usage in the everyday workplace:

- Bright Display – SVGA screen with 800 x 600 pixels for superior resolution.
- One Touch Efficiency – Descriptor labels show scope settings and status. Touch the screen once to open a setup dialog and change settings.
- Intensity Modulated Display – Display intensity can be adjusted from 0–100% to enable a better view of underlying glitches, runts, or signal modulation in long record captures. The perfect accompaniment to WaveRunner's long memory.
- Dedicated Vertical Controls – Each channel has its own volts per division (V/div) control knob, eliminating the need to multiplex a single V/div control across all four channels.
- Cursor Knobs – Turn the cursor knob to bring up a pair of vertical cursors to quickly measure timing relationships and characterize the waveform.
- Zoom Control Knobs – Four dedicated knobs make it easy to navigate any trace, from broad relationships to minute details.
- "Push" Knobs – All rotating knobs offer push functionality for added capabilities.
- Front Accessible USB Port – Use a memory stick to transfer your captured waveforms, or take your setup from scope to scope to automatically load your configuration.
- Multiple USB ports enable you to connect a variety of plug-n-play peripheral and memory devices.

WAVERUNNER 6000A SERIES

Standard Math Tools

Display up to four math function traces (F1–F4). The easy-to-use graphical interface simplifies setup of up to two operations on each function trace, and function traces can be chained together to perform math-on-math.

absolute value
average (summed)
average (continuous)
custom (MATLAB, Mathcad, VBScript) - limited points
derivative
deskew (resample)
difference (–)
enhanced resolution (to 11 bits vertical)
envelope
exp (base e)
exp (base 10)
fft (power spectrum, magnitude, phase, up to 50 kpts)
floor
histogram of 1000 events
integral
invert (negate)
log (base e)
log (base 10)
product (x)
ratio (/)
reciprocal
rescale (with units)
roof
(sinx)/x
square
square root
sum (+)
trend (datalog) of 1000 events
zoom (identity)

Standard Measure Tools

Displays any 6 parameters together with statistics, including their average high, low, and standard deviations. Histicons provide a fast, dynamic view of parameters and wave shape characteristics.

amplitude
area
base
cycles
custom (MATLAB, Mathcad, VBScript) - limited points)
delay
Δ delay
duration
duty cycle
falltime (90–10%, 80–20%, @ level)
first
frequency
last
level @ x
maximum
mean
median
minimum
number of points
+overshoot
–overshoot
peak-to-peak
period
phase
risetime (10–90%, 20–80%, @ level)
rms
std. deviation
time @ level
top
Δ time @ level
Δ time @ level from trigger
width (positive + negative)
x@ max.
x@ min.

Pass/Fail Testing

Simultaneously test multiple parameters against selectable parameter limits or pre-defined masks. Pass or fail conditions can initiate actions including document to local or networked files, e-mail the image of the failure, save waveforms, send a pulse out at therear panel auxiliary BNC output, or (with the GPIB option) send a GPIB SRQ.

WAVERUNNER 6000A SERIES

WAVERUNNER SOFTWARE OPTIONS – OFFER EXTENDED CAPABILITIES

The WaveRunner 7000A Series takes WaveShape Analysis options to a new level. The following software packages dramatically expand the capabilities of WaveRunner oscilloscopes and enable engineers to trouble-shoot circuits in more productive ways.

ADVANCED MATH AND WAVESHAPE ANALYSIS

Master Analysis Software Package (XMAP)

This package provides maximum capability and flexibility, and includes all the functionality present in XMATH, XDEV, and JTA2

Advanced Math Software Package (XMATH)

This package provides a comprehensive set of WaveShape Analysis tools providing insight into the wave shape of complex signals. Additional capability provided by XMATH includes:

- Parameter math – add, subtract, multiply, or divide two different parameters. Invert a parameter and rescale parameter values.
- Histograms expanded with 19 histogram parameters and up to 2 billion events
- Trend (datalog) of up to 1 million events
- Track graphs of any measurement parameter
- FFT capability added to include: power averaging, power density, real and imaginary components, frequency domain parameters, and FFT on up to 24 Mpts.
- Narrow-band power measurements
- Auto-correlation function
- Sparse function
- Cubic Interpolation function

Advanced Customization Software Package (XDEV)

This package provides a set of tools to modify the scope and customize it to meet your unique needs. Additional capability provided by XDEV includes:

- Creation of your own measurement parameter or math function, using third-party software packages, and display the result in the scope. Supported third-party software packages include:
  - VBScript
  - MATLAB
  - Excel
  - Mathcad
- CustomDSO – create your own user interface in a scope dialog box.
- Addition of macro keys to run VBScript files
- Support for plug-ins

WAVERUNNER 6000A SERIES

ADVANCED MATH AND WAVESHAPE ANALYSIS (CONTINUED)

Value Analysis Software Package (XVAP)

XVAP Adds the following capabilities:

Measurements:

- Jitter and Timing parameters (period@level,width@level, edge@level, duty@level, time interval error@level, frequencey@level, half period, setup, skew, Δ period@level, Δ width@level).

Math:

- Persistence histogram
- Persistence trace (mean, sigma, range)
- 1 Mpts FFTs with power spectrum density, power averaging, real, imaginary, and real+imaginary settings)

Statistical and Graphical Analysis

- 1 Mpts Trends and Histograms
- 19 histogram parameters
- Track graphs of any measurement parameter

Intermediate Math Software Package (XWAV)

XWAV Adds the following capabilities:

Math:

- 1 Mpts FFTs with power spectrum density, power averaging, real, and imaginary components

Statistical and Graphical Analysis

- 1 Mpts Trends and Histograms
- 19 histogram parameters
- Track graphs of any measurement parameter

APPLICATION SPECIFIC TEST AND ANALYSIS PACKAGES

Jitter and Timing Analysis Software Package (JTA2)

This package provides jitter timing and analysis using time, frequency, and statistical views for common timing parameters, and also includes other useful tools. JTA2 includes:

- Jitter and timing parameters, with "Track" graphs of

– Cycle-Cycle Jitter	– Period	– Hold
– N-Cycle	– Half Period	– Skew
– N-Cycle with start selection	– Width	– Duty Cycle
	– Time Interval Error	– Duty Cycle Error
– Frequency	– Setup	

- Edge@lv parameter (counts edges)
- Histograms expanded with 19 histogram parameters and up to 2 billion events
- Trend (datalog) of up to 1 million events
- Track graphs of all parameters
- Persistence histogram, persistence trace (mean, range, sigma)

WAVERUNNER 6000A SERIES

APPLICATION SPECIFIC TEST AND ANALYSIS PACKAGES (CONTINUED)

Digital Filter Software Package (DFP2)

LeCroy's Digital Filter Package (DFP2) implements a set of linear-phase Finite Impulse Response (FIR) filters and IIR filters. It enhances your ability to examine important signal components by filtering out undesired spectral components such as noise. With the custom design feature, corrupted signals can be reconstructed by applying matched (mirror) filters to compensate for known distortions.

The DFP2 option has a broad range of applications:

– System Identification
– Prediction
– Noise Cancellation
– Low-pass Filters
– Band-stop Filters
– Band-pass Filters
– High-pass Filters
– Raised Cosine, Raised Root Cosine, and Gaussian Filters

PowerMeasure Analysis Package (PMA2)

This package provides exceptional ability to measure and analyze the operating characteristics of power conversion devices and circuits.

– Automatic setup and display of relevant waveforms and parameters
– Waveforms scaled and displayed in volts, amps, watts, ohms, etc.
– Power device performance analyzed in-circuit
– Measure and view time domain response of the entire control loop
– Pre-compliance line harmonic testing to EN 61000-3-2
– Complete solutions available including probes and differential amplifiers

Disk Drive Measurements Package (DDM2)

This package provides disk drive parameter measurements and related mathematical functions for performing disk drive WaveShape Analysis.

- Disk Drive Parameters are as follows:

amplitude assymetry	local time trough-peak
local base	local time under threshold
local baseline separation	narrow band phase
local maximum	narrow band power
local minimum	overwrite
local number	pulse width 50
local peak-peak	pulse width 50-
local time between events	pulse width 50+
local time between peaks	resolution
local time between troughs	track average amplitude
local time at minimum	track average amplitude-
local time at maximum	track average amplitude+
local time peak-trough	auto-correlation s/n
local time over threshold	non-linear transition shift

- Correlation function
- Trend (datalog) of up to 1 million events
- Histograms expanded with 18 histogram parameters and up to 2 billion events

WAVERUNNER 6000A SERIES

APPLICATION SPECIFIC TEST AND ANALYSIS PACKAGES (CONTINUED)

CANbus TDM Trigger, Decode, and Measure/Graph Testing Option (CANbus TDM)

- Trigger Module with TC251-OPTO optically isolated Trigger Coupler installed (and room for one additional Trigger Coupler). Trigger Couplers are interchangeable.
- CANbus TD Series Oscilloscope Interface Module with 1.0 meter connection cable. Connects Trigger Module to LeCroy oscilloscope ProBus® interface.
- Storage case with accessories (other accessories may be required)
- Software for
  – Trigger Setup
  – CAN Protocol Decode
  – CAN Measurement, (CAN-analog, CAN-CAN, and Time@CAN timing parameters, CAN bus load% and CAN-Value Data Extraction parameters)
  – Histogramming (up to 2 billion events)
  – Graphing (Track and Trend).

CANbus TD Trigger and Decode Testing Option (CANbus TD)

- Same hardware package as CANbus TDM
- Software for only
  – Trigger Setup – CAN Protocol Decode

Oscilloscope Mixed Signal Option (MS-32)*

32 Digital Channel Oscilloscope Mixed Signal Option.
Gripper probe accessories are recommended.

* MS-32 is compatible with WR6000A 4-channel model oscilloscopes only.

EMC Pulse Parameter Software Package (WR6-EMC)

This package includes enhanced Rise@level, Fall@level and Width@level parameters. The new functionality in the WR6-EMC software package includes user definable thresholds for accurate pulse measurements. WR6-EMC includes:

Rise@level

Set measurement calculations to use one of the following:

- Base and Top (Absolute or Percent)
- Peak-Peak (Percent)
- 0V-Max (Percent)

Fall@level

Set measurement calculations to use one of the following:

- Base and Top (Absolute or Percent)
- Peak-Peak (Percent)
- 0V-Min (Percent)

Width@level

Set measurement calculations to use one of the following:

- Base and Top (Absolute or Percent)
- Peak-Peak (Percent)
- 0V-Max (Percent)
- 0V-Min (Percent)

Measurement Filtering

- Use a filter to limit the number of pulses reported in the parameter result
- Gate measurement parameters to measure individual pulses in an acquisition

Histograms expanded with 19 histogram parameters and up to 2 billion events

Parameter Math

Time@level and dTime@level enhanced with new, Peak-Peak, 0 - Max and 0 - Min parameter calculation levels

WAVERUNNER 6000A SERIES

SPECIFICATIONS	WAVERUNNER 6030A	WAVERUNNER 6050A	WAVERUNNER 6051A	WAVERUNNER 6100A	WAVERUNNER 6200A
VERTICAL SYSTEM					
Nominal Analog Bandwidth @ 50 Ω, 10 mV-1 V/div	350 MHz	500 MHz	500 MHz	1 GHz	2 GHz
Rise Time (Typical)	1 ns	750 ps	750 ps	400 ps	225 ps
Input Channels	4	4	2	4	4
Bandwidth Limiters	20 MHz; 200 MHz				
Input Impedance	1 MΩ || 20 pF (10 MΩ || 9.5 pF using PP007 probe)				
Input Coupling	50 Ω: DC, 1MΩ: AC, DC, GND				
Maximum Input Voltage	50 Ω: 5 Vrms, 1 MΩ: 250 V max (Peak AC: ≤ 10 kHz + DC)				
Channel to Channel Isolation	> 40 dB @ < 100 MHz (> 30 dB @ full bandwidth)				
Vertical Resolution	8 bits; up to 11 with enhanced resolution (ERES)				
Sensitivity	50 Ω: 2 mV/div – 1 V/div fully variable; 1 MΩ: 2 mV – 10 V/div fully variable				
DC Accuracy	±1.0% of full scale (typical); ±1.5% of full scale, ≥ 10 mV/div (warranted)				
Offset Range	50 Ω: ± 400 mV @ 2–4.95 mV/div ±1 V @ 5–100 mV/div ±10 V @ 102 mV/div–1 V/div 1 MΩ: ± 400 mV @ 2–4.95 mV/div ±1 V @ 5–100 mV/div ±10 V @ 102 mV/div–1 V/div ±100 V @ 1.02 V/div–10 V/div				
Offset Accuracy	±(1.5% of offset value + 0.5% of full scale +1 mV) all fixed gain setting < 2 V/div ±(1.5% of offset value + 1.0% of full scale + 1 mV) for variable and V/div settings ≥ 2 V/div				
Input Connector	ProBus/BNC				
TIMEBASE SYSTEM					
Timebases	Internal timebase common to all input channels; an external clock may be applied at the auxiliary input				
Time/Division Range	Real time: 200 ps/div – 10 s/div, RIS mode: to 20 ps/div, Roll mode: up to 1,000 s/div				
Clock Accuracy	≤ 5 ppm @ 25 °C (≤ 10 ppm @ 5–40 °C)				
Sample Rate and Delay Time Accuracy	Equal to Clock Accuracy				
Trigger and Interpolator Jitter	≤ 3 ps rms (typical)				
Time Interval Accuracy	Clock Accuracy + Jitter				
Channel to Channel Deskew Range	±9 X time/div setting, 100 ms max., each channel				
External Sample Clock	DC to 1 GHz; 50 Ω, (limited BW in 1 MΩ), BNC input, limited to 2 Ch operation (1 Ch in WR6051A), (minimum rise time and amplitude requirements apply at low frequencies)				
Roll Mode	User selectable. Available at lower time/div settings				
ACQUISITION SYSTEM					
Single-Shot Sample Rate/Ch	2.5 GS/s	5 GS/s	5 GS/s	5 GS/s	5 GS/s
Interleaved Sample Rate (2 Ch)	5 GS/s	N/A	N/A	10 GS/s	10 GS/s
Random Interleaved Sampling (RIS)	200 GS/s				
Trigger Rate	125,000 waveforms/second				
Sequence Time Stamp Resolution	1 ns				
Minimum Time Between Sequential Segments	8 µs				

WAVERUNNER 6000A SERIES

ACQUISITION SYSTEM (CONTINUED)

Acquisition Memory Options (Sequence Mode)	Max. Acquisition Points (4 Ch/2 Ch, 2 Ch/1 Ch in 6051A)	Segments
Standard	2M/4M	500
Option M	4M/8M	1,000
Option L	8M/16M	5,000
Option VL	12M/24M	10,000

ACQUISITION PROCESSING

	WR6030A	WR6050A	WR6051A	WR6100A	WR6200A
Time Resolution (Min. Single-shot)	200 ps (5 GS/s)			100 ps (10 GS/s)	
Averaging	Summed and continuous averaging to 1 million sweeps				
ERES	From 8.5 to 11 bits vertical resolution				
Envelope (Extrema)	Envelope, floor, or roof for up to 1 million sweeps				
Interpolation	Linear or Sin x/x				

TRIGGER SYSTEM

Trigger Modes	Normal, Auto, Single, Stop
Sources	Any input channel, External, Ext/10, or Line; slope and level unique to each source, except Line
Trigger Coupling	DC
Pre-trigger Delay	0–100% of memory size (adjustable in 1% increments, or 100 ns)
Post-trigger Delay	Up to 10,000 divisions in real time mode, limited at slower time/div settings in roll mode
Hold-off	2 ns to 20 s or 1 to 1,000,000,000 events
Internal Trigger Level Range	±4.1 div from center (typical)

	WR6030A	WR6050A	WR6051A	WR6100A	WR6200A
Trigger Sensitivity with Edge Trigger (Ch 1-4 + external)	2 div @ < 350 MHz, 1 div @ < 250 MHz	2 div @ < 500 MHz, 1 div @ < 350 MHz	2 div @ < 500 MHz, 1 div @ < 350 MHz	2 div @ < 1 GHz, 1 div @ < 750 MHz	2 div @ < 2 GHz, 1 div @ < 1.8 GHz
Max. Trigger Frequency with SMART Trigger® (Ch 1-4 + external)	350 MHz @ ≥ 10 mV	500 MHz @ ≥ 10 mV	500 MHz @ ≥ 10 mV	750 MHz @ ≥ 10 mV	750 MHz @ ≥ 10 mV
Trigger Level DC Accuracy	±4% full scale ±2 mV (typical)				
External trigger range	EXT/10 ±4 V; EXT ±400 mV				

BASIC TRIGGERS

Edge	Triggers when signal meets slope (positive or negative) and level condition.

SMART TRIGGERS

State or Edge Qualified	Triggers on any input source only if a defined state or edge occurred on another input source. Delay between sources is selectable by time or events.
Dropout	Triggers if signal drops out for longer than selected time between 2 ns and 20 s.
Pattern	Logic combination (AND, NAND, OR, NOR) of 5 inputs (4 channels and external trigger input – 2 Ch+EXT on WR6051A). Each source can be high, low, or don't care. The high and low level can be selected independently. Triggers at start or end of the pattern.

SMART TRIGGERS WITH EXCLUSION TECHNOLOGY

Glitch and Pulse Width	Triggers on positive or negative glitches with widths selectable from 600 ps to 20 s or on intermittent faults (subject to bandwidth limit of oscilloscope).
Signal or Pattern Interval	Triggers on intervals selectable between 2 ns and 20 s.
Timeout (State/Edge Qualified)	Triggers on any source if a given state (or transition edge) has occurred on another source. Delay between sources is 2 ns to 20 s, or 1 to 99,999,999 events.
Exclusion Triggering	Trigger on intermittent faults by specifying the normal width or period.

WAVERUNNER 6000A SERIES

AUTOMATIC SETUP

Auto Setup	Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals.
Vertical Find Scale	Automatically sets the vertical sensitivity and offset for the selected channels to display a waveform with maximum dynamic range.

PROBES

Probes	One PP007-WR-1 per channel standard; Optional passive and active probes available.
Probe System; ProBus	Automatically detects and supports a variety of compatible probes.
Scale Factors	Automatically or manually selected, depending on probe used

COLOR WAVEFORM DISPLAY

Type	Color 8.4" flat-panel TFT-LCD with high resolution touch screen
Resolution	SVGA; 800 x 600 pixels
Number of Traces	Display a maximum of 8 traces. Simultaneously display channel, zoom, memory, and math traces.
Grid Styles	Auto, Single, Dual, Quad, Octal, XY, Single + XY, Dual + XY
Waveform Styles	Sample dots joined or dots only

ANALOG PERSISTENCE DISPLAY

Analog and Color-Graded Persistence	Variable saturation levels; stores each trace's persistence data in memory.
Persistence Selections	Select analog, color, or three-dimensional.
Trace Selection	Activate persistence on all or any combination of traces.
Persistence	Aging time select from 500 ms to infinity.
Sweeps Displayed	All accumulated, or all accumulated with last trace highlighted.

ZOOM EXPANSION TRACES

	Display up to 4 Zoom/Math traces

CPU

Processor	Intel® Celeron,® 2.0 GHz or better.
Processing Memory	256 MB on Std and M option; 512 MB with L and VL options
Operating System	Microsoft Windows® XP Professional

INTERNAL WAVEFORM MEMORY

	M1, M2, M3, M4 Internal Waveform Memory (store full-length waveform with 16 bits/data point) or store to any number of files limited only by data storage media.

SETUP STORAGE

Front Panel and Instrument Status	Store to the internal hard drive, over the network, or to a USB-connected peripheral device.

INTERFACE

Remote Control	Via Windows Automation, or via LeCroy Remote Command Set
GPIB Port (Optional)	Supports IEEE – 488.2
Ethernet Port	10/100Base-T Ethernet interface (RJ-45 connector)
USB Ports	5 USB 2.0 ports (one on front of instrument) supports Windows-compatible devices.
External Monitor Port	Standard 15-pin D-Type SVGA-compatible DB-15; connect a second monitor to use dual-monitor display mode.
Parallel Port	Standard DB-25
Serial Port	DB-9 RS-232 port (not for remote oscilloscope control)

AUXILIARY INPUT

Signal Types	Selected from External Trigger or External Clock input on front panel
Coupling	50 Ω: DC, 1 MΩ: AC, DC, GND
Maximum Input Voltage	50 Ω: 5 Vrms, 1 MΩ: 250 V max. (Peak AC: ≤ 10 kHz + DC)

WAVERUNNER 6000A SERIES

AUXILIARY OUTPUT

Signal Type	Trigger Enabled, Trigger Output. Pass/Fail, or Off
Output Level	TTL, ≈3.3 V
Connector Type	BNC, located on rear panel

GENERAL

Auto Calibration	Ensures specified DC and timing accuracy is maintained for 1 year minimum.
Calibrator	Output available on front panel connector provides a variety of signals for probe calibration and compensation.
Power Requirements	100–240 V rms at 50/60 Hz; 115 V rms (±10%) at 400 Hz, Automatic AC Voltage Selection Installation Category: 300V CAT II; Max. Power Consumption: 400 VA/400 W; 350 VA/350 W for WaveRunner 6051A

ENVIRONMENTAL

Temperature: Operating	+5 °C to 40 °C
Temperature: Non-Operating	-20 °C to +60 °C
Humidity: Operating	5% to 80% RH (non-condensing) up to 30 °C, Upper limit derates linearly to 45% RH (non-condensing) at 40 °C
Humidity: Non-Operating	5% to 95% RH (non-condensing) as tested per MIL-PRF-28800F
Altitude: Operating	3,048 m (10,000 ft.) max at ≤ 25 °C
Altitude: Non-Operating	12,190 m (40,000 ft.)

PHYSICAL DIMENSIONS

Dimensions (HWD)	211 mm x 355 mm x 363 mm (excluding feet) 8.3" x 13.8" x 14.3"
Net Weight	10 kg. (22 lbs.), excluding printer
Shipping Weight	less than 13.6 kg. (30 lbs.)

CERTIFICATIONS

CE Compliant, UL and cUL listed; Conforms to EN 61326-1, EN 61010-1, UL 3111-1, and CSA C22.2 No. 1010.1.

WARRANTY AND SERVICE

3-year warranty; calibration recommended annually.
Optional service programs include extended warranty, upgrades, calibration, and customization services.

WAVERUNNER 6000A SERIES

ORDERING INFORMATION	PRODUCT CODE
2 GHz, 4 Ch, 5 GS/s, 2 Mpts/Ch (10 GS/s, 4 Mpts/2 Ch) Color with Windows® XP Pro	WaveRunner 6200A
1 GHz, 4 Ch, 5 GS/s, 2 Mpts/Ch (10 GS/s, 4 Mpts/2 Ch) Color with Windows XP Pro	WaveRunner 6100A
500 MHz, 4 Ch, 5 GS/s, 2 Mpts/Ch (4 Mpts/2 Ch) Color with Windows XP Pro	WaveRunner 6050A
500 MHz, 2 Ch, 5 GS/s, 2 Mpts/Ch (4 Mpts/1 Ch) Color with Windows XP Pro	WaveRunner 6051A
350 MHz, 4 Ch, 2.5 GS/s, 2 Mpts/Ch (5 GS/s, 4 Mpts/2 Ch) Color with Windows XP Pro	WaveRunner 6030A

INCLUDED WITH STANDARD CONFIGURATION	
÷10 HiZ 500 MHz Passive Probe (Total of 1 Per Channel)	PP007-WR-1
Getting Started Manual	
CD-ROM containing Operator's Manual, Remote Control Manual, and Automation Manual	
CD-ROMs containing Utility Software, and Norton Antivirus Software (1 year subscription)	
Optical 3-button Wheel Mouse – USB	
Standard Ports; 10/100Base-T Ethernet, USB 2.0 (5), Parallel, RS-232, SVGA Video out, Audio in/out	
Protective Front Cover	
Standard Commercial Calibration and Performance Certificate	
3-Year Warranty	

MEMORY OPTIONS	
24 Mpts max. when interleaved, 12 Mpts/Ch (for use with 4 Ch WaveRunner)	-VL
16 Mpts max. when interleaved, 8 Mpts/Ch (for use with 4 Ch WaveRunner)	-L
8 Mpts max. when interleaved, 4 Mpts/Ch (for use with 4 Ch WaveRunner)	-M
24 Mpts max., 2 Ch 12 Mpts/Ch Memory Option	-VL2
16 Mpts max., 2 Ch 8 Mpts/Ch Memory Option	-L2
8 Mpts max., 2 Ch 4 Mpts/Ch Memory Option	-M2

SOFTWARE OPTIONS	
Disk Drive Measurement Software Package	WR6-DDM2
Digital Filter Software Package	WR6-DFP2
Ethernet Test Software Package (WR6200A Only)	WR6-ENET
Jitter and Timing Analysis Software Package	WR6-JTA2
PowerMeasure Analysis Software Package	WR6-PMA2
Serial Data Mask Software Package	WR6-SDM*
USB 2.0 Compliance Test Software Package (WR6200A Only)	WR6-USB2
EMC Pulse Parameter Software Package (WR6100A and WR6200A Only)	WR6-EMC
Intermediate Math Software Package	WR6-XWAV
Advanced Math Software Package	WR6-XMATH
Advanced Customization Software Package	WR6-XDEV
Value Analysis Software Package (Includes XWAV and JTA2)	WR6-XVAP
Master Analysis Software Package (Includes JTA2, XMATH and XDEV)	WR6-XMAP
Processing Web Editor Software Package for Functions and Parameters	WR6-XWEB

* WR6200A model oscilloscope required for full mask testing capability, lower bandwidth models will have reduced capabilities.

HARDWARE AND SOFTWARE OPTIONS	
32 Digital Channel Oscilloscope Mixed Signal Option	MS-32**
CANbus TDM Trigger, Decode and Measure/Graph Testing Option	CANbus TDM**
CANbus TD Trigger and Decode Testing Option	CANbus TD**

* MS-32 is compatible with WR6000A 4-channel model oscilloscopes only.
*** Reference the Automotive section on page I-1 for a complete listing of CANbus TDM/TD accessories

WAVERUNNER 6000A SERIES

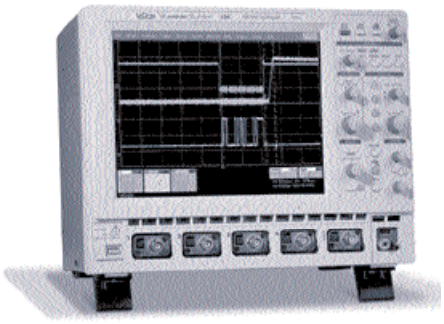
ORDERING INFORMATION	PRODUCT CODE
PROBES AND PROBE ACCESSORIES OPTIONS	
2.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP2500
1.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP1500
1 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP1000
WaveLink 4 GHz Differential Probe with Adjustable Tip Module	D300A-AT*
WaveLink 4 GHz, 5 V Differential Probe with Small Tip Module	D350ST*
WaveLink ProBus Probe Body	WL300
1 GHz Active Differential Probe (÷1, ÷10, ÷20)	AP034
500 MHz Active Differential Probe (x10, ÷1, ÷10, ÷100)	AP033
30 A; 100 MHz Current Probe – AC/DC; 30 A rms; 50 A Peak Pulse	CP031
30 A; 50 MHz Current Probe - AC/DC; 30 A rms; 50 A Peak Pulse	CP030
30 A; 50 MHz Current Probe – AC/DC; 30 A rms; 50 A Peak Pulse	AP015
150 A; 10 MHz Current Probe – AC/DC; 150 A rms; 500 A Peak Pulse	CP150
500 A; 2 MHz Current Probe – AC/DC; 500 A rms; 700 A Peak Pulse	CP500
1,400 V, 100 MHz High-Voltage Differential Probe	ADP305
1,400 V, 20 MHz High-Voltage Differential Probe	ADP300
Basic Adapter Kit for PP007-WR-1 and PP007-WS-1	PK701
Advanced Adapter Kit for PP007-WR-1 and PP007-WS-1	PK702
SMD Adapter Kit for PP007-WR-1 and PP007-WS-1	PK703
Microclip Kit for PP007-WR-1 and PP007-WS-1	PK704
1 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A

*For a complete probe, order a WL300 Probe Body with the Probe Tip Module. Only applicable with the WR6200A model oscilloscope.

HARDWARE OPTIONS AND ACCESSORIES	
IEEE-488 GPIB Interface Upgrade	WR6-GPIB
Graphics Printer	WR6A-GP
Removable Hard Drive	WR6-RHD
CD-RW Upgrade	WR6-CDRW
Graphic Printer Retrofit	WR6A-RK-GP
USB Floppy Drive	WR6-FLPY
Hard Transit Case	WR6-HARD
Soft Carrying Case	WR6-SOFT
Rackmount, 6U High	WR6-RACK
Accessory Pouch	WR6-POUCH
Mini Keyboard, USB	WR6-KBD
USB Flash Memory	MEM-USB
Video Trigger Module	VT75
Oscilloscope Cart with Additional Shelf and Drawer	OC1024
Oscilloscope Cart	OC1021
Ethernet Compliance Fixture for 10Base-T	TF-10BT
Ethernet Compliance Fixture for 100Base-T/1000Base-T [Includes a Set of 2 Test Fixtures Signals on Twisted Pair Cables (UTP)]	TF-ENET
Telecom Adapter Kit 100 Ω Bal., 120 Ω Bal., 75 Ω Unbal.	TF-ET
USB 2.0 Testing Compliance Test Fixture	TF-USB

WAVESURFER® 400 SERIES

From its large 10.4" LCD touch screen to its space-saving small footprint, the WaveSurfer® oscilloscope is a radical rethinking of the basic bench scope. It breaks the rules of conventional scope design to deliver dramatically improved signal viewing, 100x the capture time, and up-to-the-minute connectivity capabilities. More importantly, it's designed for the way you like to work—big, sharp images of your signal, a simple, easy-to-use interface, and a strong tool set for testing and debugging.



WAVESURFER 400

The WaveSurfer 10.4" display is 2-1/2 times the size of the 6.4" screens found on competitive oscilloscopes. An 800 x 600 SVGA display boasts exceptional brightness, crisp, clear signal details, and a wide viewing angle. Its 6" deep footprint eliminates the space penalty that comes with conventional oscilloscopes.

Features:

- 500 MHz, 350 MHz, and 200 MHz bandwidth
- 2 or 4 channels
- Large 10.4" color LCD touch screen; only 6" deep
- More than 100x the capture time at full sample rate compared to other scopes in its class
- Extensive connectivity options
- 1 ms long acquisition
- Zoom of detail while retaining high sample rate

Extensive connectivity options allow you to document work and effectively communicate the results. Whether you want to save data to the oscilloscope's hard drive or a network drive, e-mail other engineers, or send images to the printer, the WaveSurfer oscilloscope offers the flexibility to manage your communications and boost your productivity.

WAVESURFER SOFTWARE OPTIONS – OFFER EXTENDED CAPABILITIES

WS-MATHSURF

MathSurfer Advanced Math Software adds the following advanced math functions: Absolute Value, Averaging (summed and continuous), Derivative, Envelope, Enhanced Resolution (to 11 bits), Floor, Integral, Invert, Reciprocal, Roof, Square, and Square Root. It also adds chaining of two math functions, rescaling to different units, and 1 Mpts FFTs.

WS-ADVTRIG

The Advanced Trigger Software Package includes Runt, Slew Rate, Qualified Edge, Qualified State, Interval, and Dropout triggers.

WAVESURFER 400 SERIES

SPECIFICATIONS	WAVESURFER 424	WAVESURFER 422	WAVESURFER 434	WAVESURFER 432	WAVESURFER 454	WAVESURFER 452
VERTICAL SYSTEM						
Bandwidth (at probe tip)	200 MHz		350 MHz		500 MHz	
Rise Time (typical)	1.75 ns		1 ns		750 ps	
Input Channels	4	2	4	2	4	2
Display	10.4" color flat-panel TFT-LCD, 800 x 600 SVGA, touch screen					
Sample Rate (single-shot)	2 GS/s max. (interleaved mode), 1 GS/s (all channels)					
Sample Rate (RIS mode)	50 GS/s					
Standard Record Length	500 kpts/Ch (interleaved mode), 250 kpts/Ch (all channels)					
Maximum Record Length (Optional)	2 Mpts/Ch (interleaved mode), 1 Mpts/Ch (all channels)					
Standard Capture Time	Up to 250 µs at full sample rate					
Maximum Capture Time (Optional)	Up to 1 ms at full sample rate					
Vertical Resolution	8 bits					
Vertical Sensitivity	1 mV/div – 10 V/div (1 MΩ); 1 mV/div – 2 V/div (50 Ω)					
Vertical (DC Gain) Accuracy	±(1.5% of reading +0.5% of full scale)					
BW Limit	20 MHz		20 MHz, 200 MHz			
Maximum Input Voltage	±400 Vpk (CAT I), ±300 Vpk (CAT II)					
Input Coupling	AC, DC, GND (AC for 1 MΩ only) 50 Ω: DC, GND; 1 MΩ: AC, DC. GND					
Input Impedance	1 MΩ || 16 pF, or 50 Ω ±1%					
Probing System	BNC or ProBus					
Probes	(1) PP007-WS-1 per channel (standard)					
Time/div Range	1 ns – 1000 s/div		500 ps – 1000 s/div Roll mode from 200 ms/div – 1000 s/div		200 ps – 1000 s/div	
Timebase Accuracy	10 ppm					
TRIGGERING						
Standard	Edge, Glitch, Width, Logic (Pattern), TV/Composite Video					
Advanced (WS-ADVTRIG)	Runt, Slew Rate, Interval (Signal or Pattern), Dropout, Qualified (State or Edge)					
MEASURE, ZOOM, AND MATH TOOLS						
Standard Parameter Measurement	Amplitude, Area, Base (Low), Delay, Duty, Fall Time (90%-10%), Fall Time (80%-20%), Frequency, Maximum, Mean, Minimum, Overshoot+, Overshoot-, Period, Peak-Peak, Rise Time (10%-90%), Rise Time (20%-80%), RMS, Skew, Standard Deviation, Top (High), Width+, Width –.					
Zooming	Use front panel QuickZoom button, or use touch screen or mouse to draw a box around the zoom area.					
Standard Math	Operators include Sum, Difference, Product, Ratio, and FFT (up to 25 kpts with power spectrum output and rectangular, Von Hann, and FlatTop windows). 1 math function may be defined at a time.					
Extended Math (WS-MATHSURF)	Adds the following additional math functions: Absolute Value, Averaging (summed and continuous), Derivative, Envelope, Enhanced Resolution (to 11 bits), Floor, Integral, Invert, Reciprocal, Roof, Square, and Square Root. Also adds chaining of two math functions, rescaling to different units, and 1 Mpt FFTs.					

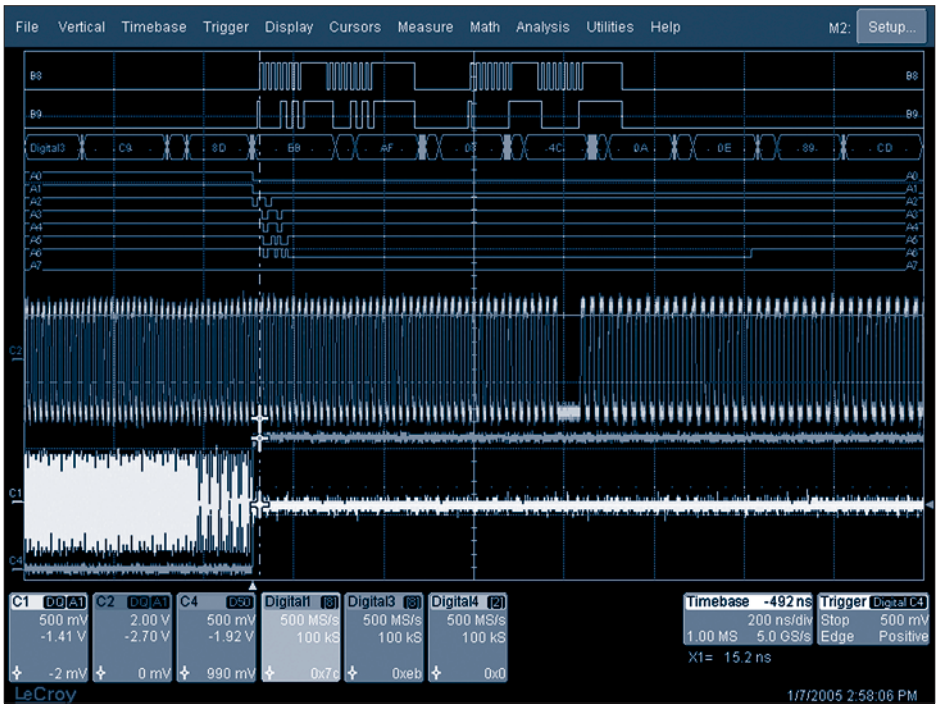
WAVESURFER 400 SERIES

ORDERING INFORMATION	PRODUCT CODE
WAVESURFER FOUR CHANNEL DIGITAL OSCILLOSCOPES	
500 MHz, 2 GS/s, 500 kpts/Ch (Interleaved), Color with 10.4" Display (1 GS/s, 250 kpts/Ch)	WaveSurfer 454
350 MHz, 2 GS/s, 500 kpts/Ch (Interleaved), Color with 10.4" Display (1 GS/s, 250 kpts/Ch)	WaveSurfer 434
200 MHz, 2 GS/s, 500 kpts/Ch (Interleaved), Color with 10.4" Display (1 GS/s, 250 kpts/Ch)	WaveSurfer 424
WAVESURFER TWO CHANNEL DIGITAL OSCILLOSCOPES	
500 MHz, 2 GS/s, 500 kpts/Ch (Interleaved), Color with 10.4" Display (1 GS/s, 250 kpts/Ch)	WaveSurfer 452
350 MHz, 2 GS/s, 500 kpts/Ch (Interleaved), Color with 10.4" Display (1 GS/s, 250 kpts/Ch)	WaveSurfer 432
200 MHz, 2 GS/s, 500 kpts/Ch (Interleaved), Color with 10.4" Display (1 GS/s, 250 kpts/Ch)	WaveSurfer 422
INCLUDED WITH STANDARD CONFIGURATION	
PP007–WS 10:1 Passive Probe (1 per Channel)	
Operator's Getting Started Manual, Quick Reference Guide	
CD-ROM with Operator's Getting Started Manual, Quick Reference Guide, and Remote Control Manual	
10/100Base-T Ethernet Port, 3 USB 2.0 Ports, SVGA Video Output Port, RS232-C Serial Port, Centronics Parallel Port, Protective Front Cover	
Standard Commercial Calibration and Performance Certificate	
3-Year Warranty	
MEMORY OPTIONS FOR FOUR CHANNEL WAVESURFER	
2 Mpts/2 Ch, 1 Mpts/4 Ch	WS-L-4
MEMORY OPTIONS FOR TWO CHANNEL WAVESURFER	
2 Mpts/1 Ch, 1 Mpts/2 Ch	WS-L-2
SOFTWARE OPTIONS	
Advanced Trigger Software Package	WS-ADVTRIG
Electrical Telecom Test Software Package	WS-ET-PMT
MathSurfer Advanced Math Software Package	WS-MATHSURF
Operating System Lockout Option for Businesses	WS-LOCKOUT-BUS
Operating System Lockout Option for Not-for-Profit Organizations	WS-LOCKOUT-NFP
HARDWARE AND SOFTWARE OPTION	
32 Digital Channel Oscilloscope Mixed Signal Option	MS-32*

* Only applicable with WS434 and WS454 model oscilloscopes. Reference the Mixed Signal Testing section on page E-1 for a complete listing of MS-32 accessories.

HARDWARE OPTIONS AND ACCESSORIES	
Basic Adapter Kit for PP007-WR-1 and PP007-WS-1	PK701
Advanced Adapter Kit for PP007-WR-1 and PP007-WS-1	PK702
SMD Kit for PP007-WR-1 and PP007-WS-1	PK703
Microclip Kit for PP007-WR-1 and PP007-WS-1	PK704
USB 2.0 to GPIB IEEE-488.2 Adapter	WS-GPIB
Mounting Bracket Only – 100 mm Square	WS-MB
Mounting Stand – Desktop Clamp Style (Includes WS-MB Mounting Bracket)	WS-MS-CLAMP
Mounting Stand – Pedestal Style (Includes WS-MB Mounting Bracket)	WS-MS-PED
Rackmount Ears Kit	WS-RMA-25
Complete Battery System containing one (1) battery pack and one (1) charger	WS-BATT-SYS
Additional Battery Pack	WS-BATTERY
Soft Carrying Case	WS-SOFT
Accessory Pouch	WS-POUCH
DC Adapter	WS-DCADAP
External Graphics Printer	GP-EXT
Additional Graphic Printer Paper (10 Rolls)	GPR10
÷10 HiZ 500 MHz Passive Probe	PP007-WS-1
Mini Keyboard, USB	428210002†

MS-32



Enhanced Test and Analysis Capabilities for Mixed Signal Environments

Finally, the ultimate solution for mixed signal oscilloscopes—enough channels. LeCroy's MS-32 and a WaveSurfer® or WaveRunner® oscilloscope provide 4 analog and 32 digital channels for powerful measurement capability. LeCroy now offers the perfect solution for embedded controller testing where there are multiple analog signals coincident with digital signals. Analog signals include comparators, voltage sources, sensor/actuator signals, etc.; while digital signals include address or data lines, control signals, or peripheral serial data signals.

Users can capture all their signal information using long memory, or set up digital or analog trigger conditions to capture the event of interest. Signal debug is simple, using standard oscilloscope tools, such as cursors, measurement parameters, and zooming.

Features:

- 32 digital channels
- Long capture time (1 Mpts/Ch of digital memory, always available)
- Ability to capture up to 125 MHz digital clocks
- Simple oscilloscope setup and user interface

4 Analog + 32 Digital Channel Capability

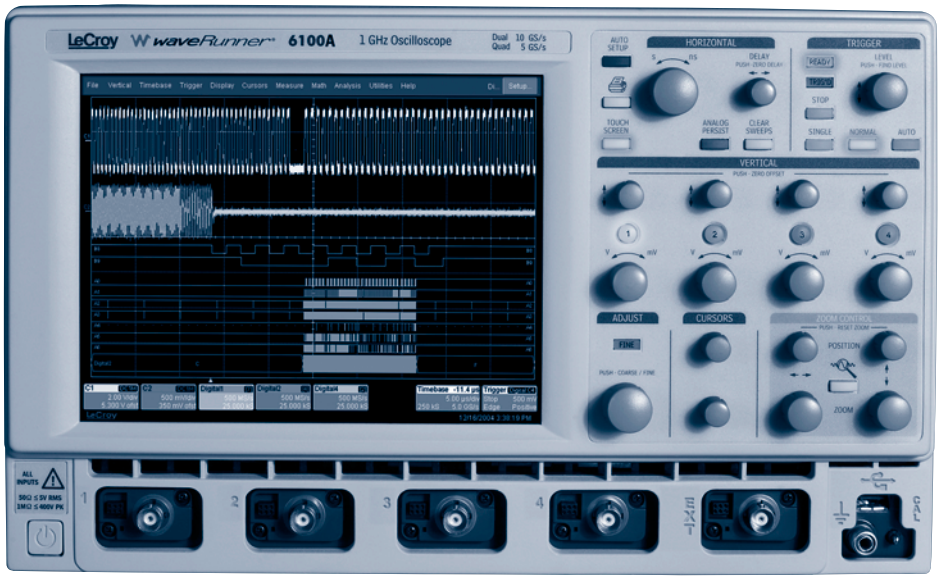
LeCroy introduces the first oscilloscope solution to combine 4 analog channels with 32 digital channels. This is ideal for the most efficient testing of 16-bit embedded controllers, where all 16 ADDR and 16 DATA lines can be viewed at one time. Or, a multitude of ADDR and DATA lines can be viewed, in addition to control lines and low-speed serial data lines (SPI, I2C, etc.). Testing and debugging efficiency is greatly enhanced by eliminating the need to continuously disconnect/reconnect signals to observe different behaviors.

MS-32

Functions:

- **Long Digital Capture Time** – 1 Mpts of digital memory/channel ensures that users can capture their area of interest. 1 Mpts is always available on every channel.
- **Parallel Bus Definition** – The digital information obtained by viewing parallel ADDR or DATA bus information can be defined as a bus display. Users can also define a digital trigger for a particular bus value. Up to 4 different buses can be defined.
- **User Interface** – A familiar interface eliminates the need to spend a lot of time learning a new tool.
- **Resize/Reposition** – Digital lines can be resized and repositioned anywhere on the oscilloscope grid by using the front panel controls or software menus.
- **Flexibly Trigger** – Select from a number of different analog triggers; or create a digital trigger by defining a digital trigger pattern, logic bus value, or interval.
- **Cursors** – Cursors will read time or bus information, as appropriate.
- **Quick Setup** – Unlike a traditional Logic Analyzer, the MS-32 is easy to use. A single module consolidates all of the MS-32/oscilloscope interconnections, so users can start viewing signals and debugging quickly. In addition, all standard oscilloscope tools are readily accessible.

MS-32



Use the MS-32 with Most 4-Channel WaveRunner or WaveSurfer Oscilloscopes

Available for 6030A, 6050A, 6100A, 6200A	
Bandwidth Range	350 MHz–2 GHz
# Analog Channels	4
Analog Sample Rate	5 GS/s per Channel (500 MHz) 10 GS/s max. (6100A and 6200A only)
Analog Memory	2 Mpts/Ch standard Options up to 12 Mpts/Ch
Digital Memory	1 Mpts/Ch (with MS-32)
Application Packages	CAN Bus Trigger and Decode Power Measure and Analysis Disk Drive Measure Serial Data Mask Ethernet USB 2.0
Display Size	8.4"
Operating System	Windows® XP

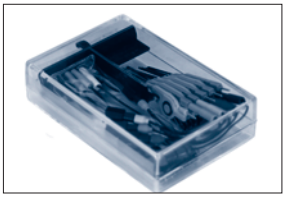
Available for WS434, WS454	
Bandwidth Range	350 MHz–500 MHz
# Analog Channels	4
Analog Sample Rate	2 GS/s max.
Analog Memory	250 kpts/Ch
Digital Memory	1 Mpts/Ch (with MS-32)
Application Packages	None
Display Size	10.4"
Operating System	Windows® XPe

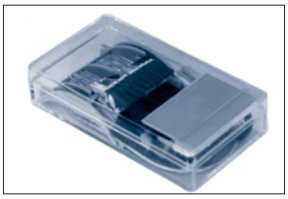
MS-32

MS-32 System Components

1 **Oscilloscope Interface Module**
2 **Power Supply**
3 **USB 2.0 Cable**
4 **32 Channel Digital Logic Pod**
5 **10.5" Digital Lead Set**
6 **Foam Lined Soft Accessory Case**

5x Magnifying Glass (not pictured)





MS-32 Gripper Probe Set Accessories

PK400-1 – Large gripper probe set for 0.10" (2.54 mm) pin pitch, includes 10 probes with color-coded leads

PK400-2 – Medium gripper probe set for 0.04" (1.0 mm) pin pitch, includes 10 probes with color-coded leads

PK400-3 – Small gripper probe set for 0.008" (0.2 mm) pin pitch, includes 10 probes with color-coded leads

SPECIFICATIONS

DIGITAL CHANNELS

Number	32
Memory	1 Mpts/Ch
Probe Inputs	240 kΩ || 10 pF
Threshold Levels	TTL, ECL, CMOS (2.5, 3.3, 5 V), PECL, or User Defined.
Sampling Rate	1 kS/s to 500 MS/s
Minimum Input Voltage Range	±300 mV around the threshold voltage setting
Maximum Input Voltage	30 V
Digital Channel Grouping	4 digital groups can be defined. Each group may use any combination of 32 digital lines. Groups can be displayed as individual lines, or collapsed into a bus view.
Triggering	User selectable analog (i.e., std. oscilloscope trigger) or digital trigger

DIGITAL TRIGGER

Setup Type	Logic, Logic Bus, or Interval
Logic Setup	Up to 32 digital lines, with any combination of 0, 1, or X (don't care). In addition, a Rising Edge, Falling Edge, or Either Edge condition may also be set (Note: multiple edges are OR combined).
Logic Bus Setup	Up to 32 digital lines, defined in hexadecimal format

MS-32

DIGITAL TRIGGER (CONTINUED)	
Interval	Define a single digital line, the slope, the condition, and the time period in which the second occurrence of that digital line should occur. Available conditions are < or >.
Accuracy	±1 digital sample (based on digital sample rate)
Certifications	CE Approved. Conforms to EN61326-1 and EN61010-1

PHYSICAL DIMENSIONS	
Pod Dimensions (WLD)	3.8" x 6.3" x 1.2" (9.6 cm x 16 cm x 3 cm)
Pod Weight	14 oz. (397 g)
Complete System Dimensions (WLD)	12.5" x 9.8" x 2.5" (32 cm x 25 cm x 6.4 cm)

ORDERING INFORMATION	PRODUCT CODE
OSCILLOSCOPE MIXED SIGNAL OPTION	
32 Digital Channel Oscilloscope Mixed Signal Option for WaveSurfer 400 Series and WaveRunner 6000A Series Oscilloscopes	MS-32*
MS-32 with License to use on 5 Oscilloscopes	MS-32-5LIC
MS-32 with License to use on 2 Oscilloscopes	MS-32-2LIC

* MS-32 can be used with all 4-channel WaveRunner 6000A model oscilloscopes, and with WaveSurfer 434 and 454 model oscilloscopes.

INCLUDED WITH MS-32
32 Digital Channel Logic Pod with Power Supply
10.6" (27 cm) Lead Set
6 ft. (1.8 m) USB 2.0 Cable
Oscilloscope Interface Module with 5 ft. (1.5 m) Cables
Soft Accessory Case
Magnifying Glass (5x)
Printed Operator's Manual (English)
Quick Reference Guide (English)
CE Conformance Certificate Contained in Manual

HARDWARE OPTIONS AND ACCESSORIES	
Large Gripper Probe Set for 0.10" (2.54 mm) Pin Pitch, Includes 10 Probes with Color-coded Leads	PK400-1
Medium Gripper Probe Set for 0.04" (1.0 mm) Pin Pitch, Includes 10 Probes with Color-coded Leads	PK400-2
Small Gripper Probe Set for 0.008" (0.2 mm) Pin Pitch, Includes 10 Probes with Color-coded Leads	PK400-3
10" Digital Lead Set, 32 Digital Channel Lead Set (for Clock Speeds ≤ 125 MHz)	MS-32-STDLEADS
14" Digital Lead Set, 32 Digital Channel Lead Set (for Clock Speeds < 25 MHz)	MS-32-STDLEADS-L
Mictor Connection Cable, 3" long (7.6 cm), 38-pin (for Clock Speeds ≤ 125 MHz)	MS-32-Mictor-S
Mictor Connection Cable, 14" long (35.6 cm), 38-pin (for Clock Speeds < 100 MHz)	MS-32-Mictor-L
Retrofit GoLogic U36-1M to MS-32	RK-GOLOGIC-MS-32

INSTRUMENT CARTS

LeCroy's new line of sturdy instrument carts create streamlined workstations designed to address space confines while adding mobility and versatility to oscilloscopes and related equipment.

OC1024/OC1021

Features:

- Steel and aluminum frame finished with a durable powder-coat epoxy
- Height- and angle-adjustable shelves
- Base bin for storage of larger instruments and accessories
- Mounting straps to secure instruments
- High quality casters; 2 locking casters
- Drawer for storage of small, delicate leads, and cables (OC1024)
- Pegboard style side panels for storage of probes, cables, and accessories (OC1024)

SPECIFICATIONS

OC1024	
Width	57.9 cm (22.8")
Depth	55.9 cm (22")
Height	137 cm (54")
Weight	36 kg (79 lbs.)
OC1021	
Width	54.8 cm (21.6")
Depth	55.9 cm (22")
Height	76.2 cm (30")
Weight	21.8 kg (48 lbs.)
Top Shelf	
Width	50.8 cm (20") [46.48 cm (18.3") between side extrusions]
Tilt Shelf	
Width	45.9 cm (18.1")
Depth	50.8 cm (20")
Bottom Bin	
Width	49.5 cm (19.5")
Depth	43.1 cm (17")
Height	4.0 cm (1.6")

ORDERING INFORMATION	PRODUCT CODE
137 cm (54") high oscilloscope cart with height and angle adjustable tilt shelf, top shelf with drawer, bottom bin, mounting straps, and "pegboard" style side panels. Supports all models in LeCroy oscilloscope line.	OC1024
76.2 cm (30") high oscilloscope cart with height and angle adjustable tilt shelf, bottom bin, and mounting straps. Supports all models in LeCroy oscilloscope line.	OC1021

OE555
OE525
OE455
OE425

OE CONVERTERS

These wide-band multi-mode optical-to-electrical converters are designed for measuring optical communications signals. Their broad wavelength range and multi-mode input optics make these devices ideal for applications including Gigabit Ethernet and Fibre Channel, as well as SONET/SDH up to 2.5 Gb/s.

The OE425 and OE455 are ProBus modules compatible with WavePro and WaveRunner oscilloscopes as well as WaveMaster when used with a LPA-BNC adapter. The OE525 and OE555 are ProLink modules compatible with WaveMaster, SDA and DDA oscilloscopes.

Features:

- Frequency range to 5 GHz (6 GHz optical)
- 62.5 µm or narrower multi-mode or single mode fiber input
- Broad wavelength range:
- 500-870 nm (OE425, OE525)
- 950-1630 nm (OE455, OE555)
- High responsivity
- Low noise:

SPECIFICATIONS	OE425/OE525	OE455/OE555
Wavelength Range	500–870 nm 460–870 nm (.1 V/mW)	950–1630 nm 800–1630 nm (.1 V/mW)
Conversion Gain	0.5 V/mW	1.1 V/mW
Bandwidth	5 GHz (6 GHz optical)	3.5 GHz (4.5 GHz optical)
Equivalent Noise	2.2 µW rms	1.2 µW rms
Maximum Optical Power (at 5% saturation)	2.2 mW	1.3 mW
Rise Time	90 ps	108 ps
Maximum Safe Input	5.5 mW	1.3 mW
Temperature Drift	.00275 dB / °C	.00275 dB / °C
Frequency Response Ripple	1.1 dB	1.1 dB
Connector Type	FC/PC	FC/PC

ORDERING INFORMATION	PRODUCT CODE
Optical-to-Electrical Converter, 500–870 nm ProBus BNC Connector	OE425
Optical-to-Electrical Converter, 950–1630 nm ProBus BNC Connector	OE455
Optical-to-Electrical Converter, 500–870 nm ProLink BMA Connector	OE525
Optical-to-Electrical Converter, 950–1630 nm ProLink BMA Connector	OE555

TRANSIT CASES

ORDERING INFORMATION	PRODUCT CODE
Soft Accessory Case for Probes – features inside flap for storing manuals, plus roomy interior for a probe and its many accessories.	SAC-01
Hard Transit Case for WaveRunner 6000A	WR6-HARD
Soft Carrying Case for the WaveRunner 6000A	WR6-SOFT
Hard Transit Case for WaveMaster, DDA5005A, and SDA Series – molded high densitypolyethylene plastic case. Features pull handle and wheels, with custom polyethylene foam interior. 25" x 23" x 14"	WM-TC1
Soft Carrying Case for WaveMaster, DDA5005A, and SDA Series – nylon and herculyte vinyl shell. Features accessory pouch, shoulder strap, diamond rubber feet, foam insert, and plastic reinforcement. 20.5" x 13.5" x 16.5"	WM-SCC
Soft Carrying Case for the WaveSurfer Series.	WS-SOFT

SAC-01

WM-TC1

WM-SCC

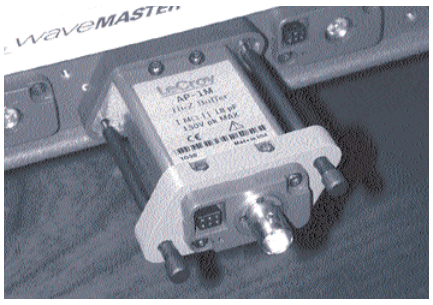
AP-1M

The AP-1M offers a convenient method to provide high impedance input when using the WaveMaster Series oscilloscopes, DDA5005A and SDA series.

Features:
- 500 MHz bandwidth (typical)
- 1 MΩ input impedance path
- FSR ±8 V dynamic range

Compatible with the following accessories:
- High impedance passive probes (not required for PP066)
- ADP300/ADP305/AP031 differential probes
- Cpxxx series current probes. Includes PP005A Passive Probe

ORDERING INFORMATION	PRODUCT CODE
1 MΩ Adapter includes PP005A Passive Probe	AP-1M



AP-1M

VT75 VIDEO TRIGGER

VT75

VT75 is an accessory that provides video triggering on standard and custom video signals. The device is configured to allow the analog input signal to pass through to the input channel while picking off the triggering information. The input impedance is video standard 75 ohm, and the connector is a true 75 ohm BNC. In addition to standard settings, the VT75 has a custom option that allows users to set the field and line number to trigger on, as well as the sync polarity and interlace. By selecting TV Auto Setup, the oscilloscope sets the vertical and time scale factors, trigger, and other modes necessary to obtain a stable view of a video field.

Features:

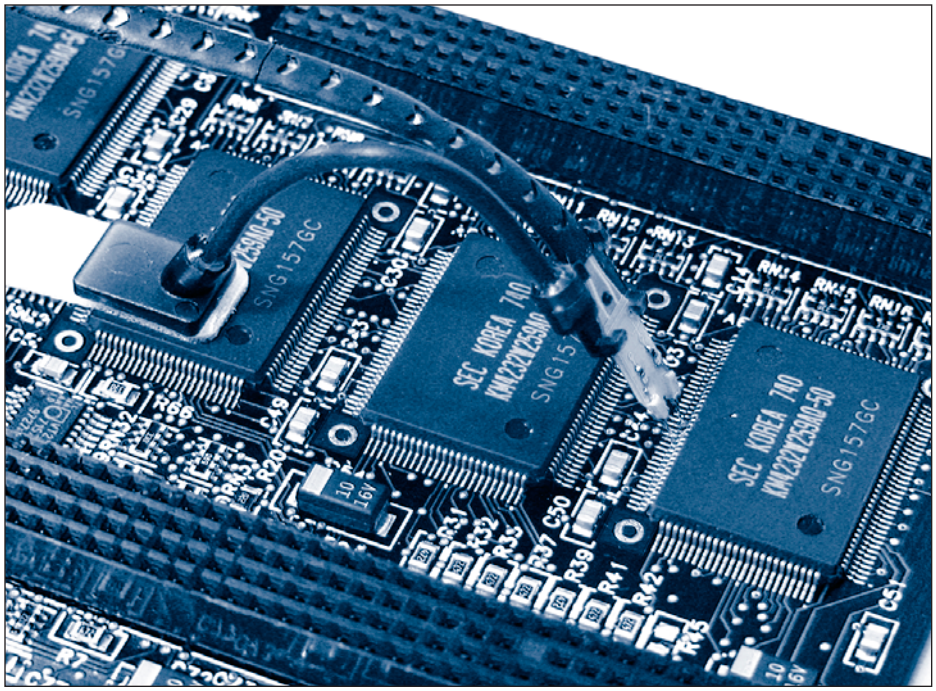
- Presets for standard NTSC, PAL, SECAM video signals
- CUSTOM mode allows selection of field and line numbers
- Standard 75 ohm video input

SPECIFICATIONS

Preset Standards	NTSC, PAL, SECAM
Custom	Any line 1–1500, and field 1–8 Positive or negative sync, 8:1, 4:1, 1:2 or 1:1 interlace
Input Impedance	75 Ω
Input Range	500 mV – 2 Vp-p
Compatibility	X-Stream oscilloscope with ProBus interface
VT75 Includes	0.9 m (36") 75 Ω BNC cable, SAC-01 Soft Accessory Case

ORDERING INFORMATION	PRODUCT CODE
Video Trigger Module	VT75
Soft Accessory Case	SAC-01

D11000PS DIFFERENTIAL PROBE SYSTEM



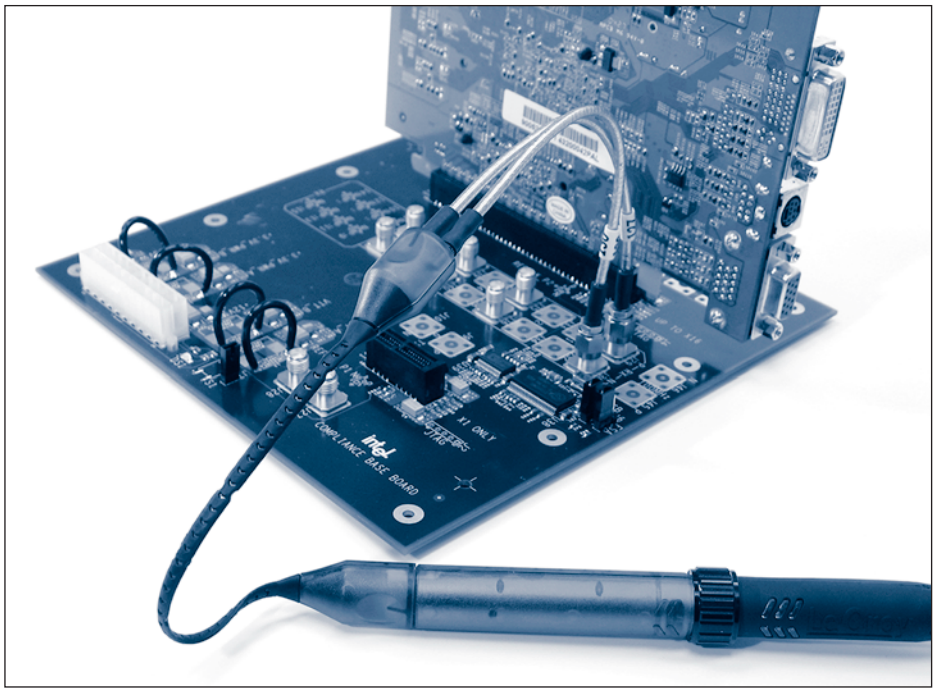
The D11000PS extends the full signal acquisition performance of the SDA 11000 to the probe tips. With 11 GHz system bandwidth, the probe enables direct measurement of high-speed serial data streams up to 6.25 Gb/s.

Choice of Interconnect Styles Without Compromising Performance
The D11000PS provides both direct Solder-In and cabled SMA interconnect lead assemblies. Each interconnect lead comes with a dedicated probe amplifier module that has calibration data optimized for the respective lead. This eliminates the performance compromise of using a single calibration for multiple lead types. The Solder-In lead provides the highest possible signal integrity with a high loading impedance. The dual SMA interconnect leads provide a true differential 50 Ω input. This is a convenient alternative to direct cabling into the oscilloscope inputs, freeing up the second channel for other signal input, and eliminating the need to set up waveform math and match cable delays.

Unsurpassed Waveform Accuracy
When used to acquire input signals forthe SDA 11000, the D11000PS provides unprecedented waveform fidelity, even with signals at highest serial data rates. The D11000PS utilizes third generation compensation calibration, the most advanced in use today, to provide optimal system response.

Each individual probe is characterized with this system. Information on the probe's frequency and time domain responses are stored in non-volatile memory within the probe amplifier module. This informationis uploaded to the SDA 11000 when the probe is connected. The probe calibration data and the SDA 11000 calibration data combine to generate new equalization filters for the composite system. The resulting compensation system corrects for frequency response deviations, as well as group delay correction and reflection cancellation.

D11000PS DIFFERENTIAL PROBE SYSTEM



Reproducing accurate serial data eye patterns requires maintaining precise magnitude and phase relationships between the fundamental and the odd harmonics. The advanced calibration system used in the D11000PS assures the best eye pattern fidelity.

Superior Probe Loading Characteristics

Accurate frequency response is not enough to assure good waveform fidelity. Excessive probe loading can cause waveform distortion. The D11000PS continues the legacy of LeCroy high-performance probe design, placing special emphasis on minimizing loading of the circuit under test.

The Solder-In lead and dedicated probe amplifier module have a high input resistance at DC and low frequencies, allowing the probe to be used in circuits which cannot drive the low resistance of a pure transmission line probe. The direct cabled SMA inputs have 50 Ω input impedance with low VSWR.

Ease of Use

Attention to fine details during the D11000PS design process has resulted in several "ease of use" features. A common mode measure feature allows the user to measure the average common mode component with a single click in the probe control menu. AutoColor ID lights an indicator in the probe body, matching the color of the waveform trace. When multiple channels are used, this feature instantly identifies which waveform corresponds to which probe.

Several connection accessories designed specifically for the D11000PS provide convenient and secure mounting of the probe body and Solder-In tip to the test circuit. DC blocking adapters extend the common mode range of the SMA cabled input for use with higher common mode voltages such as Digital Video Interface (DVI). A finger wrench allows tightening of SMA connectors on dense test fixtures.

D11000PS DIFFERENTIAL PROBE SYSTEM

Compatibility

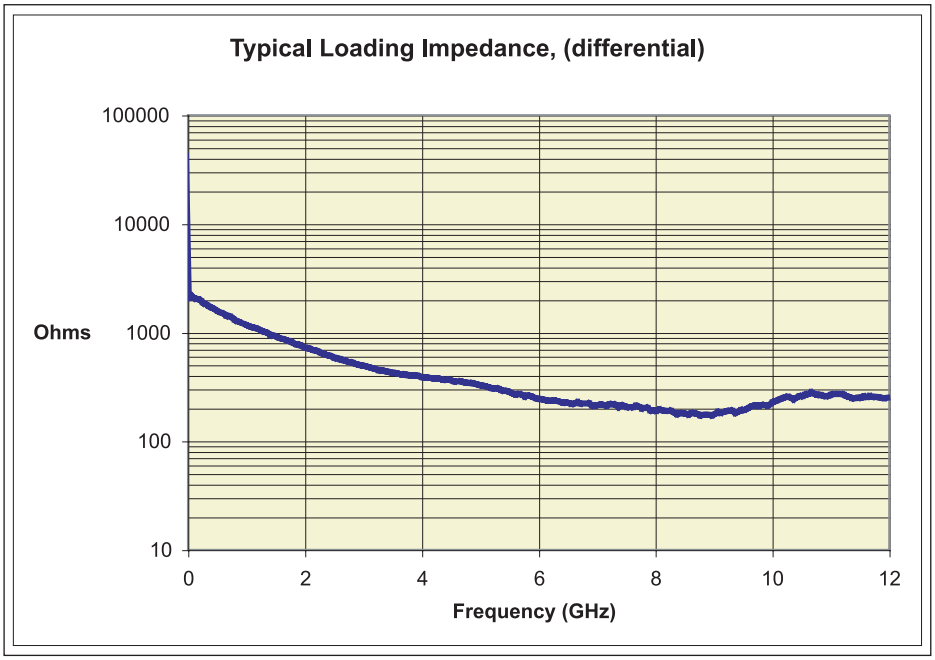
The D11000PS is designed specifically for use with the SDA 11000. However, it does contain additional calibration data for use with all of the lower bandwidth WaveMaster®, SDA, and DDA 5005A series oscilloscopes and analyzers.

SPECIFICATIONS

Bandwidth, System, -3 dB	11 GHz (Typical)*
Rise Time, System	< 50 ps (Typical)*
Rise Time, Probe only	< 40 ps
Attenuation, Nominal	÷3
LF Attenuation Accuracy	2% (20–30 ˚C)
Output Zero	< 15 mV referred to input
Noise, System	5 mV rms (Typical)[1]
Differential Mode Range	±1 V
Common Mode Range	±4 V, Solder-In tip ±2 V, SMA cable input†
Input Resistance at DC, (Solder-In lead)	40 kΩ differential 20 kΩ each side to ground
Minimum Input Impedance (Solder-In lead, to 11 GHz)	> 175 Ω (Refer to graph)
Input Impedance, (SMA cable input)	50 Ω
Input VSWR, (Typical, each lead to ground)	< 1.5:1 DC–6 GHz < 2.0:1 6 GHz–11 GHz
CMRR, (Typical)	> 40 dB DC–1 GHz > 30 dB 1 GHz–4 GHz > 20 dB 4 GHz–11 GHz

* Measured as a system with SDA 11000.
† Can be extended by using DC Blocking Adapters.

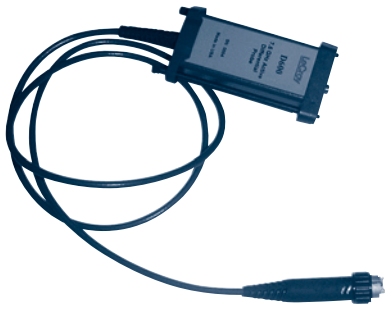
D11000PS DIFFERENTIAL PROBE SYSTEM



D11000PS Includes:
Probe amplifier modules (2–1 each for SMA input and Solder-In lead), Solder-In lead assembly (2), SMA interconnect lead, SMA input cables (matched pair), Probe body, SMA DC blocking adapters (2), ground lead and clip, SMA finger wrench (2), tip retaining clip kit for Solder-In lead, probe body mounting clamp set, FreeHand probe stand, ESD dissipating wrist strap, SAC-01 soft accessory case with insert, small accessory case, D11000PS Instruction Manual, certificate of traceable calibration.

ORDERING INFORMATION	PRODUCT CODE
Differential Probe System	D11000PS
Replacement Solder-In Interconnect Lead	D11000SI
NIST Traceable Calibration with Test Data	D11000PS-CCNIST

WAVELINK DIFFERENTIAL PROBES



D600A-AT
D300A-AT
D600ST
D350ST
D500PT

WaveLink high bandwidth differential probes are designed to provide an optimum mechanical connection for signal measurement. They virtually eliminate distortion when measuring signals, which is particularly useful in eye pattern measurements—now routine for systems using fast serial data bus architecture. WaveLink probes provide industry-leading technology for wideband signal connection to test instruments. The first differential probes to employ SiGe technology, they deliver full system bandwidth when used with LeCroy 6 GHz, 5 GHz, and 3 GHz instruments. They are also the first differential probes to use a unique calibration process to achieve superb waveform fidelity for routine voltage measurements.

Features:
- Unique adjustable tips for reliable contact
- Wide assortment of small tips ideal for restricted spaces
- Best-in-class probe loading for accurate signal measurement
- Superior loading characteristics and precise frequency response
- Outstanding fidelity for high-speed signals

D600A-AT and D300A-AT Features:
- Built-in thumbwheel for precise positioning of tip; stays put after adjustment
- Maintains sharp points for good contact
- Tips made of “NiTiNOL,” a super-elastic nickel-titanium alloy
- Probe flexes as you apply pressure and consistently returns to original form

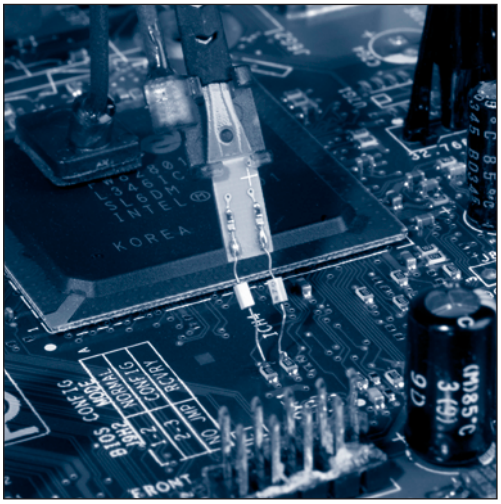
D600ST and D350ST Features:
- Best-in-class mechanical design for optimum utility
- Small tip high bandwidth differential probe
- Three interconnect configurations for flexibility
- Very small form factor for accessing tight spaces
- Highly flexible long lead

D500PT Positioner Mounted Tip Features:
- Positioned tip assembly
- Probe tip module
- Module mounting clamp
- Ground lead and clip
- WaveLink series instruction manual
- Quick Start guide
- Calibration certificate
- FreeHand probe stand
- Tip repair tool
- Replacement tips (2)

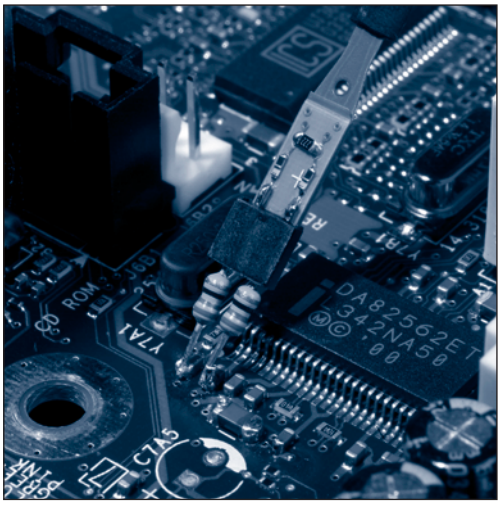
WAVELINK DIFFERENTIAL PROBES

THREE DIFFERENT TIPS FOR INTERCONNECT FLEXIBILITY

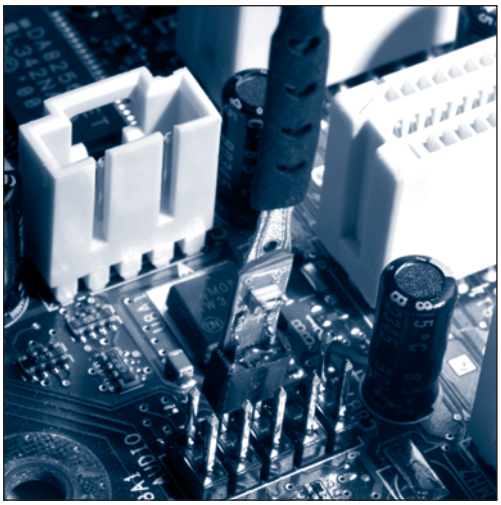
A. Solder-In Lead
The Solder-In interconnect lead features the smallest physical tip size of any high bandwidth differential probe and the highest level of electrical performance. Two very small damping resistors are directly soldered into the connect points providing a reliable, intermittent free electrical connection. The resistors have highly flexible leads allowing connection to input points with a wide range of input spacing.



B. Quick Connect (D600ST only)
The Quick Connect interconnect lead enables you to quickly move the probe between multiple test points on the test circuit. Just solder a pair of damping resistors at each location where interconnection is required. A small connector mounted on the probe tip, plugs into the damping resistors, letting you quickly move between sets of test points.



C. Square Pin
Many applications, such as IC characterization boards, use standard 0.025" square pins for interconnect. The Square Pin interconnect lead directly mates with a pair of 0.025" (0.635 mm) square pins which are mounted on standard 0.100" (2.54 mm) centers.



WAVELINK DIFFERENTIAL PROBES

SPECIFICATIONS

Rise Time, probe only	
D600ST-SI	65 ps*
D600ST-QC	75 ps* (Typical)
D600ST-SP	95 ps* (Typical)
D600A-AT	65 ps*
D300A-AT	95 ps†
D350ST-SP	90 ps†
D350ST-SI	80 ps† (Typical)
D500PT	< 100 psec**
LF Attenuation Accuracy (with 0 V common mode)	
D600A-AT, D300A-AT, D600ST, and D500PT	2% 0 ±1.2 V 5% ±1.2 V ±2.4 V
D350ST	2% 0 ±2.5 V 5% ±2.5 V ±5 V
Output Zero (for ≥ 15 minutes after Autozero)	
D600A-AT, D300A-AT, D600ST, and D500PT	< 10 mV RTI
D350ST	< 20 mV RTI
Bandwidth, DC to -3 dB	
D600ST-SI	6 GHz††
D600ST-QC	4 GHz††
D600ST-SP	3 GHz††
D600A-AT	6 GHz††
D300A-AT	3 GHz***
D350ST-SP	3 GHz***
D350ST-SI	3 GHz***
D500PT	5 GHz**
Input Dynamic Range	
D600A-AT, D300A-AT, D600ST, and D500PT	±2.4 V
D350ST	±5 V
Common Mode Range (Max. peak voltage either input to ground)	
D600A-AT, D300A-AT, D600ST, and D500PT	±2.4 V
D350ST	±5 V
DC Input Resistance	
D600A-AT, D300A-AT, D600ST, and D500PT	4 kΩ differential 2 kΩ either input to ground
D350ST	8 kΩ differential 4 kΩ either input to ground
CMRR	
D600A-AT:	
DC to 1 GHz	> 40 db
1 GHz to 3 GHz	> 30 dB
3 GHz to 7 GHz	> 20 dB
D600ST:	
DC to 1 GHz	> 30 db
1 GHz to 3 GHz	> 25 dB
3 GHz to 7 GHz	> 20 dB

* Measured with 6 GHz oscilloscope
† Measured with 3 GHz oscilloscope
** Measured with 5 GHz oscilloscope
†† Typical, with 6 GHz oscilloscope
*** Typical, with 3 GHz oscilloscope

WAVELINK DIFFERENTIAL PROBES

SPECIFICATIONS (CONTINUED)

D500PT:	
DC to 1 GHz	> 25 db
1 GHz to 3 GHz	> 19 dB
3 GHz to 5 GHz	> 16 dB
D350ST:	
DC to 1 GHz	> 30 db
1 GHz to 3 GHz	> 25 dB
D300A-AT:	
DC to 1 GHz	> 40 db
1 GHz to 3 GHz	> 30 dB

Noise	
D6xxxxxx	5.8 mV rms with
D500PT	6 GHz oscilloscope
D300A-AT	4.2 mV rms with 3 GHz oscilloscope
D350ST	7.7 mV rms with 3 GHz oscilloscope

* Measured with 6 GHz oscilloscope
† Measured with 3 GHz oscilloscope
** Measured with 5 GHz oscilloscope
† † Typical, with 6 GHz oscilloscope
*** Typical, with 3 GHz oscilloscope

ORDERING INFORMATION	PRODUCT CODE
PROBE TIP MODULES	
WaveLink 7.5 GHz Differential Probe with Adjustable Tip Module	D600A-AT*
WaveLink 4 GHz Differential Probe with Adjustable Tip Module	D300A-AT*
WaveLink 7 GHz Differential Probe with Small Tip Module	D600ST*
WaveLink 4 GHz, 5 V Differential Probe with Small Tip	D350ST*
WaveLink 6 GHz, Differential Positioner with Mounted Tip Probe Module	D500PT*
PROBE BODIES	
WaveLink ProLink Probe Body	WL600
WaveLink ProBus Probe Body	WL300
POSITIONER	
Cascade Microtech EZ-Probe Positioner	EZ PROBE
SERVICE OPTIONS	
NIST Traceable Calibration with Test Data†	D600A-AT-CCNIST† D300A-AT-CCNIST† D600ST-CCNIST† D350ST-CCNIST† D500PT-CCNIST†

* For a complete probe, order a WL300 or WL600 Probe Body with the Probe Tip Module.

† -CCNIST NIST traceable calibration with test data is an available option for D600ST, D350ST, D500PT, D600A-AT, or D300A-AT probe tip module only when ordered with either a WL600 or WL300 probe body.

WAVELINK DIFFERENTIAL PROBES

ORDERING INFORMATION (CONTINUED)

CONSUMABLES AND REPLACEMENT PARTS	PRODUCT CODE
Replacement Quick Connect Lead Set for D600ST	D600ST-QC
Replacement Solder-In Lead Set for D600ST	D600ST-SI
Replacement Square Pin Lead Set for D600ST	D600ST-SP
Replacement Solder-In Lead Set for D350ST	D350ST-SI
Replacement Square Pin Lead Set for D350ST	D350ST-SP
Replacement Tip Assembly for D500PT	D500PT-TIP
Replacement Resistor Kit for D600ST-SI	PK600ST-1
Replacement Resistor Kit for D600ST-QC	PK600ST-2
Replacement Probe Tip Holder Kit	PK600ST-3
Replacement Probe Body Mounting Kit	PK600ST-4
Replacement Resistor Kit for D350ST-SI	PK350ST-1
Replacement Probe Tips for D500PT (pkg. of 2)	PK500PT-1
Probe Characterization Fixture	PCF-200
WaveLink Probe Series Instruction Manual	WL-OM-E

D600A-AT, D300A-AT Adjustable Tip modules Include: Protective storage case, ground wire and clip, WaveLink series instruction manual, Quick Start guide, calibration certificate.

D600ST Small Tip Module Includes: Solder-in interconnect lead set with replacement damping resistors (10), Quick Connect interconnect lead set with additional damping resistors (20), Square Pin interconnect lead set, ground wire and clip, probe tip mounting kit, WaveLink series instruction manual, Quick Start guide, calibration certificate.

D350ST Small Tip Module Includes: Solder-in interconnect lead set with replacement damping resistors (10), Square Pin interconnect lead set, ground wire and clip, probe tip mounting kit, WaveLink series instruction manual, Quick Start guide, calibration certificate.

D500PT Positioner Mounted Tip Includes: Positioned tip assembly, Probe tip module, Module mounting clamp, Ground lead and clip, WaveLink Series instruction manual, Quick Start guide, Calibration certificate, FreeHand probe stand, Tip repair tool, Replacement tips (2)

WL600, WL300 Probe Bodies Include: SAC-01 Soft accessory case with WaveLink Series insert, probe characterization fixture, probe body mounting clip, probe cable clamp (2), and small probe accessory case.

WaveLink Probe Calibration when ordered with WL600 or WL300 also substitute: Certificate of NIST traceable calibration in place of calibration certificate.

PP006A

PP005A

PP002A

PASSIVE PROBES

These high impedance passive probes are intended for general-purpose everyday use. Their probe compensation networks are optimized for the specific oscilloscope front end characteristics for which they are designed. Optional accessories extend their capability in a variety of physical interconnection situations.

Features:

- Bandwidth from 350 MHz to 500 MHz
- Probe encoding ring for automatic scale factor readout on LeCroy oscilloscopes

SPECIFICATIONS

Model Number	Bandwidth	Input R	Input C	Attenuation	Maximum Voltage	Recommended Oscilloscope
PP006A	500 MHz	10 MΩ	12.0 pF	÷10	600 V Cat II	2
PP005A	500 MHz	10 MΩ	11.0 pF	÷10	500 V Cat I	1, 4
PP002A	350 MHz	10 MΩ	14.0 pF	÷10	500 V Cat I	3

COMPATIBILITY

1 = LCxxx, 93xx, LA314, LA354
2 = WaveRunner scopes
3 = 9304, LT224
4 = WavePro

ORDERING INFORMATION	PRODUCT CODE
÷10,500 MHz 10 MΩ Passive Probe (recommended for all LT Series)	PP006A
÷10, 500 MHz 10 MΩ Passive Probe (recommended for WavePro, 93XX and LCXXX Scopes)	PP005A
÷10, 350 MHz 10 MΩ Passive Probe	PP002A

PASSIVE PROBES ACCESSORIES

ORDERING INFORMATION	PRODUCT CODE
PK001 – Standard Probe Accessory for PP002	
Ground Lead PP002	PP001/002-1
Probe Tip to BNC adapter	PP001/002-2
Sprung Hhook PP002	PP001/002-3
M/F Lead – Long (4")	
M/F Lead – Short (2")	
PK102 – Standard Probe Accessory Kit for PP005/PP005	
Sprung Hook (Black)	PP005-HOOK
Spring Tip (0.38 mm)	PP005-ST38
Spring Tip (0.8 mm)	PP005-ST8
Rigid Tip (0.8 mm)	PP005-RT
Probe Tip to BNC Adapter	PP005-BNC
Ground Lead (11 cm)	PP005-GL11
Ground Lead (22 cm)	PP005-GL22
Ground Lead (Spring)	PP005-GLPT
IC Insulating Tip	
Probe Tip to BNC Adapter	
Adjustment Screw Driver	
PPK106 – SMT Accessories for PP005/PP005A, PPExkV	
Dual Lead Adapter	PK106-1
Single Lead Adapter	PK106-2
0.5 mm Clip (Orange)	PK106-3
Probe Tip to PCB Adapter	PK106-4
M/F Lead – Long (4")	PK106-5
M/F Lead – Short (2")	PK106-6
0.5 mm Clip (Yellow)	PK106-8
PK101 – Microclip Accessory Kit for PP005/PP005A	
Single Lead Adapter	PK106-2
QFPIC Clip (0.5 mm Pitch)	PACC-CL001
PK116 – Standard Probe Accessory Kit for PP006/PP006A	
Sprung Hook	PK116-1
Ground Lead	PK116-2
Ground Pin	PK116-3
Insulating Tip	
Screw Driver	
PK006 – SMT Accessories for PP006/PP006A	
Dual Lead Adapter PK006	PK006-1
Single Lead Adapter PK006	PK006-2
0.5 mm Clip (Black and Red)	PK006-3
0.8 mm Clip (Black and Red)	PK006-4
M/F Lead – Long (4")	
M/F Lead – Short (2")	

PASSIVE PROBES

PP007-WR-1

PP007-WS-1

The PP007 embodies leading edge technology in passive probe design. A rugged, general-purpose probe, its small size is optimized for maximum waveform fidelity. The PP007's small 2.5 mm ground sleeve provides superior visibility, as well as a greater ability to probe dense circuits than traditional 3.5 mm and 5 mm probes. Its sharp probe tip* is spring loaded, allowing it to retract into the narrow probe head. Low input capacitance and low inductance optimize functionality in high frequency applications. For best performance, the WR version is designed to be used with the WaveRunner 6000A Series, while the WS version is designed for the WaveSurfer 400 Series.

Features:

- Compact probe head
- Fine pitch SMD probing support
- Rugged, sharp tip
- HF optimized connection accessories
- Over 30 accessories
- Low input capacitance

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Attenuation	÷ 10
Bandwidth	> 500 MHz
Input R	10 MΩ
Input C	9.5 pF
Max. Input Voltage	400 V CAT I (1250 V surge) 300 V CAT II

GENERAL CHARACTERISTICS

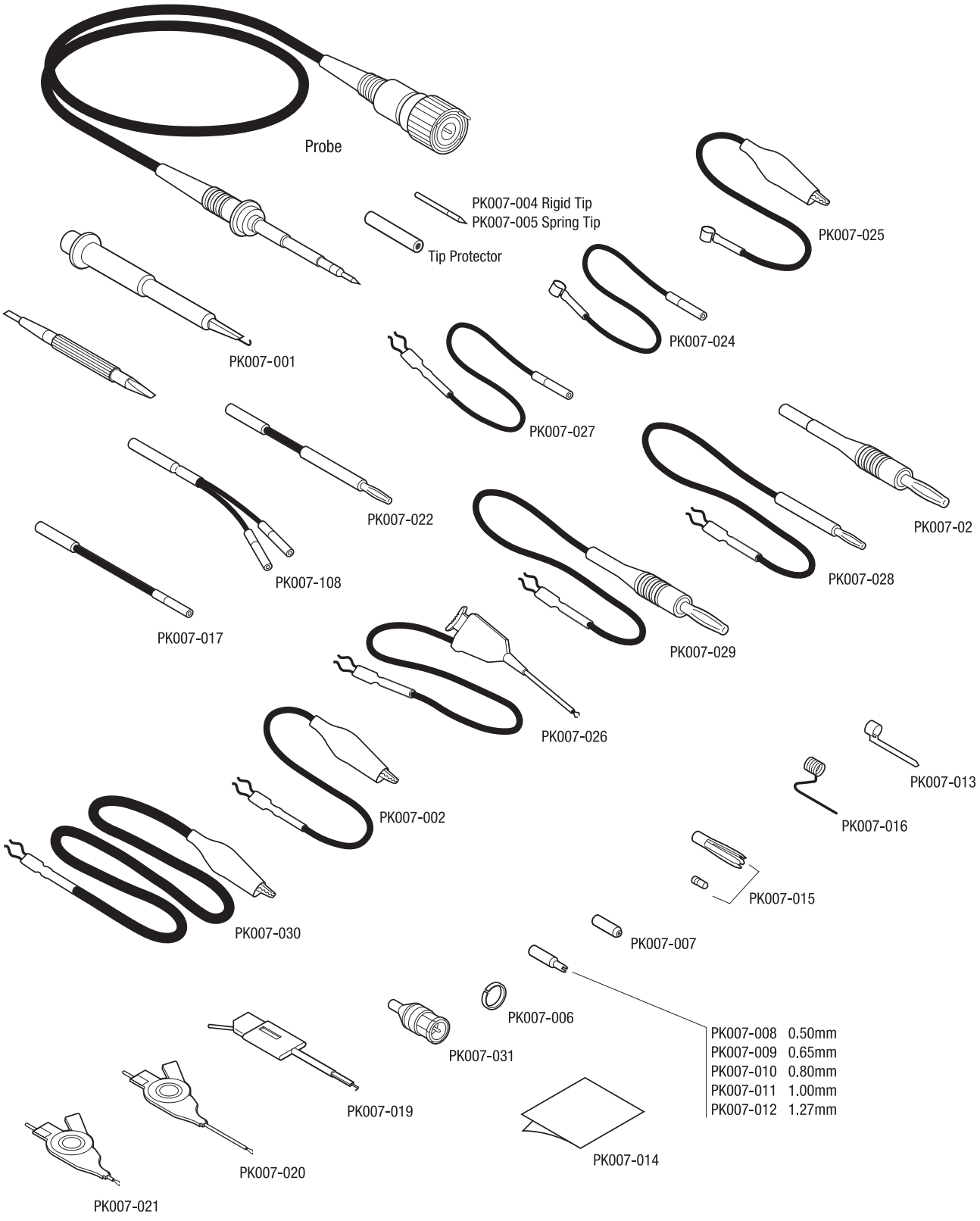
Ground Sleeve Diameter	2.5 mm
Input Pin Diameter	0.5 mm
Cable Length	1.3 m

ORDERING INFORMATION	PRODUCT CODE
÷10 HiZ 500 MHz Passive Probe for WaveRunner 6000A Series Oscilloscopes	PP007-WR-1
÷10 HiZ 500 MHz Passive Probe for WaveSufer 400 Series Oscilloscopes	PP007-WS-1
Basic Adapter Kit	PK701
Advanced Adapter Kit	PK702
SMD Adapter Kit	PK703
Microclip Kit	PK704
Instruction Manual	PP007-OM-E

* A rigid tip is included

PASSIVE PROBES ACCESSORIES

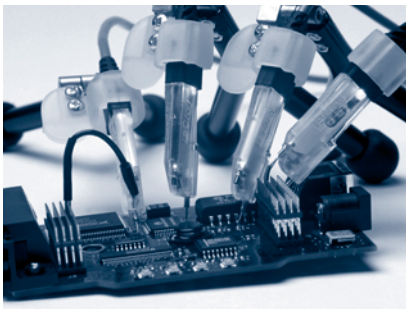
ACCESSORIES FOR THE PP007 PROBES



PASSIVE PROBE ACCESSORIES

ORDERING INFORMATION PP007 PROBE ACCESSORIES	PK701	PK702	PK703	PK704	PRODUCT CODE
Sprung Hook	2	1			PK007-001
Standard Ground Lead	2	1			PK007-002
Adjustment Tool	1	1			PK007-003
Rigid Tip	2	2			PK007-004
Spring Tip	2	1	2		PK007-005
Color Coding Rings (3 Red, 3 Yellow, 3 Blue, 3 Green)		2			PK007-006
Insulating Cap		2	2		PK007-007
IC-cap for 0.5 mm Pitch		1	2		PK007-008
IC-cap for 0.65 mm Pitch		1	2		PK007-009
IC-cap for 0.8 mm Pitch		1	2		PK007-010
IC-cap for 1.0 mm Pitch		1	2		PK007-011
IC-cap for 1.27 mm Pitch		1	2		PK007-012
Ground Blade		1	2		PK007-013
Copper Pad		1	2		PK007-014
PCB-adapter		5		1	PK007-015
Ground Spring	2	1	1		PK007-016
Single Adapter Lead			1	1	PK007-017
Dual Adapter Lead		1	1	1	PK007-018
Pico Hook		2			PK007-019
Microclip Long 0.5 mm		2	1	2	PK007-020
Microclip Short 0.5 mm		2	1	2	PK007-021
Adapter 2 mm Plug					PK007-022
Adapter 4 mm Plug					PK007-023
Probe Tip Ground Lead w/0.8 mm Socket		1	1		PK007-024
Probe Tip Ground Lead w/Alligator-clip					PK007-025
Ground Lead with Miniclip		1			PK007-026
Ground Lead with 0.8 mm Socket		1	1		PK007-027
Ground Lead with 2 mm Plug					PK007-028
Ground Lead with 4 mm Plug					PK007-029
HF-compensated Ground Lead		1	1		PK007-030
BNC-adapter		2			PK007-031
Product Description Brochure	1	1	1	1	PK007-032

ACTIVE VOLTAGE PROBES



HFP2500

HFP1500

HFP1000

LeCroy's series of HFP active probes are versatile, small and lightweight, yet still maintain the high bandwidth needed for accurate measurement. Five interchangeable tips facilitate access regardless of tight fits and difficult locations. The FreeHand probe holder brings added versatility, allowing several probes to be used at the same time on a variety of test points while maintaining the short paths needed to preserve signal fidelity. The HFP probes also offer AutoColor ID, which automatically illuminates the probe head in a connected oscilloscope's trace color. This unique capability eliminates the need to manually apply plastic rings or colored tape to determine which channel the probe is connected to.

Features:

- 1 GHz to 3.5 GHz bandwidth
- 0.7 pF input capacitance
- ±8 V dynamic range
- ±12 V offset range (except HFP 1000)
- 5 interchangeable tips for probing a variety of test points
- Replaceable probe tip socket
- Hands-free probing with FreeHand probe holder
- AutoColor ID feature matches the channel trace color

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

BANDWIDTH (PROBE ONLY)

HFP1000	1 GHz
HFP1500	1.5 GHz
HFP2500	2.5 GHz
Input Capacitance	0.7 pF (measure at 1 GHz)
DC Input Resistance	100 kΩ
Input Dynamic Range	±8 V
Probe Offset Range	N/A **(HFP1000)** ±12 V **(HFP1500, HFP2500)**
Attenuation	÷10
Attenuation Accuracy	±1%
Output Zero	< 4 mV, referred to input
Offset Accuracy **(n/a for HFP1000)**	±1%, ±4 mV, referred to input

GENERAL CHARACTERISTICS

Cable Length	1.3 m
Probe Head Size (LWH)	61 mm x 7.3 mm x 13.1 mm
Input Sockets	Signal and ground sockets compatible with 0.025" (0.635 mm) square pins, 0.036" (0.91 mm) maximum diameter (for round pins)

WARRANTY

1 year

COMPATIBILITY

HFP1000	Recommended for 500 MHz and lower BW oscilloscopes
HFP1500	Recommended for 1 GHz and lower BW oscilloscopes
HFP2500	Recommended for 2 GHz and lower BW oscilloscopes

ACTIVE VOLTAGE PROBES ACCESS.

ORDERING INFORMATION HFP PROBES	HFP1000	HFP1500	HFP25000	PRODUCT CODE
Standard Probe Accessory Kit for HFP1000				PK110
Standard Probe Accessory Kit for HFP1500				PK109
Standard Probe Accessory Kit for HFP2500				PK108
Soft Accessory Case				SAC-01
Microclip 0.5 mm			2	PACC-CL001
Straight Tip	4	4	4	PACC-PT001
Sharp Tip	4	4	4	PACC-PT002
IC Lead Tip		4	4	PACC-PT003
SMD Discrete Tip		4	4	PACC-PT004
Bent Sharp Tip		4	4	PACC-PT005
FreeHand Probe Holder		1	1	PACC-MS001
Replaceable Cartridge		1	1	PACC-MS002
Low C Cartridge		1		PACC-MS003
Ground Spring Hook		1	1	PACC-LD001
Square Pin Ground Spring	1	1	1	PACC-LD002
Short Right Angle Lead		2	2	PACC-LD003
Long Right Angle Lead		2	2	PACC-LD004
Short Single Lead	1	2	2	PACC-LD005
Long Single Lead	1	2	2	PACC-LD006
0.8 mm Clip	2	2	2	PK006-4
Offset Tip	2		2	AP03X-OFFSET-PIN

HIGH-BANDWIDTH TRANSMISSION LINE

The PP066 is a high-bandwidth passive probe designed for use with the WaveMaster and other high-bandwidth oscilloscopes with 50 Ω input termination. This very low capacitance probe provides an excellent solution for higher frequency applications, especially the probing of transmission lines with 20–100 Ω impedance. The PP066 accommodates a wide range of applications, including probing of analog and digital ICs commonly found in computer, communications, data storage, and other high-speed designs.

PP066

Features:

- Interchangeable attenuator tips
- Signal integrity at high bandwidth
- Standard SMA cable connection
- Ultra low capacitance

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS	
Bandwidth	DC to 7.5 GHz
Risetime	< 47 ps
Input C	< 0.20 pF
Input R	500 Ω (÷10 cartridge) 1000 Ω (÷20 cartridge)
Maximum Voltage	15 V rms
Cable Length	1 m

The PP065 is a transmission line probe designed for use at very high frequencies. The probe's input impedance remains nearly constant over its entire frequency range. Robust to over voltage and ESD exposure, it is particularly useful in applications producing fast rising, narrow pulses with amplitudes, which exceed the dynamic range of active probes.

PP065

Features:

- 1 GHz
- Low capacitance
- ÷100 1 GHz 5 k passive probe

SPECIFICATIONS

Input R Ohm	500 Ω
Maximum Voltage	22 V
Compatibility	LCXXX, 93XX, LA314, LA354, WaveRunner and WavePro Scopes
Bandwidth	1 GHz
Attenuation	100:1
Input Capacitance	1.5 pF

ORDERING INFORMATION	PRODUCT CODE
7.5 GHz Low Capacitance Passive Probe	PP066
1 GHz Low Capacitance Passive Probe (÷10, 5 KΩ)	PP065
INCLUDED WITH PP066 PROBE	
PACC-AD001	SMA to BNC Adapter

DIFFERENTIAL PROBES

AP034

AP033

High bandwidth, excellent common-mode rejection ratio (CMRR) and low noise make these active differential probes ideal for applications such as disk drive design and failure analysis, as well as wireless and data communication design. With the ProBus interface, the AP034 and AP033 become an integral part of the oscilloscope, allowing sensitivity, offset and common-mode range to be displayed on the scope screen. Common mode sensing and input protection capabilities of the AP033 add additional functionality.

Features for both probes:

- 500 MHz **(AP033)** and 1 GHz **(AP034)** bandwidths
- x10 gain to ÷ 10 attenuation range **(AP033)**
- 10,000:1 DC CMRR
- Low 9 nV/√Hz noise **(AP033)**
- 1.5 pF/side input C **(AP034)**
- 200 µV/div **(AP033)**
- Input ESD protection
- Autozero feature

SPECIFICATIONS	AP034	AP033
Bandwidth	1 GHz	500 MHz
Gain	x1 (÷10 and ÷20 with plug-on attenuators)	x10, x1, ÷10 (÷100 with plug-on ÷10 attenuator)
DC Accuracy	2% typical (probe only)	1% in x1 without external attenuator
Input Resistance	1 MΩ II 1.5 pF each input to ground 2 MΩ II 0.85 pF between inputs	1 MΩ each input to ground 2 MΩ differential between inputs
Differential Mode Range	±400 mV (x1) ±4 V (÷10) ±8 V (÷20)	±400 mV (x1) ±40 mV (x10) ±4 V (÷10) ±40 V (÷100)
Offset Range	±1.6 V (x1) ±16 V (±10) ±32 V (±20)	±400 mV (x1, x10) ±4 V (±10) ±40 V (±100)
Common-Mode Range	±16 V (x1) ±42 V (±10) +42 V (±20)	±42 V peak (±10) +4.2 V peak (±100)
CMRR	70 Hz 10,000:1 (80 dB) 1 MHz 100:1 (40 dB) 100 MHz 18.1 (25 dB) 500 MHz 9:1 (19 dB)	70 Hz 10,000:1 (80 dB) 100 kHz 10,000:1 (80 dB) 1 MHz 1000:1 (60 dB) 10 MHz 100:1 (40 dB) 250 MHz 5:1 (14 dB)

DIFFERENTIAL PROBES

SPECIFICATIONS (CONTINUED)

	AP034/AP033
Max. Nondestruct Voltage	±200 VDC continuous
Cable Length	1.2 m
Operating Temperature	0 °C to 50 °C
Standard Accessories	÷10 Plug-on Attenuator ÷20 Plug-on Attenuator **(AP034 only)** Plug-on AC Coupler
Probe Connection Accessory Kit	Flex Lead Set (1) Input 'Y' Lead (1) Mini Clip, 0.8 mm (3) Mini Clip, 0.5 mm (2) Ground Lead (1) Offset Pins, Round (4) Square Pin Header Strip (1)
Warranty	1 year

PK033 – Standard Probe Accessory Kit for AP033/AP034

Dual Lead	AP03X-FLEX-LEAD
Single Lead	NA
Offset Pin (package of 10)	AP03X-OFFSET-PIN
0.5 mm Clip (red and black)	PK006-3
0.8 mm Clip (red and black)	PK006-4
1x6 Square Pin Header	NA

Other Accessories for AP033/AP034

AC Coupler	AP03X-AC-COUPLER
÷10 Attenuator for AP033	AP033-ATTN
÷10 Attenuator for AP034	AP034-DA10
÷20 Attenuator for AP034	AP034-DA20

ORDERING INFORMATION	PRODUCT CODE
1 GHz Active Differential Probe (÷1, ÷10, ÷20)	AP034
500 MHz Active Differential Probe (x10, ÷1, ÷10 or ÷100)	AP033

HIGH VOLTAGE PASSIVE PROBES

PPE1.2KV

PPE2KV

PPE4KV

PPE5KV

PPE6KV

PPE20KV

The PPE series includes five fixed-attenuation probes covering a range from 2 kV to 20 kV, and one switchable probe providing ÷10/÷100 attenuation for voltage inputs up to 1.2 kV. All fixed-attenuation, standard probes automatically rescale compatible LeCroy oscilloscopes for the appropriate attenuation of the probe.

Features:

- Safe, accurate high-voltage measurement
- 1.2 kV to 20 kV

HIGH-VOLTAGE PROBES SELECTION GUIDE SPECIFICATIONS

Types	Bandwidth (MHz)	Input R (Ω)	Input C (pF)	Attenuation	Maximum Voltage	Probe Encoding	Cable
PPE1.2kV*	400	50 M	< 6	÷10 / ÷100	600 V/1.2 kV	No	2 m
PPE2kV*	400	50 M	< 6	÷100	2 kV	Yes	2 m
PPE4kV*	400	50 M	< 6	÷100	4 kV	Yes	2 m
PPE5kV*	400	50 M	< 6	÷100	5 kV	Yes	2 m
PPE6kV*	400	50 M	< 6	÷1000	6 kV	Yes	2 m
PPE20kV†	100	50 M	< 2	÷1000	20 kV (40 KV peak)	Yes	3 m

ORDERING INFORMATION	PRODUCT CODE
÷10/÷100; 200/300 MHz; 5 MΩ/50 MΩ High-Voltage Probe 600 V/1.2 kV max. Voltage DC	PPE1.2KV
÷1000; 100 MHz; 50 MΩ High-Voltage Probe 20 kV (40 kV Peak) max. Voltage DC and Peak AC	PPE20KV
÷100; 400 MHz; 50 MΩ High-Voltage Probe 2 kV max. Voltage DC and Peak AC	PPE2KV
÷100; 400 MHz; 50 MΩ High-Voltage Probe 4 kV max. Voltage DC and Peak AC	PPE4KV
÷100; 400 MHz; 50 MΩ High-Voltage Probe 5 kV max. Voltage DC and Peak AC	PPE5KV
÷1000; 400 MHz; 50 MΩ High-Voltage Probe 6 kV max. Voltage DC and Peak AC	PPE6KV
Accessory Kit for PPE1.2kV, 2kV, 4kV, 5kV, and 6kV	PK103
Standard Probe Accessory Kit for PPE20kV	PK104
Ground Lead (15 cm)	PK104-1
Hook	PK104-2
Standard Probe Accessory Kit for PPE1.2kV, PPE2kV	PK103
Sprung Hook (red)	PK103-1
Ground Lead (22 cm)	PP005-G22
Crocodile Clip	PK30x-2
Probe Tip to BNC Adapter	PP005-BNC
IC Insulating Tip	
Screw Driver	
Probe Tip to Banana Plug Adapter	
Ground Lead with Banana Plug	
Spring Tip (0.8 mm)	PP005-ST8
Rigid Tip V2A	PP005-RT

STANDARD ACCESSORY KIT FOR PPE20KV

Ground Lead (15 cm)	PK104-1
Hook	PK104-2

Supplied with probe:
* Probe Kit: Trimming tool, ground lead, rigid tip, IC insulator, BNC adapter, tip insulator, spring hook, red crocodile clip. 4mm safety ground lead, and green/yellow crocodile clip.
† Probe Kit: trimming tool, and ground lead with a crocodile clip.

HIGH VOLTAGE DIFFERENTIAL PROBES

The AP031 is a low cost, battery operated active differential probe intended for measuring higher voltages. The differential techniques employed permit measurements to be taken at two points in a circuit without reference to the ground, allowing the oscilloscope to be safely grounded without the use of opto-isolators or isolating transformers.

Features:

- Safe floating measurements
- 15 MHz bandwidth
- 700 V maximum input voltage
- Works with any 1 MΩ input oscilloscope

AP031

SPECIFICATIONS

Attenuation	÷10 / ÷100
Bandwith	15 MHz
Input R	4 MΩ
Differential Mode Range	±70 V / ±700 V DC + Peak AC
Common Mode Range	±700 V DC + Peak AC
CMRR	86 dB @ 50 Hz
Power Source (four AA batteries)	56 dB @ 200 kHz

ORDERING INFORMATION	PRODUCT CODE
700 V, 15 MHz Differential Probe (÷10, ÷100)	AP031

ADP30X high-voltage active probes are safe, easy-to-use, and ideally suited for measuring power electronics. The ADP300 is designed for troubleshooting low-frequency power devices and other circuits where the reference potential is elevated from the ground or the location of the ground is unknown. The ADP305 is designed for measuring the high-speed floating voltages found in today's power electronics.

Features:

- 20 MHz and 100 MHz bandwidth
- 1,000 V rms common mode voltage
- 1,400 V peak differential voltage
- EN 61010 CAT III
- 80 dB CMRR at 50/60 Hz
- ProBus system
- Full remote control

ADP305

ADP300

HIGH VOLTAGE DIFFERENTIAL PROBES

SPECIFICATIONS

ELECTRICAL CHARACTERISTICS

Bandwidth	20 MHz **(ADP300)**	
	100 MHz **(ADP305)**	
Differential Voltage	1,400 V peak	
Common Mode Voltage	1,000 V rms CAT III	
Low-Frequency Accuracy (probe only)	1% of Reading	
CMRR	50/60 Hz	80 dB (10,000:1)
	100 kHz	50 dB (300:1)
Max. Slew Rate (referenced to input)	60,000 V/µs **(ADP300)**	
	300,000 V/µs **(ADP305)**	
AC Noise (referenced to input)	50 mV rms	
Attenuation	÷100/÷1000 (automatically selected by scope)	
Input Impedance	Between inputs	8 MΩ, 6 pF
	Each input to ground	4 MΩ, 1 pF
Sensitivity	1 V/div to 350 V/div **(ADP300)**	
	200 mV/div to 350 V/div **(ADP305)**	
Interface	ProBus, 1 MΩ*	

GENERAL CHARACTERISTICS

Overall Length	2 m
Input Connectors	4 mm Shrouded Banana Plug
Operating Temperature	0 °C to 50 °C
Warranty	1 year

STANDARD ACCESSORIES

ADP305

All ADP300 Accessories
Safety Spade (1 Red, 1 Blue)
Plunger Clamp Clip (1 Red, 1 Blue)
Plunger Jaw Clip (1 Red, 1 Blue)
Safe Alligator Clip (1 Red, 1 Blue)
Soft Accessory Case

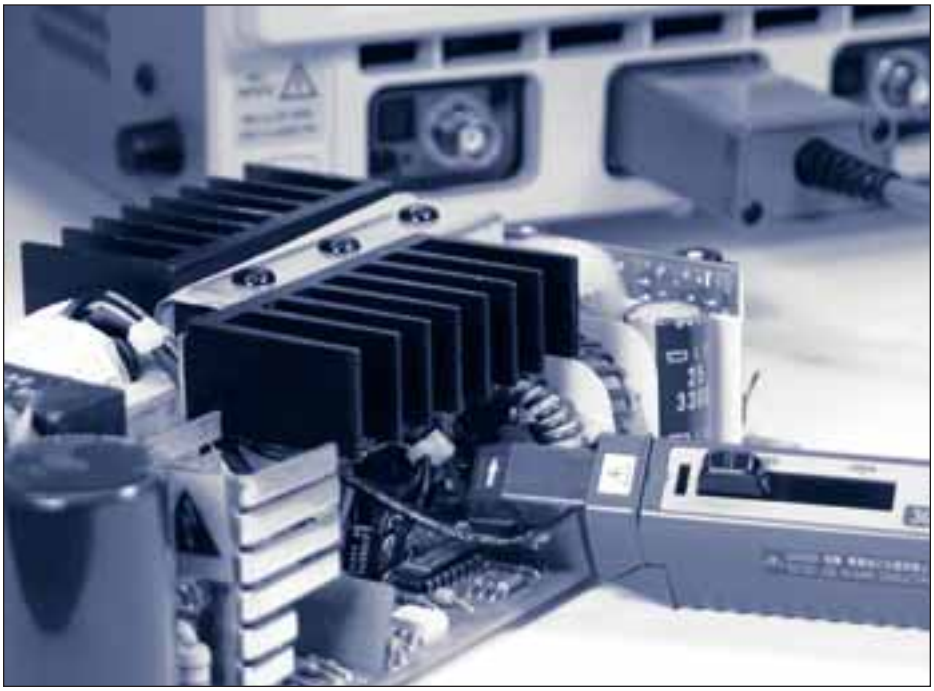
ADP300

Instruction Manual
Certification of Calibration
Plunger Hook Clip (1 Red, 1 Blue)
Straps for Holding Probe

ORDERING INFORMATION	PRODUCT CODE
1,400 V, 100 MHz High-Voltage Differential Probe	ADP305
1,400 V, 20 MHz High-Voltage Differential Probe	ADP300

* Requires AP-1M for oscilloscopes with 50 Ω only inputs

CURRENT PROBES



Accurately measure AC, DC, and impulse currents.

MEASURE CURRENTS IN A WIDE RANGE OF APPLICATIONS

Measuring AC and DC Currents
LeCroy current probes do not require the breaking of a circuit or the insertion of a shunt to make accurate and reliable current measurements. Based on a combination of Hall effect and transformer technology, LeCroy current probes are ideal for making accurate AC, DC, and impulse current measurements.

Fully Integrated with Oscilloscope
Many current probes require external power supplies or amplifiers to display a waveform on the oscilloscope screen. All LeCroy current probes are powered through the LeCroy ProBus® connection and require no additional hardware. Along with providing power, the ProBus connection allows the current probe and oscilloscope to communicate, resulting in current waveforms automatically displayed on screen in Amps, and calculated power traces scaled correctly in Watts. This full integration also allows for Degauss and Autozero functions to be done directly from the oscilloscope with a single button press.

Applications
LeCroy current probes are available in a wide range of models for a wide range of applications. The full range of LeCroy current probes includes models with bandwidths up to 100 MHz, peak currents up to 700 A and sensitivities to 10 mA/div. Multiple current probes can be used together to make measurements on three-phase systems, or a single current probe can be used with a voltage probe to make accurate instantaneous power measurements. LeCroy current probes are often used in applications such as the design and test of switching power supplies, motor drives, electric vehicles, and uninterruptible power supplies.

CURRENT PROBES

CP031

CP031 – 30A, 100 MHz

The CP031 is LeCroy's highest bandwidth current probe. Along with the high 100 MHz bandwidth the CP031can probe continuous currents of 30 A rms and peak currents up to 50 A. The CP031 features a small form factor making it easier to probe on a crowded, compact board.

Features:

- 100 MHz bandwidth
- Small form factor accommodates large conductors with small jaw size
- 30 A rms continuous current, 50 A peak current

CP030

CP030 – 30 A, 50 MHz

The CP030 was designed with a small form factor for today's crowded boards. The small jaw can probe currents in tight spaces and still clamp onto conductors up to 5 mm in diameter. Continuous currents of 30 A rms and peak currents of 50 A can be measured by the CP030, which also features a 50 MHz bandwidth.

Features:

- Small form factor accommodates large conductors with small jaw size
- 30 A rms continuous current, 50 MHz bandwidth
- 50 A peak current

AP015

AP015 – 30 A, 50 MHz

The AP015 current probe can measure continuous current of 30 A rms and peak pulses of up to 50 A for durations up to 10 seconds. This probe also features an overheating protection circuit, which will display an on-screen warning to the user to prevent damage. A probe unlock detection feature is also built in to the AP015 to ensure accurate measurements.

Features:

- 30 A rms continuous current, 50 MHz bandwidth
- 50 A peak current for up to 10 seconds
- Overheating and Probe Unlock Detection

CURRENT PROBES

CP150 – 150 A, 10 MHz Features:

- 150 A rms continuous current
- 500 A peak
- 10 MHz bandwidth

CP150

CP500 – 500 A, 2 MHz Features:

- 500 A rms continuous current
- 700 A peak
- 2 MHz bandwidth

CP500

CURRENT PROBES

SPECIFICATIONS	CP031*†	CP030*†
ELECTRICAL CHARACTERISTICS		
Max. Continuous Input Current	30 A	30 A
Bandwidth	100 MHz	50 MHz
Max. Peak Current at Pulse Width	50 A ≤ 10 µs	50 A ≤ 10 µs
Rise Time (typical)	≤ 3.5 ns	≤ 7 ns
Minimum Sensitivity	20 mA/div	20 mA/div
Max. In-Phase Current	–	–
Low-Frequency Accuracy	1%	1%
AC Noise	≤ 2.5 mA	≤ 2.5 mA
Coupling	AC, DC, GND	AC, DC, GND
GENERAL CHARACTERISTICS		
Cable Length	1.5 m	1.5 m
Weight	240 g	240 g
Max. Conductor Size (diameter)	5 mm	5 mm
Interface	ProBus, 1 MΩ only††	ProBus, 1 MΩ only††
Usage Environment	Indoor	Indoor
Operating Temperature	0 °C to 40 °C	0 °C to 40 °C
Max. Relative Humidity	80%	80%
Max. Altitude	2000 m	2000 m
Maximum Insulated Wire Voltage	300 V CAT I, 150 V CAT II	300 V CAT I

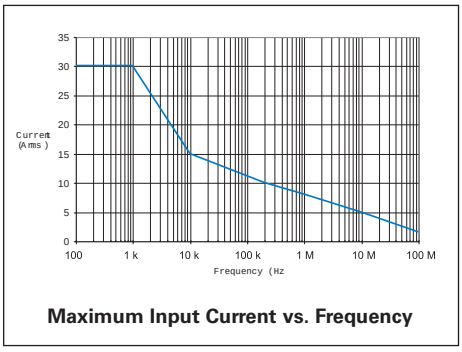
* Guaranteed at 23 °C ±3 °C

† The CP031 and CP030 are compatible with LeCroy X-Stream oscilloscopes running firmware version 4.3.1.1 or greater.

†† Requires AP-1M for use with 50 Ω input only oscilloscopes.

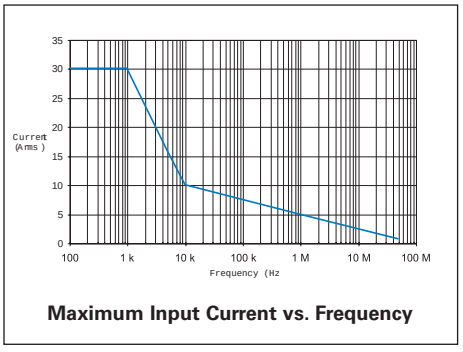
ORDERING INFORMATION	PRODUCT CODE
30 A; 100 MHz Current Probe – AC/DC; 30 A rms; 50 A Peak Pulse	CP031
30 A; 50 MHz Current Probe – AC/DC; 30 A rms; 50 A Peak Pulse	CP030
30 A; 50 MHz Current Probe – AC/DC; 30 A rms; 50 A Peak Pulse	AP015
150 A; 10 MHz Current Probe – AC/DC; 150 A rms; 500 A Peak Pulse	CP150
500 A; 2 MHz Current Probe – AC/DC; 500 A rms; 700 A Peak Pulse	CP500

CP031 – 30 A, 100 MHz



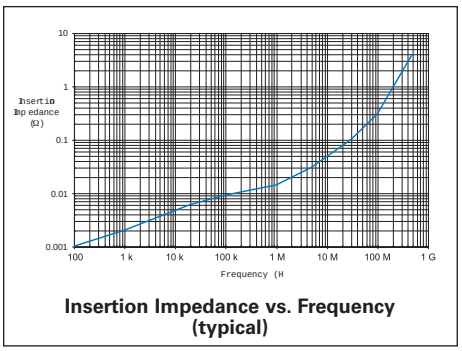
Maximum Input Current vs. Frequency

CP030 – 30 A, 50 MHz



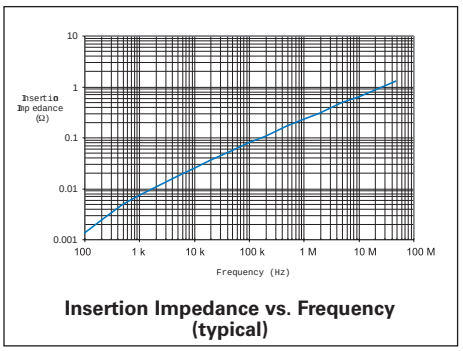
Maximum Input Current vs. Frequency

CP031 – 30 A, 100 MHz



Insertion Impedance vs. Frequency (typical)

CP030 – 30 A, 50 MHz



Insertion Impedance vs. Frequency (typical)

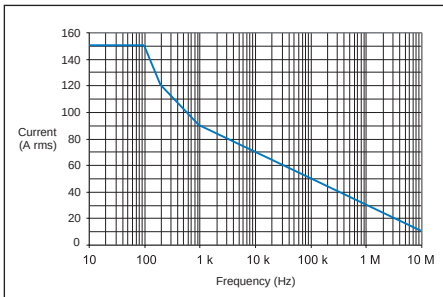
CURRENT PROBES

	AP015	CP150	CP500
	30 A	150 A	500 A
	50 MHz	10 MHz	2 MHz
	50 A ≤ 10 s	500 A ≤ 30 µs	700 A
	≤ 7 ns	< 35 ns	< 175 ns
	10 mA/div	200 mA/div	200 mA/div
	–	500 A	1150 A
	1%	1%	1%
		≤ 25 mA	25 mA
	AC, DC, GND	AC, DC, GND	AC, DC, GND
	2 m	2 m	6 m
	300 g	500 g	630 g
	5 mm	20 mm	20 mm
	ProBus, 1 MΩ only††	ProBus, 1 MΩ only††	ProBus, 1 MΩ only††
	Indoor	Indoor	Indoor
	0 °C to 40 °C	0 °C to 40 °C	0 °C to 40 °C
	80%	80%	80%
	2000 m	2000 m	2000 m
	300 V CAT I	600 V CAT II, 300 V CAT III	600 V CAT II, 300 V CAT III

* Guaranteed at 23 °C ±3 °C

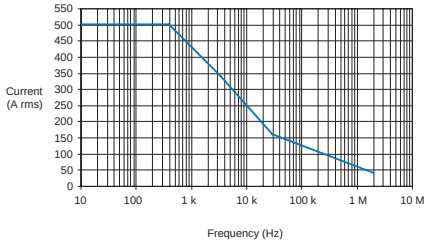
† The CP031 and CP030 are compatible with LeCroy X-Stream oscilloscopes running firmware version 4.3.1.1 or greater.
†† Requires AP-1M for use with 50 Ω input only oscilloscopes.

CP150 – 150 A, 10 MHz



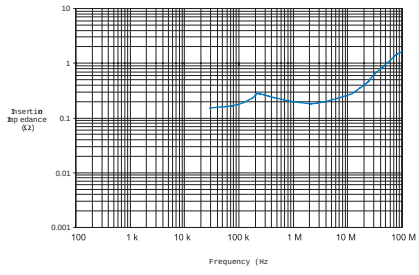
Maximum Input Current vs. Frequency

CP500 – 500 A, 2 MHz



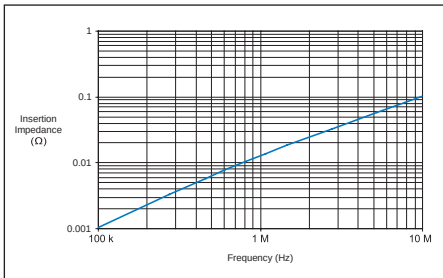
Maximum Input Current vs. Frequency

AP015 – 30 A, 50 MHz



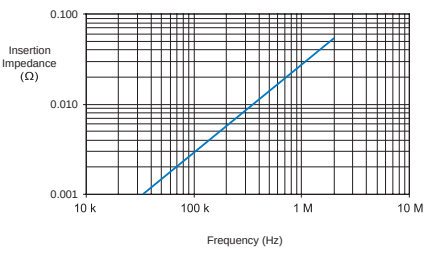
Insertion Impedance vs. Frequency (typical)

CP150 – 150 A, 10 MHz



Insertion Impedance vs. Frequency (typical)

CP500 – 500 A, 2 MHz



Insertion Impedance vs. Frequency (typical)

PROBE DESKEW AND CALIBRATION

TF-DSQ

The TF-DSQ fixture facilitates calibration of timing measurements in single-ended and differential probes—a unique concern in high-speed measurements. By requiring only one connection of a probe to the fixture and one button press, the TF-DSQ ensures probe calibration results that are valid for the duration that the probe is connected to the circuit. An extremely fast edge with 75 ps risetime combines with probe gain and offset calibration capabilities for added accuracy.

Features:

- Deskews to ±20 ps typical accuracy
- Differential and single-ended drive
- 75 ps edge for precise deskewing
- Calibrates gain, offset and skew at the same probing point
- Accounts for risetime variations
- Accounts for common-mode voltage variations
- DC gain calibration accounts for probe loading effects
- Integrated operation with scope for fully automatic calibration

SPECIFICATIONS

SCOPE COMPATIBILITY	SCOPES
(requires software version 3.6.0 or later)	WaveMaster **(8300, 8300A, 8500, 8500A, 8600A, and 8620A including all WaveMaster XXL models)**
	Serial Data Analyzers **(SDA 3000, 3000A, 5000, 5000A, 6000, 6000A, and 6020 including all SDA XXL models)** Disk Drive Analyzers **(DDA 5005A and 5005A XXL)**
Scope Connection	ProLink
Probes Supported	WL600 and WL300 with all Probing Accessories AP020, AP033, AP034 HFP1000, HFP1500, HFP2500, and HFP3500 PP005, PP005A
DC Range	±5V Single-ended, ±10V Differential
DC Accuracy	±(1% + 600 µV)
Edge Risetime	75 ps (typical) < 95 ps (guaranteed)
Edge Amplitude and Rep Rate	Approximately 800 mV @ 10 MHz
Deskew Accuracy	±20 ps (typical)

ORDERING INFORMATION	PRODUCT CODE
Probe Deskew and Calibration Fixture	TF-DSQ
Included:	Prolink Extender 48" 50 ohm Cable with Male SMA Connectors Calibration Certificate Operator's Manual Soft Accessory Case

EZ PROBE POSITIONER

The EZ Probe Positioner provides stable, accurate X, Y and Z positioning in one fluid motion. Its unique 3-D joystick, with 3:1 motion reduction and single-clutch, fully-articulating arm, allow simple, precise positioning in anything from card cages to MCMs. Any current handheld probes can be easily attached, facilitating the measurement process and ensuring more precise connectivity.

ORDERING INFORMATION	PRODUCT CODE
Cascade Microtech EZ-Probe Positioner	EZ PROBE

EZ PROBE

ADPPS

Power Adapter for AP033, AP034 and HFP1000 Active Probes; allows the probe's output to be connected to other non-ProBus test equipment, including spectrum and network analyzers.

ORDERING INFORMATION	PRODUCT CODE
ProBus-to-BNC and Power Adapter for AP033, AP034, and HFP Series (BW limited to 1 GHz)	ADPPS

ADPPS

TRANSIT CASE

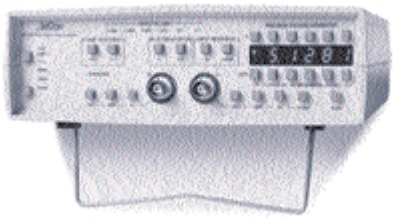
Soft Accessory Case for probes—features inside flap for storing manuals, plus roomy interior for a probe and its many accessories.

ORDERING INFORMATION	PRODUCT CODE
Soft Accessory Case for Probes	SAC-01

SAC-01

DIFFERENTIAL AMPLIFIERS AND ACCESS.

The DA1855A is a stand-alone, high-performance differential amplifier providing the fastest overdrive recovery of any commercially available product. This unique capability allows the amplifier to make measurements that would normally be limited by oscilloscope overdrive recovery.



DA1855A

Features:

- Full control from oscilloscope through ProBus interface
- DC to 100 MHz bandwidth
- Outstanding 100,000: 1 Common Mode Rejection Ratio (CMRR)
- Gain of X1 or X10
- Industry-leading overdrive recovery
- Low noise
- Selectable BW limiting
- Two gain control modes when connected to a LeCroy oscilloscope
- Built-in Precision Voltage Generator (PVG)
- Comparator and true differential offset modes

SPECIFICATIONS

GENERAL	
Amplifier Gain	1 or 10
Gain Accuracy	±1% + uncertainty of termination resistance
Output Zero	≤ 2 mV referred to input
Bandwidth	> 100 MHz (X1 gain)
Output Impedance	50 Ω
Intended Output Load	50 Ω
Maximum Output	limited at ±.50 V into 50 Ω
Input Attenuation	÷1 or ÷10
Input Impedance	1 MΩ II 20 pF 100 MΩ resistance selectable in ÷1 attenuation setting only

MAX. DIFFERENTIAL LINEAR INPUT	
(X1 Gain, ÷1 Attenuator)	±0.5 V
(X10 Gain, ÷1 Attenuator)	±0.05 V
(X1 Gain, ÷10 Attenuator)	±5.0 V
(X10 Gain, ÷10 Attenuator)	±0.5 V

MAX. COMMON MODE INPUT	
(÷1 Attenuator)	±15.5 V
(÷10 Attenuator)	±155 V

DIFFERENTIAL OFFSET RANGE (VDIFF) MODE	
(X1 Gain, ÷1 Attenuator)	±10 V
(X10 Gain, ÷1 Attenuator)	±1 V
(X1 Gain, ÷10 Attenuator)	±100 V
(X10 Gain, ÷10 Attenuator)	±10 V

COMPARISON OFFSET RANGE (VCOMP) MODE	
Effective Comparison Voltage Range	
(÷1 Attenuator)	±15.5 V
(÷10 Attenuator)	±155 V

DIFFERENTIAL AMPLIFIERS AND ACCESS.

COMMON MODE REJECTION RATIO, X1 OR X10 GAIN, ÷1 ATTENUATION

≥ 50,000 : 1	1 (94 dB) @ 70 Hz
≥ 50,000 : 1	1 (94 dB) @ 100 kHz
≥ 316 : 1	1 (50 dB) @ 10 MHz

OVERDRIVE RECOVERY

In X10 gain, amplifier settles to within 1 mV referred to the input within 100 nsec from 4 V input (8000% overdrive).

BANDWIDTH LIMIT FILTERS (LOW PASS)

20 MHz, 1.0 MHz, and 100 kHz

MAXIMUM NONDESTRUCT INPUT

250 V peak

PRECISION VOLTAGE SOURCE

Output Range	±15.5 V
DC Accuracy	0.05% of reading +500 µV (15 °C to 45 °C)
Resolution	100 µV (5 1/2 digit)

POWER REQUIREMENTS

Line Voltage Requirement	100 to 250 V AC
Line Frequency Range	48–66 Hz
Power Consumption	≈ 26 W, ≈ 36 VA ≈ 52 W, ≈ 72 VA (DA1855A-PR2)

ENVIRONMENTAL CHARACTERISTICS

Operating Range	0 °C to 50 °C
Non-Operating	-4 °C to 75 °C

PHYSICAL CHARACTERISTICS

Height	7.29 cm (2.87") 8.75 cm (3.4") (DA1855A-PR2)
Width	21.2 cm (8.36") 43.9 cm (17.3") (DA1855A-PR2 without rack mounting ears installed)
Depth	23.2 cm (9.12") 42.5 cm (16.7") (DA1855A-PR2)
Weight	2.15 kg (4.75 lbs.) 9.5 kg (21 lbs.) (DA1855A-PR2)
Shipping Weight	3.12 kg (6.88 lbs.) 11.3 kg (25 lbs.) (DA1855A-PR2)

WARRANTY

3 years

ORDERING INFORMATION	PRODUCT CODE
1 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A
2 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A-PR2
2 Ch, DA1855A with Rackmount	DA1855A-PR2-RM*

* Must be ordered at time of purchase, no retrofit.

DIFFERENTIAL AMPLIFIERS AND ACCESS.

The DXC100A is a high performance, passive, matched differential probe pair designed for use with the DA18xxA Series differential amplifiers. It allows for precise adjustment and matching of transient response, and optimization of the system Common Mode Rejection Ratio (CMRR).

Features:

- DC to 100 MHz bandwidth with DA1855A
- Maximum input voltage 500 V
- Selectable ÷10 or ÷100 attenuation factor
- 1.2 meter cable length

DXC100A

SPECIFICATIONS

Attenuation Factor	÷10 or ÷100
System Bandwidth (-3 dB) (with DA1855A)	100 MHz
System Risetime (with DA1855A)	3.5 ns
Input Resistance	1 MΩ ±1%
Input Capacitance	10.5 pF ±0.5 pF
Max. Nondestructive Input Voltage	500 V DC + peak AC
Length	1.2 meter

ENVIRONMENTAL CHARACTERISTICS

Operating Range	0 °C to 50˚C
Non-Operating	40 °C to 71˚C

PHYSICAL CHARACTERISTICS

Weight	0.18 kg (6.4 oz.)
Shipping Weight	0.45 kg (1 lb.)

WARRANTY

1 year

ORDERING INFORMATION	PRODUCT CODE
÷100 or ÷10 Selectable, 250 MHz Passive Differential Probe Pair	DXC100A*

* Must be used with DA Series differential amplifiers

DXC200

DIFFERENTIAL AMPLIFIERS AND ACCESS.

The DXC200 is a pair of ÷1 probes matched for differential measurement applications. It is designed to minimize capacitative loading while still maintaining practical probe-to-circuit attachment. The DXC200 allows the user to take advantage of the DA18xxA Series' 100 Ω input resistance setting.

Features:

- Low capacitance
- ÷1 differential probe pair
- 0.7 meter cable length

SPECIFICATIONS

Attenuation Factor	÷1
System Capacitance (with DA18xxA)	< 50 pF
Length	0.7 meter

DXC200 AND DA1855A SYSTEM SPECIFICATIONS

Risetime	7 ns
Bandwidth (-3 dB)	50 MHz
Input Resistance (selectable)	1 or 100 MΩ
Maximum Nondestructive Input Voltage	500 VDC + peak AC

ENVIRONMENTAL CHARACTERISTICS

Operating Range	0 °C to 50 °C
Non-Operating	-4 °C to 75 °C

PHYSICAL CHARACTERISTICS

Weight	0.14 kg (5 oz.)
Shipping Weight	0.45 kg (1 lb.)

WARRANTY

1 year

ORDERING INFORMATION	PRODUCT CODE
÷1, 50 MHz Passive Differential Probe Pair	DXC200*

* Must be used with DA Series differential amplifiers

DIFFERENTIAL AMPLIFIERS AND ACCESS.

The DXC5100 is a passive, high voltage differential probe pair for use with DA18xxA Series differential amplifiers. It is ideal for motor drive and other applications with high bus voltages. Maximum differential input voltage is 500 volts (5 kV when used with DA101).

Features:

- Maximum input voltage 2500 V to ground
- ÷100 attenuation
- DC to 100 MHz bandwidth with DA1855A
- < 2.75 pF input capacitance

DXC5100

SPECIFICATIONS

Attenuation Factor	÷100, ±1.75%
Max. Input Voltage, each probe to ground	2500 V (DC + peak AC)
Input Resistance	10 MΩ
Input Capacitance	< 2.75 pF
Cable Length	3.1 meter
Weight	275 g (10 oz.)
Shipping Weight	0.5 kg (1 lb. 1.6 oz.)
WARRANTY	1 year

ORDERING INFORMATION	PRODUCT CODE
÷100, 250 MHz 2.5 kV, High-Voltage Probe Pair	DXC5100*

The DA101 is a ÷10 passive external attenuator. When used with the DXC5100, it extends the probe pair's differential mode range to up to 5000 volts, provided that the common mode voltage of 2500 volts to ground for each probe is not exceeded.

DA101

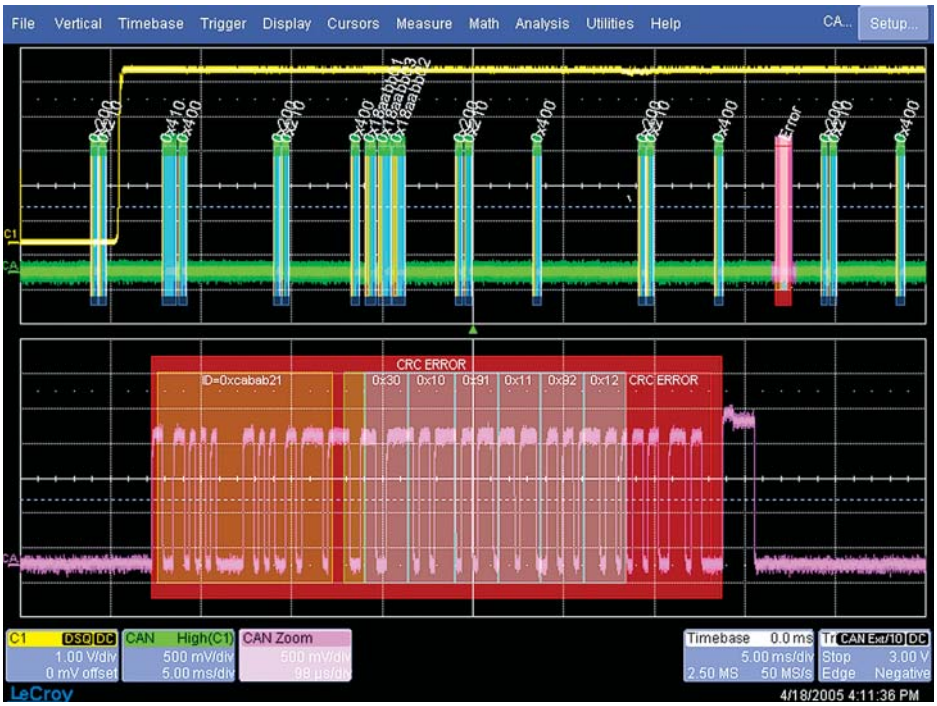
SPECIFICATIONS

Attenuation Factor	÷10
Weight	0.10 kg (3.5 oz.)
Shipping Weight	0.41 kg (0.9 lb.)

ORDERING INFORMATION	PRODUCT CODE
÷10, 1 MΩ External Passive Attenuator	DA101†

* Requires DA101 for full performance
† Recommended with DXC5100

CANBUS TDM/TD – TRIGGER AND DECODING



Debug and Validate Faster. Improve Reliability. Lower Costs.
With the new CANbus TDM/TD, LeCroy provides a dramatically improved solution for testing and debugging CAN systems. Now Analog, CAN Message data, and Digital signals can all be viewed on a single instrument—an easy-to-use, everyday bench oscilloscope. With this single display and the robust CANbus TDM/TD toolset, engineers will capture more information and develop more insight easily and quickly. By eliminating the need for a variety of instruments and displays, the LeCroy CANbus TDM/TD system sets a new standard for CAN bus testing. The oscilloscope triggers on pre-defined CAN messages, then captures, decodes, and shows them on the display. Other analog or digital signals on the CAN ECU can also be captured and displayed. Cursors, measurement parameters, and graphing tools quickly characterize timing and other signal relationships.

Features:
- Capture > 10,000 CAN messages in one acquisition.
- Trigger on CAN Data, Remote, or Error Frames.
- Decode CAN messages on the oscilloscope display.
- View analog, digital, and CAN signals.
- Measure performance and statistically analyze.
- Graph and plot performance data.

Understanding Performance Has Never Been Easier
With CANbus TD/TDM, the right toolsets make all the difference in understanding CAN system performance. Anomalies are identified more readily; debugging proceeds more quickly.

Performance Capabilities include the following:
- Trigger on CAN or Analog signals. Set CAN message ID and DATA conditions.
- Trigger on Data, Remote, or Error frames.
- One touch zooming of the CAN message is especially helpful with long acquisitions of thousands of CAN messages.

CANBUS TDM/TD – TRIGGER AND DECODING

- Add digital measurement capability with LeCroy's MS-32 option.
- Error Frame Highlight allows users to intuitively locate error frames in long acquisitions.
- Optional memory (up to 12 Mpts/Ch) allows capture times of 10 s or more (2 Mpts/Ch standard).
- CAN Decode is done quickly and automatically, with information overlaid on the CAN physical layer signal.
- Utilize Statistical Views for numerical calculations and histograms, of millions of events.
- Quickly Search through CAN message data. Jump to next conditional frame. Automatically view the searched frame in a zoom window.
- Obtain Exact Node Matching by setting Tseg1, Tseg2, and other values exactly the same as your nodes under test, just like the tools that you are used to.

Graphing Tools

CANbus TDM contains unique graphing and statistical analysis capability that can be used to validate and analyze CAN system performance

Histogram

A graphical plot of measurement data for any automatic measurement parameter, including CAN timing parameters, frequency, amplitude, etc. Worst-case values, modality, and stability can be intuitively understood quickly; and root cause of irregularities debugged. Up to 2 billion measurement values can be histogrammed.

Track

A graphical plot of measurement data values that is time-correlated to all other measurement signals. The vertical scale of the Track is the measurement value, and the horizontal scale is time. As the measurement value changes with time, the Track changes, which enables intuitive understanding of signal modulation and other behavior. Track is ideal for understanding PWM or F-V converter signals.

Trend

A graphical plot of measurement data that is very similar to chart recorder functionality. Like Track, Trend displays measurement values on the vertical axis, but data can be accumulated over many oscilloscope acquisitions (up to 1 million events). Trend is ideal for recording temperature, pressure, stress, strain, or other slow-speed analog signals.

ORDERING INFORMATION	PRODUCT CODE
STANDARD	
CANbus TDM Trigger, Decode, and Measure/Graph Testing Option	CANbus TDM

- Trigger Module with TC251-OPTO optically isolated Trigger Coupler installed (and room for one additional Trigger Coupler). Trigger Couplers are interchangeable.
- CANbus TD Series Oscilloscope Interface Module with 1.0 meter connection cable. Connects Trigger Module to LeCroy oscilloscope ProBus® interface.
- Software for:
  - Trigger Setup
  - CAN Protocol Decode
  - CAN Measurement, (CAN-analog, CAN-CAN, and Time@CAN timing parameters, CAN bus load% and CAN-Value Data Extraction parameters)
  - Histogramming
  - Graphing (Track and Trend)

CANBUS TDM/TD – TRIGGER AND DECODING

ORDERING INFORMATION

PRODUCT CODE

- 1.0 meter USB 2.0 cable from LeCroy external CANbus TD Trigger Module to LeCroy oscilloscope
- Black fabric storage case (SAC-01) with foam insert and room for storage of all equipment and two additional Trigger Coupler accessories (not included)
- Quantity 1 (one) 9-pin DSUB socket to 2-wire adapter cable (for ISO 11898-2 CAN)
- Quantity 1 (one) 9-pin DSUB socket to 4-wire adapter cable (dual-use, for ISO 11519 CAN and GM-LAN/J2411 CAN)
- Quantity 2 (two) 9-pin to 9-pin DSUB 120 ohm terminations
- Quick Reference Guide in English
- Instruction Manual in English
- Quantity 1 (one) Phillips head screwdriver

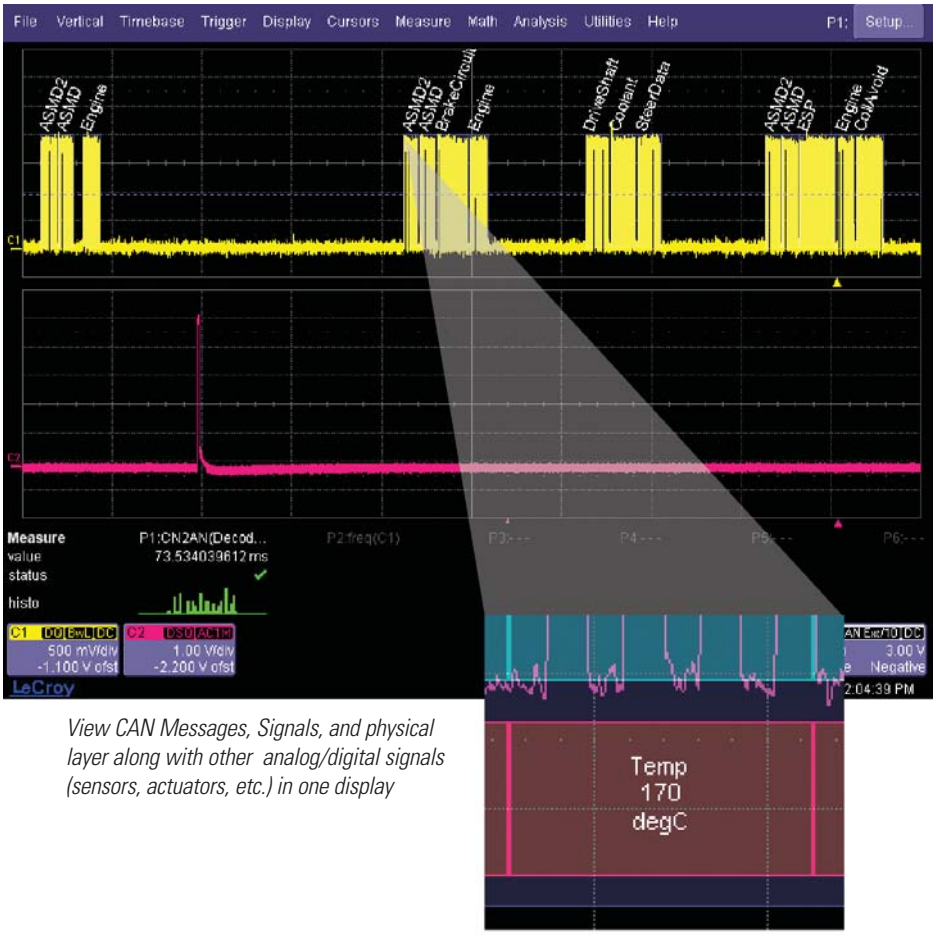
CANbus TD Trigger and Decode Testing Option • Same hardware package as CANbus TDM • Software for – Trigger Setup – CAN Protocol Decode	CANbus TD
CANbus TDM for use on 5 Oscilloscopes. One hardware package and a license to use the software on 5 different oscilloscopes.	CANbus TDM-5LIC
CANbus TD for use on 5 Oscilloscopes. One hardware package and a license to use the software on 5 different oscilloscopes.	CANbus TD-5LIC

ACCESSORIES

CAN 1041 Opto-isolated High-speed Trigger Coupler	TC1041-OPTO
CAN 1050 Opto-isolated High-speed Trigger Coupler	TC1050-OPTO
CAN 1054 Opto-isolated Low-speed Trigger Coupler	TC1054-OPTO
CAN 251 Opto-isolated High-speed Trigger Coupler (one is included with CANbus TD)	TC251-OPTO
CAN 5790c Opto-isolated Single-wire Trigger Coupler	TC5790c-OPTO
CAN B10011S Opto-isolated Truck and Bus Trigger Coupler	TC10011-OPTO
CAN Cable Set (ISO 11898-2)	902329-00
CAN Cable Set (ISO 11519, GM-LAN/J2411)	902330-00
CAN Bus Y Connection Cable, 2 m, with Terminating Resistor	902393-00
500 MHz Active Differential Probe (x10, ÷1, ÷10, ÷100)	AP033
1,400 V, 100 MHz High-Voltage Differential Probe	ADP305
1,400 V, 20 MHz High-Voltage Differential Probe	ADP300

VEHICLE BUS ANALYZERS

VEHICLE BUS ANALYZERS



View CAN Messages, Signals, and physical layer along with other analog/digital signals (sensors, actuators, etc.) in one display

The Vehicle Bus Analyzer is the first conventional oscilloscope to decode CAN serial data into Symbolic (application layer) text. Now, for the first time, an engineer has both the full range of CAN protocol stack information—symbolic, hex, and electrical signal—and the ability to view additional in-circuit electrical signals (sensors and actuators, voltage levels, transients, etc.) that influence the CAN bus. In addition, up to four different CAN buses can be decoded at one time. Standard and specialized oscilloscope tools can be used to validate and debug designs.

Features:

- Symbolic (Application Layer) decode of up to 4 CAN buses
- Compatible with DBC database format
- Display decoded results above waveform on oscilloscope screen
- CAN triggering with setup in symbolic format
- Gateway timing measurements (CAN message to CAN message across a gateway)
- Capture thousands (seconds) of CAN messages with 4 Mpts of memory (up to 24 Mpts optional)
- All CANbus TDM functionality, including:
  - Timing measurements
  - Bus Load measurements
  - CAN message data extraction
  - CAN message Bit Rate calculation
  - Statistical calculation of timing information for many events, and graphical display
  - Graphs/Plots of CAN message data

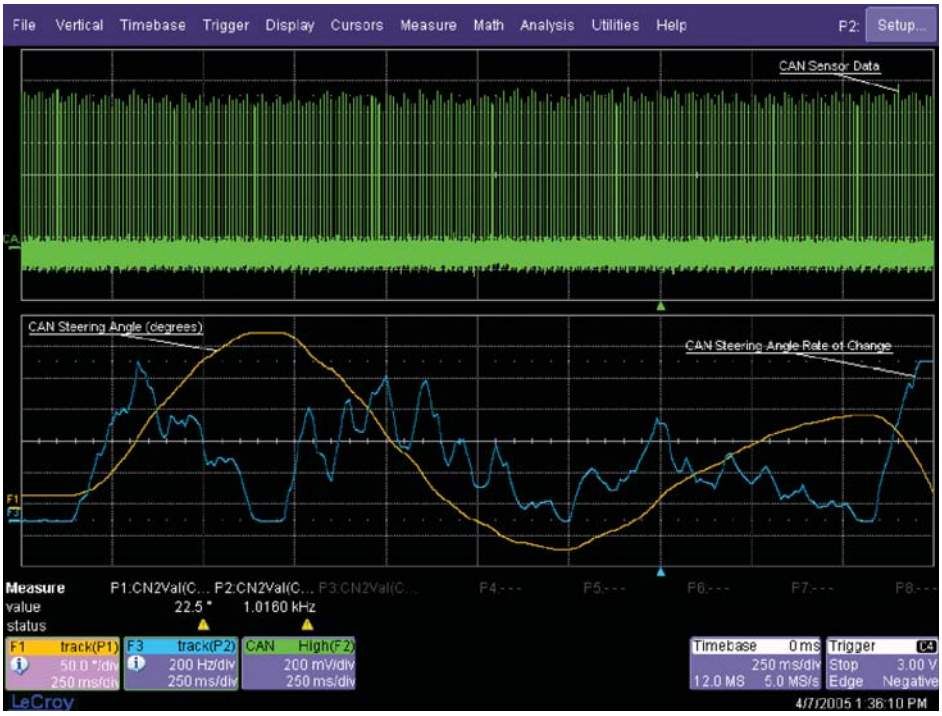
VEHICLE BUS ANALYZERS

Eliminate the Barriers to Fast Debug

Direct symbolic decoding and triggering allows fast and intuitive understanding of events. Simply load your existing DBC database file into the oscilloscope (no re-entry of data is required), capture CAN message traffic, and all electrical (signal), protocol (hex) and symbolic (application) layer information is quickly displayed on the oscilloscope screen. Use standard oscilloscope and specialized Vehicle Bus Analyzer tools to find rare events, automatically measure and statistically analyze event timing, and graph/plot information, including extracted CAN message data.

The Single Tool Enhances Productivity

The VBA concentrates all your information in one place. Timing measurements across gateways are now possible. Understanding is fast, intuitive, and in a familiar format. Complete, time-correlated understanding of all ECU or circuit behaviors is simple. Time-consuming workarounds are a thing of the past.



Unique Measurement Tools

The VBA can make many measurements not possible with other instruments. Aside from timing measurements, the VBA can also extract CAN data from a CAN message stream, graphically plot that data on the oscilloscope display, and compare it to other electrical signals. Here, information on the steering angle and steering angle rate of change is extracted from the CAN message acquisition, rescaled to decimal values, and plotted as a time-correlated "Track" on the VBA display.

VEHICLE BUS ANALYZERS

ORDERING INFORMATION

	PRODUCT CODE
VEHICLE SOLUTIONS	
1 GHz, 4 Ch Vehicle Bus Analyzer	VBA6100A
500 MHz, 4 Ch Vehicle Bus Analyzer	VBA6050A

All Vehicle Bus Analyzers are complete with LeCroy's powerful WaveRunner 6000A Series oscilloscope, Vehicle Bus Analyzer software, and CAN bus triggering hardware kit. Reference the WaveRunner 6000A Series brochure for complete information on the 500 MHz (WR6050A) and 1 GHz (WR6100A) oscilloscope available at www.lecroy.com

VEHICLE BUS ANALYZER SOFTWARE CAPABILITIES

- Symbolic (application layer) decode of up to 4 separate CAN buses
- Symbolic CAN trigger setup
- Hexadecimal decode and trigger setup
- Binary trigger setup
- Automated timing measurements, including capability to measure timing across gateways:
  - CAN message to Analog signal
  - Analog signal to CAN message
  - CAN message to CAN message
- Bus Load % measurements (up to 2 billion events)
- CAN message extraction and display in scaled decimal values
- CAN message bit rate calculation
- Statistical calculations of many measurements
- Histogram (graphical) display of statistical data, including timing measurements
- Trend and Track plots of extracted CAN data
- Persistence trace, mean, and sigma functionality
- Complete set of Jitter and Timing (@level) parameters

CAN TRIGGERING HARDWARE CONTENTS

- Trigger Module with TC251-OPTO optically isolated Trigger Coupler installed (and room for one additional Trigger Coupler). Trigger Couplers are interchangeable.
- Oscilloscope Interface Module with 1.0 meter connection cable. Connects Trigger Module to LeCroy oscilloscope ProBus® interface.
- 1.0 meter USB 2.0 cable from LeCroy external CANbus TD Trigger Module to LeCroy oscilloscope
- Black fabric storage case (SAC-01) with foam insert and room for storage of all equipment and two additional Trigger Coupler accessories (not included)
- Quantity 1 (one) 9-pin DSUB socket to 2-wire adapter cable (for ISO 11898-2 CAN)
- Quantity 1 (one) 9-pin DSUB socket to 4-wire adapter cable (dual-use, for ISO 11519 CAN and GM-LAN/J2411 single-wire CAN)
- Quantity 2 (two) 9-pin to 9-pin DSUB 120 ohm terminations
- Quick Reference Guide and Instruction Manual in English
- Quantity 1 (one) Phillips head screwdriver

OPTIONS AND ACCESSORIES

24 Mpts max. (interleaved), 12 Mpts/Ch memory option	VBA-VL
16 Mpts max. (interleaved), 8 Mpts/Ch memory option	VBA-L
8 Mpts max. (interleaved), 4 Mpts/Ch memory option	VBA-M
32 Digital Channel Oscilloscope Mixed Signal Option	MS-32
CANbus TDM Trigger, Decode, and Measure/Graph Testing Option	CANbus TDM
CANbus TD Trigger and Decode Testing Option	CANbus TD
CANbus TDM Trigger, Decode, and Measure/Graph Testing Option with a License for Software to be Used on 5 Oscilloscopes	CANbus TDM-5LIC
CANbus TD Trigger and Decoding Testing Option with a License to Work on 5 Oscilloscopes	CANbus TD-5LIC
CAN 1041 Opto-isolated High-speed Trigger Coupler	TC1041-OPTO

VEHICLE BUS ANALYZERS

ORDERING INFORMATION	PRODUCT CODE
OPTIONS AND ACCESSORIES (CONTINUED)	
CAN 1050 Opto-isolated High-speed Trigger Coupler	TC1050-OPTO
CAN 1054 Opto-isolated Low-speed Trigger Coupler	TC1054-OPTO
CAN 251 Opto-isolated High-speed Trigger Coupler (one is included with CANbus TD)	TC251-OPTO
CAN 5790c Opto-isolated Single-wire Trigger Coupler	TC5790c-OPTO
CAN B10011S Opto-isolated Truck and Bus Trigger Coupler	TC10011-OPTO
CAN Cable Set (ISO 11898-2)	902329-00
CAN Cable Set (ISO 11519, GM-LAN/J2411)	902330-00
CAN Bus Y Connection Cable, 2m with Terminating Resistor	902393-00
1 GHz Active Differential Probe (÷1, ÷10, ÷20)	AP034
500 MHz Active Differential Probe (x10, ÷1, ÷10, ÷100)	AP033
1,400 V, 100 MHz High-Voltage Differential Probe	ADP305
1,400 V, 20 MHz High-Voltage Differential Probe	ADP300
1 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP1000
1.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP1500

SOFTWARE OPTIONS

LeCroy oscilloscopes provide the best methods for probing, viewing, and manipulating electrical signals. Their standard measurements let users perform calculations simply and quickly. Signal shape and variation can be analyzed through parameter measurements, histograms or frequency analysis.

In addition to its wide array of standard measurements, any LeCroy oscilloscope can be upgraded with an application package, adding sequencing of measurements that transform the oscilloscope into a powerful analyzer. Each package provides measurements that use the whole oscilloscope memory, which provides better time accuracy at long time settings, enhanced resolution in the frequency domain, and more measurements extracted from the waveform in the statistical domain. LeCroy software accessories efficiently extend the oscilloscope's capability to new levels.

LeCroy's architecture allows added packages to be seamlessly incorporated directly into the simple graphic user interface. The new measurements are explained on the screen or in the scope's help system, so users will always understand the calculations on a signal. Users can even track the trend of a measurement over time. These additional tools facilitate troubleshooting, as they allow a greater understanding of the signal makeup.

There is an expandable package for virtually every application. For even more capability, our XDEV package lets users create their own oscilloscope measurements and run them within the scope. No other company in the industry offers measurement customization at such an integrated level.

Analysis for the future – MAUI architecture allows fast development of new measurements—combining probe, scope setup, documentation all in one oscilloscope package. LeCroy—from your circuit to your manager's desk.

APPLICATION	WaveSurfer	WaveRunner	WavePro	WaveMaster	WaveExpert	Serial Data Analyzer	Disk Drive Analyzer
CAN Bus Trigger, DeCode and Measure		CANbus TDM, CANbus TD					
Communication Mask Test	ET-PMT	SDM, ET-PMT	SDM, ET-PMT	SDM, ET-PMT	●*	SDM, ET-PMT	SDM, ET-PMT
Disk Drive Head, Channel and Failure Analysis		DDM2	DDM2	DDM2		DDM2	●
Fibre Channel					●*	●	
InfiniBand					● *	●	
Mixed Signal Measurements	MS-32	MS-32					
PCI Expre						SDA-PCIE-G2	
PLL Analysis, Clock & Timing		JTA2	JTA2	JTA2		ASDA-J	JTA2
Power Conversion Devices and Power Supply Measurement		PMA2	PMA2	PMA2		PMA2	
Rapid I/O					●*	●	
Serial ATA						SDA-SATA	
Spectrum Analysis	MATHSURF	XMATH, XWAV	XMATH	XMATH	●	●	●
USB2		USB2	USB2	USB2		USB2	USB2
Ethernet		ENET	ENET	ENET		ENET	ENET
Advanced Optical Recording Measurement			AORM	AORM		AORM	AORM

Optional solution

● Standard

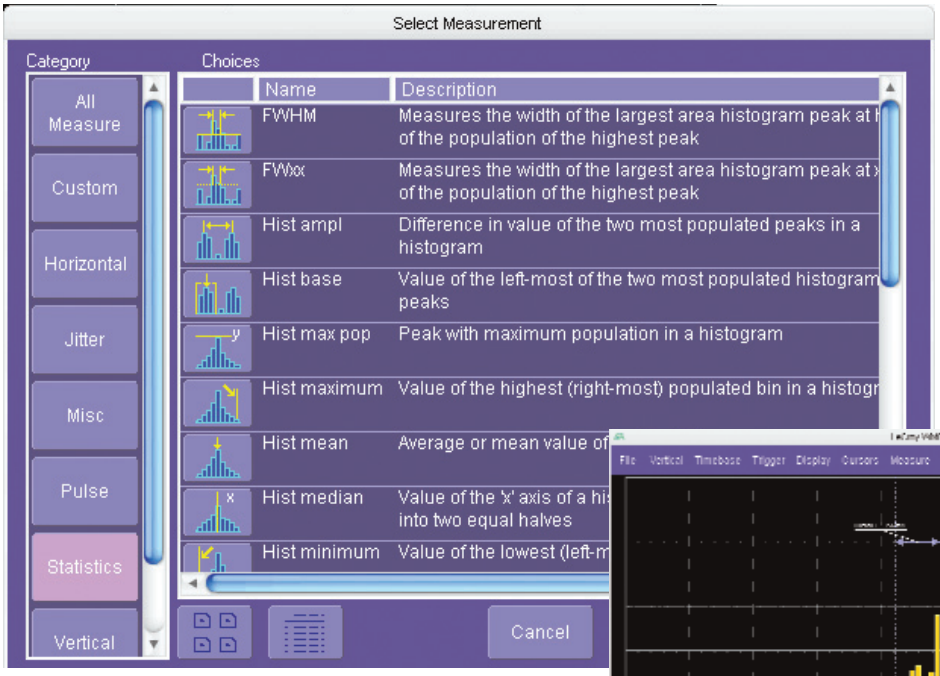
* Compliance mask included

SOFTWARE OPTIONS

		WaveRunner	WavePro	WaveMaster	WaveExpert	Serial Data Analyzers	Disk Drive Analyzers
XMATH	Advanced Math Software Package	■	■	■	■	●	●
XDEV	Advanced Customization Software Package	■	■	■	■	■	●
XMAP	Master Analysis Software Package (Includes JTA2, XMATH and XDEV)	■	■	■		■	■
JTA2	Jitter and Timing Analysis Software Package	■	■	■		●	■
XWEB	Processing Web Editor Software Package for Functions and Parameters	■	■	■	■	■	■
DDM2	Disk Drive Measurement Software Package	■	■	■		■	
DFP2	Digital Filter Software Package	■	■	■	■	■	■
ET-PMT	Electrical Telecom Test Software Package	■	■	■		●	■
PMA2	Power Measure and Analysis Software Package	■	■	■		■	■
SDM	Serial Data Mask Software Package	■	■	■		●	■
LabNotebook™		●	●	●	●	●	●

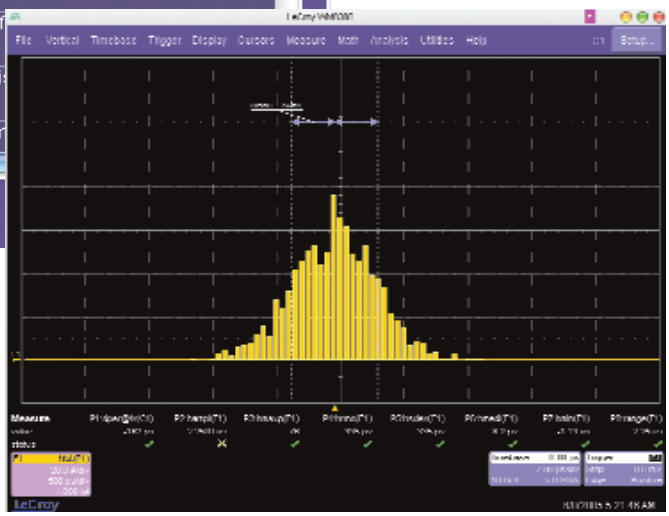
● Standard
■ Optional

XMATH – ADVANCED MATH PACKAGE



This software works with

- **WaveExpert**
- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**
- **DDA**



This above histogram is showing expanded histogram measurements.

The XMATH Advanced Math Package for LeCroy X-Stream oscilloscopes provides a comprehensive set of signal WaveShape Analysis tools that offer insight into the shape of complex signals.

XMATH includes expanded histogram functions, Trend and Track, enhanced FFT capabilities, and Parameter math. XMATH lets you perform these operations over the whole signal, whether 250 points or 100 million waveform points.

Features:

- Complete set of comprehensive signal analysis tools
- Expanded histogram functions
- Enhanced FFT capabilities
- Track graphs of any measurement parameter
- Trend up to 1 million events
- Persistence Functions
- Parameter math – add, subtract, multiply or divide two different parameters
- Auto-correlation function
- Cubic, Linear, and Sin x/x interpolation functions
- Narrow-band power measurements
- Sparse function
- Up to 8 different math functions

Additional Features:

XMATH also gives you over 20 more parameters, including a Trend function to facilitate trending up to 1 million events, and an Auto-Correlation function which will help separate a periodic signal from noise.

XMATH – ADVANCED MATH PACKAGE

Fast Fourier Transform (FFT)
When coupled with LeCroy's X-Stream architecture, XMATH's enhanced FFT capabilities allow you to do an FFT on up to 50M input points and with 5 different windows. For frequency power at a given point, XMATH provides narrow power measurements.

The FFT function's display of the frequency content of your signal will give you insight into potential problems within your circuit. LeCroy's Math on Zoom capability lets you single out problem areas of your signal and analyze the frequency content while seeing the live measure result updating on the screen.

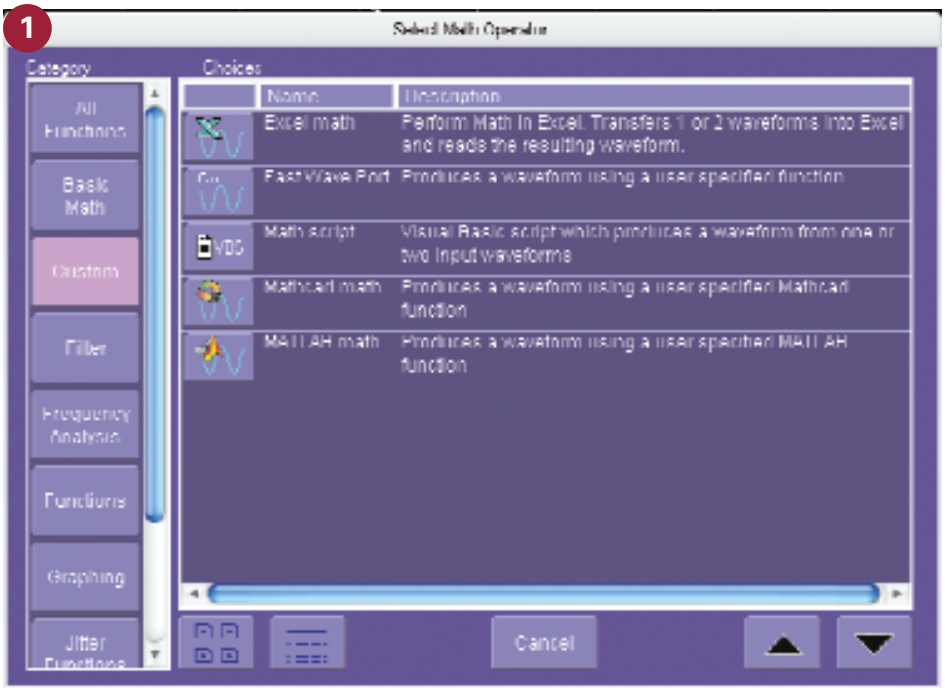
Histograms
An understanding of statistical variations in parameter values tells you about the range or variation of a measurement. A well-controlled design will have a narrow mean and distribution of measurements. Often, knowing the average, minimum, maximum, and standard deviation of the parameter may be enough, but a more detailed understanding of the distribution of a parameter's values can help an engineer locate anomalous behavior in a design.

Parameter Math
XMATH allows you to do math on Parameters. Add, subtract, multiply, or divide two different parameters to extend the abilities of the oscilloscope. For example, you are able to take a measurement of the voltage of a signal and divide that by the current of the signal to find the resistance. With XMATH the result can be renamed and displayed live on the screen.

Persistence Functions
XMATH includes the ability to further process persistence waveform data. For example, by creating a new trace as the mean of a persistence waveform you are able to analyze the data using the parameters on the oscilloscope.

ORDERING INFORMATION	PRODUCT CODE
Advanced Math Software Package	XMATH

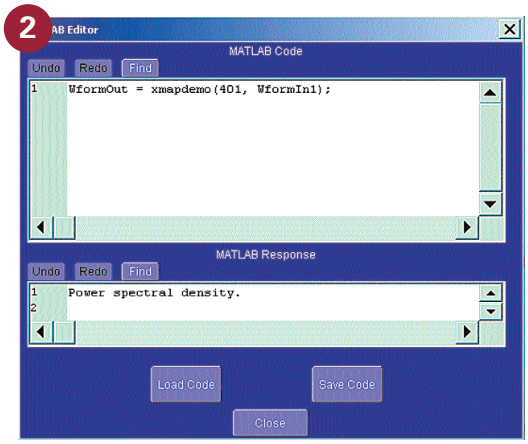
XDEV – CUSTOMIZATION PACKAGE

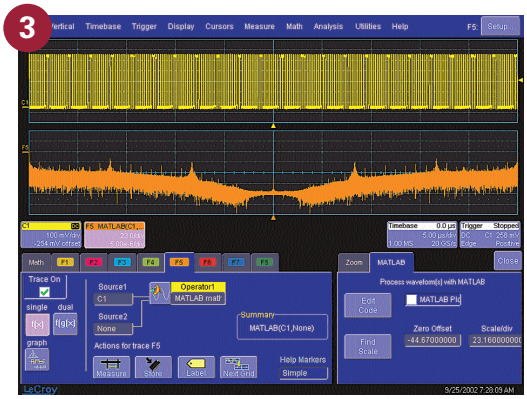


An example of XDEV Advanced Customization is shown below. 1) Select a customized algorithm. 2) Load your algorithm. 3) The calculated result is displayed on the WaveMaster oscilloscope.

XDEV Customization Package lets you modify, expand, and integrate your own measurements from within your LeCroy oscilloscope, making your design and debug time more efficient.

Only LeCroy completely integrates third party programs into the oscilloscope's processing stream by allowing you to create and deploy a new measurement or math algorithm directly into the WaveShape Analysis Engine and display the result on the oscilloscope in real-time. There is no need to run a separate program, or ever leave the oscilloscope window. XDEV Advanced Customization package enables you to extend your LeCroy X-Stream oscilloscope to include your most recent in house proprietary algorithms the same day they are created.





This software works with

- **WaveExpert**
- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**

XDEV – CUSTOMIZATION PACKAGE

Features:

- Create and run your own measurement parameters and math functions using VBScript
- Use C/C++, and other programming languages to create your own custom algorithms
- Create your own user interface
- Support for third-party applications: Excel, MATLAB, Mathcad
- Add macro keys to run VBScript files
- Plug-in support

Unsurpassed Customization Capability

The LeCroy X-Stream oscilloscope design incorporates a fast, robust COM-based architecture that provides a level of customization that simply cannot be approached by any other oscilloscope. It allows you to create your own script in your favorite programming language (Visual Basic, C, C++), which can then be integrated seamlessly into the WaveShape Analysis engine with the results shown on the oscilloscope display.

Seamlessly Integrate Third-Party Applications

With the XDEV Advanced Customization package, third-party applications such as Excel, MATLAB, and Mathcad become part of your LeCroy X-Stream oscilloscope allowing you to fully integrate your measurements. Analyze your data in a third-party application installed on your oscilloscope and display the results in your LeCroy X-Stream oscilloscope.

Create Custom Measurements and Math Functions

With XDEV you are able to create your own custom measurement parameters and math functions allowing for limitless analysis capability. Use your own proprietary measurements in the oscilloscope for faster results. Using XDEV's support for macro keys, you need only set up your measurement once and then the scope will repeat it for you, enabling you to easily run your custom VBScript files.

Customizable User Interface

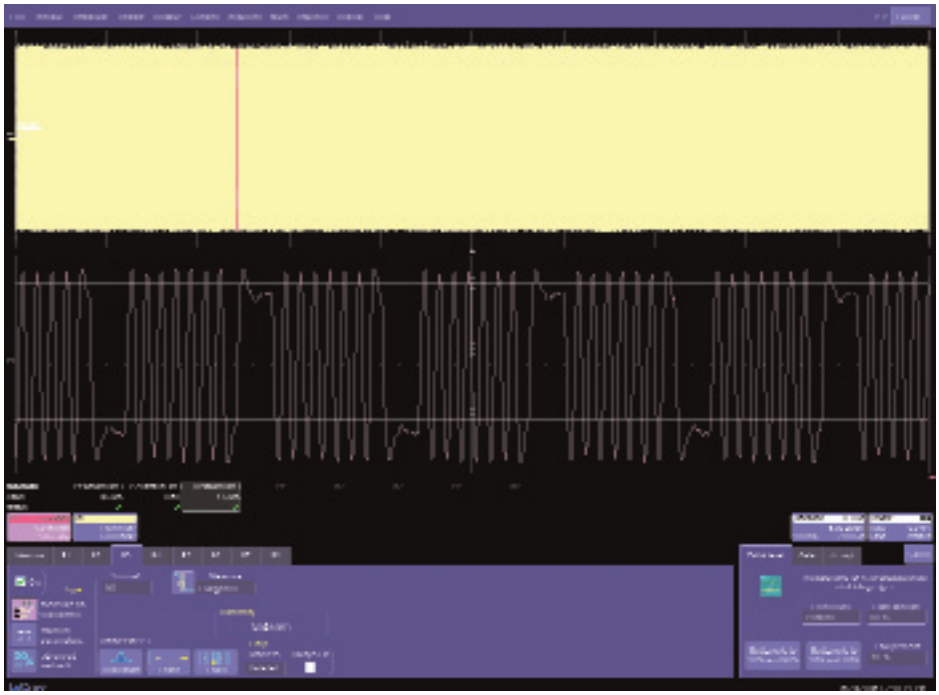
CustomDSO allows you to create setups that can be recalled by the touch of a single button. This process can be extended to include rings of three or more setups as well as trees of setups. CustomDSO also lets you add your own ActiveX™ controls to a setup, allowing you to create personalized user interfaces.

FastWavePort

This unique processing function enables you to insert your own custom processing algorithm, written in the C/C++ language, into your oscilloscope's processing stream. FastWavePort maximizes data throughput from the acquisition system to your processing function.

ORDERING INFORMATION	PRODUCT CODE
Advanced Customization Software Package	XDEV

XMAP – MASTER ANALYSIS PACKAGE



XMAP combines timing analysis tools (JTA2) with complex math capability (XMATH) and advanced customization (XDEV).

This software works with

- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**
- **DDA**

The LeCroy family of oscilloscopes take WaveShape Analysis to a whole new level by offering more measurement choices, more powerful ways to analyze the measurements and more viewing capabilities. The result is an oscilloscope that provides greater insight into signal wave shapes than has been previously available in any type of test instrument.

The highest level of WaveShape Analysis is available with the Master Analysis Package (XMAP). This option expands the basic FFT function to accommodate all acquired points, provides averaging in the frequency domain, and enables measurement of spectral power density, real and imaginary components, and frequency domain parameters. It also provides measurement of 12 additional timing parameters for jitter and timing analysis, plus time vs. time JitterTrack™ plots. Histogramming is provided for up to two billion events, and histogram measurements are enhanced through the availability of 18 parameters that statistically define the shape of the distribution. The auto-correlation function is also included.

In addition to the wider range of math functions and signal parameter measurements, XMAP also permits the user to create customized parameter measurements and custom math functions, perform parameter math (such as computing the ratio of peak power to average power or similar computations that involve addition, subtraction, multiplication or division of signal parameters), and doubles the number of math traces (from four to eight).

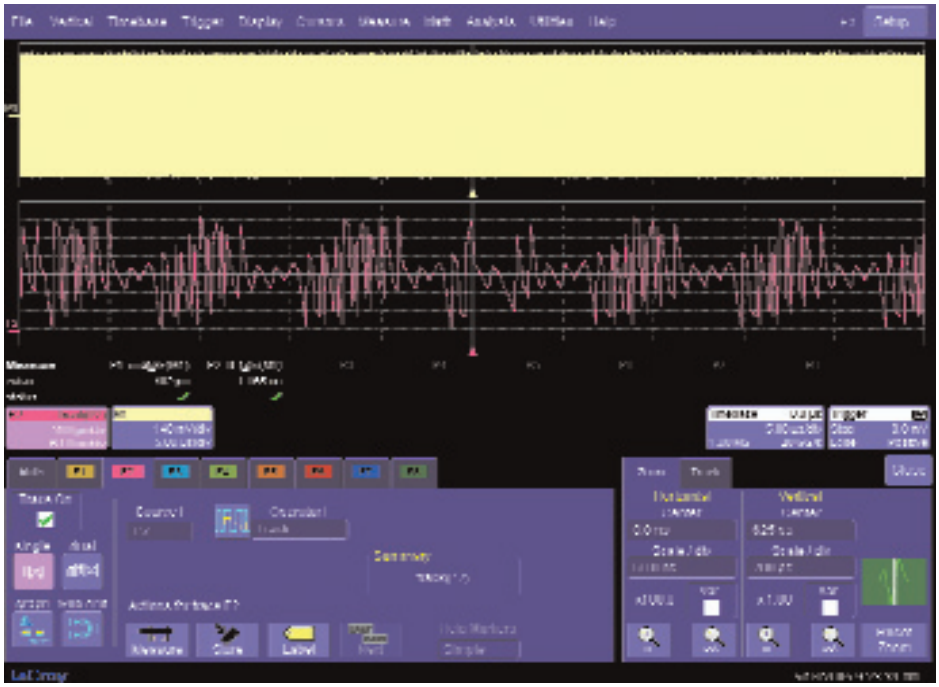
Features:

- Comprehensive set of signal WaveShape Analysis tools (includes JTA2, XMATH, XDEV)
- Provides insight and speed of validation and debug process in a design
- Helps modify, expand, and integrate your own measurements from within your LeCroy oscilloscope

JTA2 – JITTER AND TIMING PACKAGE

This software works with

- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**
- **DDA**



Track of TIE@level is displayed in math function F2.

LeCroy digital storage oscilloscopes offer measurement and analysis capabilities designed to help resolve your complicated design problems.

The JTA2 software package for LeCroy oscilloscopes provides advanced jitter and timing analysis capabilities. It uses LeCroy's long memory and Zoom architecture to capture and precisely measure thousands of cycles of timing information and then present the results with three different views. View flexibility helps engineers seek out and identify the source of jitter in an electrical or electro-mechanical system.

Features:

- A rich set of timing measurements for clock, clock-to-data, and data stream analysis
- Expanded parameters with three views of jitter, including JitterTrack™
- Persistence functions
- High-speed clock and data jitter analysis
- High-accuracy, peak-to-peak jitter measurements
- Spot modulation effects, frequency drift and other timing problems
- Flexibility of operation – to do exactly what you need

Statistical View

LeCroy's statistical view of jitter gives insight by providing a view of the distribution of jitter. As with any noise-based phenomena, the peak-to-peak value grows as more values are measured. Therefore, anyone interested in determining worst-case timing and jitter values needs to consider the number of measurements taken in making this determination. More is better. With memory from 1M to 100 Mpts/Ch JTA2 provides the largest data population for statistical measurements.

Spectral View

Because jitter may have various frequency components, it is important that a spectral view of jitter be available. This view often reveals critical insights into the sources of jitter. LeCroy provides a direct view of these frequency components as an FFT of jitter. Unlike FFT's of a clock signal, this provides a spectral view that is purely of the timing measurement variations.

JTA2 – JITTER AND TIMING PACKAGE

LeCroy JitterTrack
The key to understanding and debugging jitter is JitterTrack. Imagine that each clock period is represented by a horizontal arrow. Variations in time (of the period) are not clear at all. Now imagine that each of these arrows is flipped perpendicularly and placed time-synchronized to the individual periods they represent. The amplitude of each arrow represents the time duration of each period. By connecting the tops of those arrows, you now can see how a particular jitter measurement varies over time, perfectly synchronized to the signal being measured.

Time Interval Error (TIE)
LeCroy oscilloscopes in conjunction with JTA2 Jitter and Timing Analysis Package can be used to test both optical and electrical communications signals. One type of analysis function which is common for both types of signals is Time Interval Error (TIE). TIE measures the position of each edge in a waveform and compares it to the position the edge would have if the waveform frequency was perfect. This analysis can reveal modulation effect, phase noise, and other sources of timing variations.

Persistence Functions
JTA2 includes the ability to further process persistence waveform data. For example, by creating a new trace as the mean of a persistence waveform you are able to analyze the data using the parameters on the oscilloscope.

Parameters

period at level	TIE at level	setup
width at level	frequency at level	skew
edge at level	dv/dt	Δ period at level
duty at level	half period	Δ width at level

Math Processing

persistence histogram	persistence trace range
persistence trace mean	persistence trace sigma

Statistical and Graphical Analysis

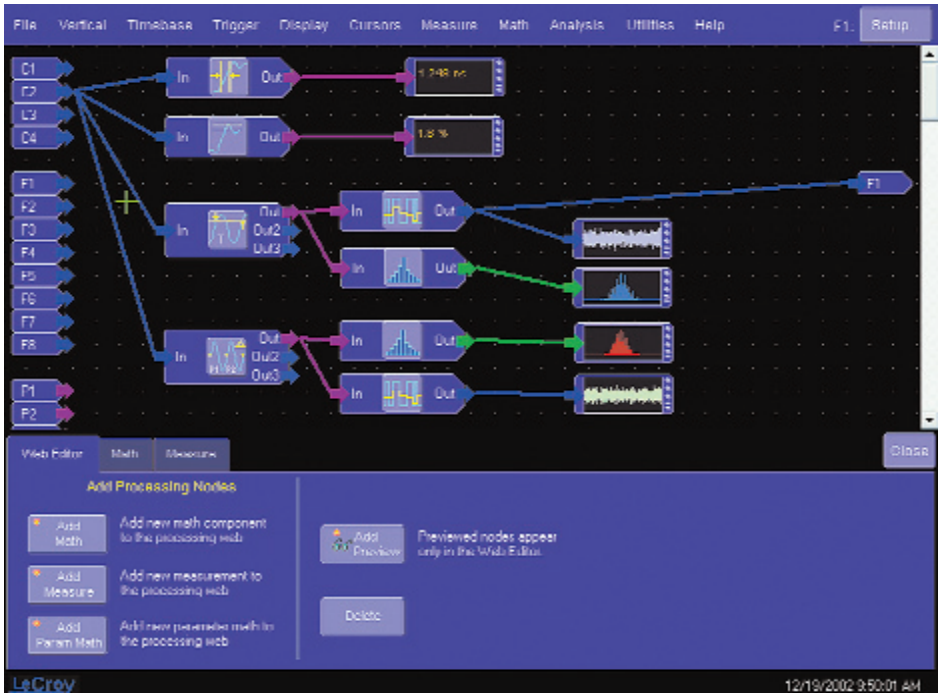
track	histogram base	percentile
trend (20000)	high	peaks
histograms	histogram median	range
histogram parameters	histogram rms	sigma
average	low	total population
full width at half max bin	max population	x at peak
full width at x% max bin	mode	population at x
histogram amplitude		

ORDERING INFORMATION	PRODUCT CODE
Jitter and Timing Analysis Software Package	JTA2

XWEB – WEB PROCESSING EDITOR

This software works with

- **WaveExpert**
- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**
- **DDA**



Drag and drop functions and measurements. Chain an unlimited number of functions together for maximum analysis power.

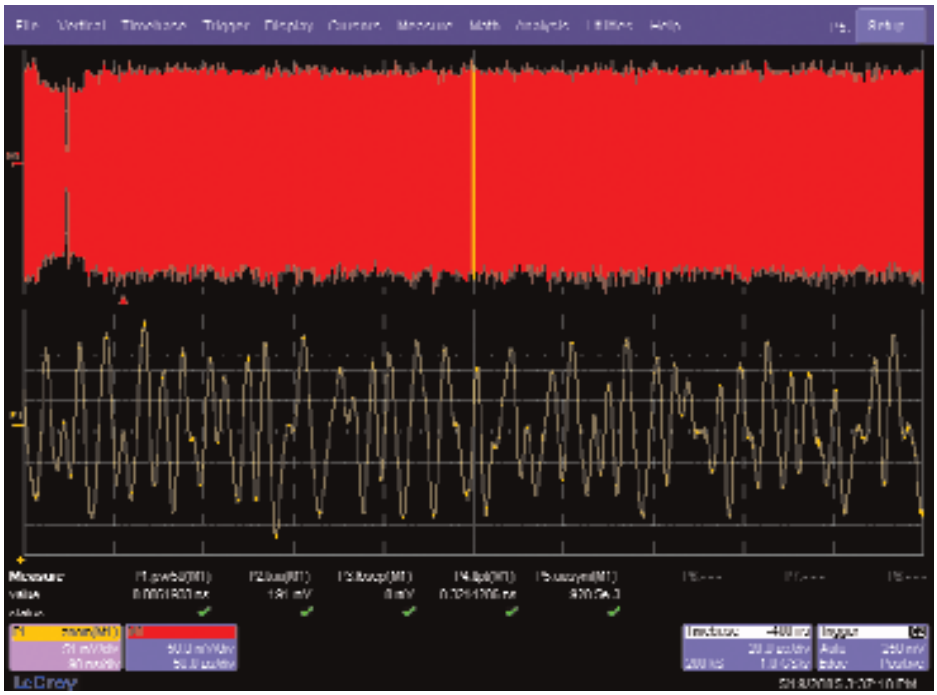
The processing web provides a graphical way to quickly and easily set up math functions and parameter measurements. Practically unlimited math-on-math functions can be chained together, and parameter measurements for any math output waveform anywhere on the web can be inserted.

Features:

- Chain together any combination of Math and Measurements using a graphical editor
- Easily visualize the block diagram of custom processing configurations
- Color-coded interconnect 'wires' show data types (Waveforms, Parameters, Histograms, etc.)
- Add 'Preview Nodes' to the diagram, allowing the value/signal at intermediate nodes to be viewed.

ORDERING INFORMATION	PRODUCT CODE
Processing Web Editor Software Package for Functions and Parameters	XWEB

DDM2 – DISK DRIVE MEASUREMENT



In this example, DDM2 allows the user to perform up to eight simultaneous parametric measurements of critical disk drive properties.

This software works with

- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**

The perfect solution for failure analysis when testing disk drives, DDM2 software adds dozens of measurements to standard oscilloscopes capabilities. This package provides disk drive parameter measurements and related mathematical functions for performing disk drive analysis.

The Disk Drive Measurement and PRML Measurement packages utilize IDEMA® test methods and industry standard PRML measurements to extend the range of capabilities of the LeCroy WaveMaster, WaveRunner and WavePro oscilloscopes.

Features:

- Disk Drive Parameters
  - amplitude symmetry
  - auto correlation s/n
  - local base
  - local baseline separation
  - local maximum
  - local minimum
  - local number
  - local peak-peak
  - local time between events
  - local time between peaks
  - local time between troughs
  - local time at minimum
  - local time at maximum
  - local time peak-trough
  - local time over threshold
  - local time trough-peak
  - local time under threshold
  - narrow band phase
  - narrow band power
  - non-linear transition shift
  - overwrite
  - pulse width 50
  - pulse width 50-
  - pulse width 50+
  - resolution
  - track average amplitude
  - track average amplitude-
  - track average amplitude+
- Correlation function
- Trend (datalog) of up to one million events
- Histograms expanded with 19 histogram parameters and up to 2 billion events

DDM2 – DISK DRIVE MEASUREMENT

TAA	Resolution	lnum	ltot	msnr
TAA+	Overwrite	lpp	ltpt	rsnr
TAA-	lbase	ltbe	lttp	m_to_r
PW50	lbsep	ltbp	ltut	nbph
PW50+	lmax	ltmn	NLTS	nbpw
PW50-	lmin	ltmx	ACSN	

Frequency Domain Parameters Description
These parameters provide a rapid technique to extract the amplitude and phase of single frequencies from complex waveforms. These parameters are more efficient than using an FFT if the frequencies of interest are known.

Histograms
Any waveform parameter may be histogrammed. The histogram function produces a waveform with the vertical axis in units of "Events" and the horizontal axis in parameter units (volts, nanoseconds,...etc.). The histogram shows the statistical variation of the selected parameter. Over thirteen different statistical measurements can be modified on the histogram.

PRML Measurement Package
PRML Parameters
PRML (Partial Response Maximum Likelihood) recording channels provide higher area densities by allowing magnetic transitions to be written at closer spacing than peak detection channels. The following parameters provide a time domain technique to measure the time shift and S/N ratio created by this magnetic writing process.

The DDM2 package also includes the following functions:
- Non Linear Transition Shift
- Auto Correlated Signal to Noise
- Auto Correlation

ORDERING INFORMATION	PRODUCT CODE
Disk Drive Measurement Software Package	DDM2

AORM – ADVANCED OPTICAL RECORDING

A Precise, Accurate Characterization Tool Kit

The AORM software package is now available in the new generation (WaveMaster and WavePro 7200A or better) high performance oscilloscopes. In addition to all the ORM/AORM features supplied in legacy oscilloscopes for over ten years, the AORM option in new generation/X-Stream oscilloscope environment provides a completely updated user interface and improved debug tools written to support ever-increasing read/write data rates and larger media capacity required for the latest CD and DVD implementations. Typical applications include game machine technology and high capacity DVD Read/Write.

The unique combination of deep acquisition memory available in LeCroy oscilloscopes plus the flexibility of AORM in adapting to Optical Recording standards provides the user with ultimate measurement accuracy and 2-dimensional correlation of recording parameters.

This software works with

- **WaveMaster**
- **WavePro**
- **SDA**
- **DDA**

Features:

- Real Time Emulation of CD and DVD Channel Signal Processing
- Histogram, Trend and XY Parametric Views
- Flexible, Powerful suite includes ORM Measurements Package
- Equalizer, Slicer and Clock Extraction functionality

CD and DVD Channel Emulation

In AORM, Channel emulation enables real time signal processing in software. Responding to innovations in Optical Disk Drive technology, LeCroy is pleased to introduce a software package designed to interface with existing CLV (Constant linear Velocity) type systems as well as new CAV (Constant Angular Velocity) type systems used for Hard Disk Drive and High Speed CD-ROM applications. AORM is also compatible with ZCLV (Zoned Constant Linear Velocity) systems used in DVD Drive.

AORM allows the user to simulate several aspects of RF signals, including:

- Equalization with Low Pass Filtering and Signal Boost/pre-emphasis control
- Slicing, which sharpens signal edges and filters out low frequency content
- Software clock recovery with user configurable PLL
- Slicer Threshold, which verifies PLL stability

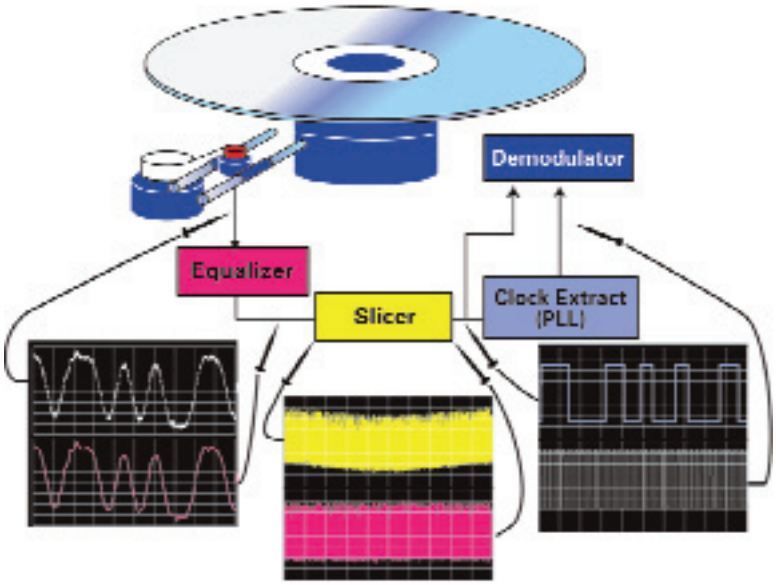


Figure 1 depicts a block diagram of signal processing in Optical Disk Drive. AORM software extracts baseline fluctuation and slices the RF signal to generate a binary signal. Then the software PLL extracts clock content from the incoming binary signal, and decoder decode from binary signal timing refer to the clock. Accordingly a timing of an edge of binary signal and clock has big meaning.

AORM – ADVANCED OPTICAL RECORDING

Histogram, Trend and XY Parametric Views

As hardware designers are quick to recognize, measurement results often need to be summarized and tabulated for quick interpretation. Oscilloscope technology further enhances AORM functionality:

- Long Memory Records
- Multi Zoom
- Smart Trigger (Interval and Width)
- Statistics of Parameter
- Signal processing views (Histogram/Trend/XY Trend)

Characterization of ISI

Since its introduction over a decade ago, ORM has been viewed as the optical disk recording measurement standard. However, characterization of ISI using edge shift parametric measurements versus pit-space pair was a tedious, time-consuming process. AORM software adds five parameters that greatly simplify characterization of ISI: **BES, BESS, EES, EESS, BEES.**

Bes Pulse width between beginning specified edge shift of specific pit-space pair and next positive clock edge

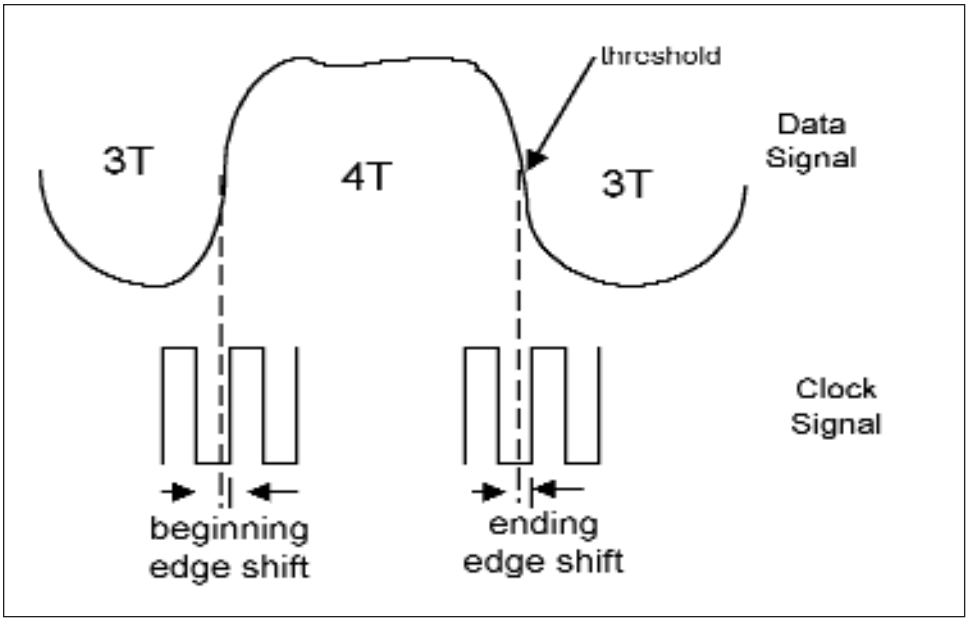
bess Standard deviation of bes

ees Pulse width between trailing edge shift of specific pit/space pair and nearest specified clock edge

eess Standard deviation of ees

bees Beginning and ending edge shift for a specific pit (space) preceded and followed by a specific space (pit)

AORM – ADVANCED OPTICAL RECORDING



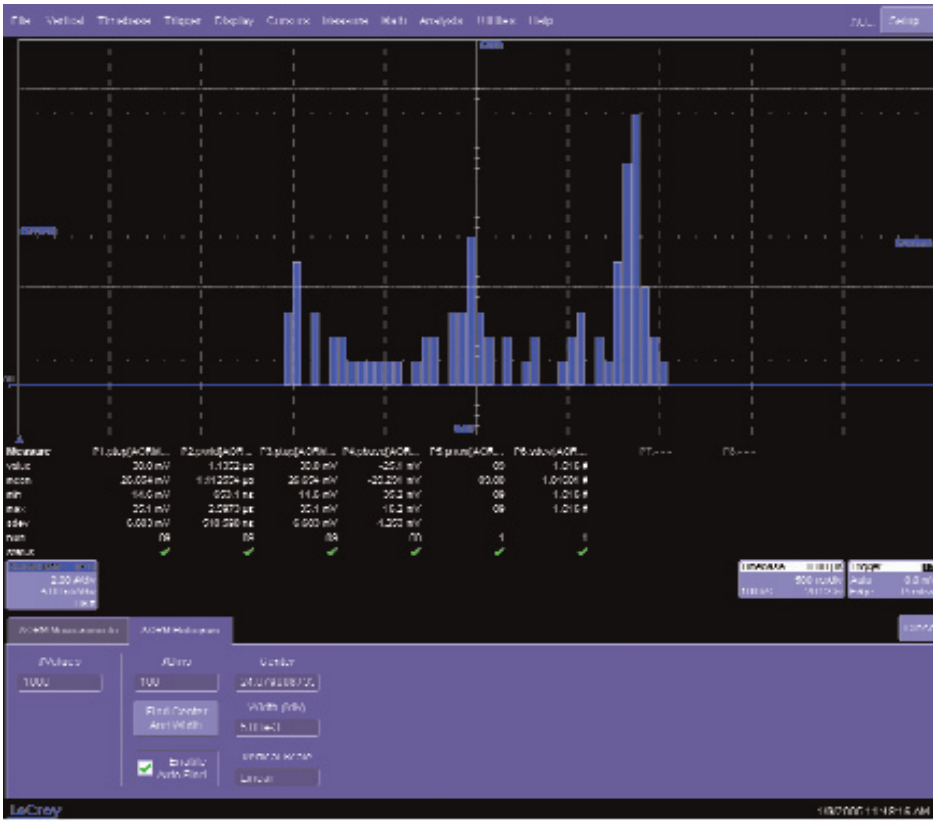
PARAMETER DEFINITION TABLE

Timing Analysis Parameters		Amplitude Analysis Parameters	
deltap2c	Data edge shift referred to clock	**paa**	Average amplitude of RF signal
deltap2cs	Standard deviation of deltap2c	**pasym**	Asymmetry of RF signal
edgsh	Pit or space width difference from ideal value	**pbase**	Base of pit or space
period	Period of each cycle of clock	**pmax**	Maximum of pit or space
pnum	Number of pit or space pair	**pmidl**	Middle voltage of pit or space
pwid	Width of pit or space pairs	**pmin**	Minimum of pit or space
t@pit	Delay of pit or space from trigger	**pmoda**	Modulation of RF signal
timj	Standard deviation of edgsh	**pres**	Resolution of RF signal
		ptop	Top of pit or space

AORM – ADVANCED OPTICAL RECORDING

View Options:

- *Parameter* – the source trace(s) will be displayed along with the custom parameters.
- *List by nT* – the source trace(s) will be displayed along with the list by nT parameter display.
- *Histogram* – The histogram of the selected parameter is shown.
- *Trend* – The trend of the selected parameter is shown.
- *XY Plot* – Plots the trend of the selected measurement vs either the trend t@pit or pwid as appropriate



Histogram Function.

AORM Package Configuration includes all the software and oscilloscope accessories required to run the application on the WaveMaster or WavePro (7200A or better) family. A retrofit kit (RK-AORM) is available for existing ORM customers.

ORDERING INFORMATION	PRODUCT CODE
AORM Advanced Optical Recording Measurements Package for WavePro 7200 or better family of oscilloscopes	AORM
Retrofit Kit for AORM Measurements Package for existing ORM customers	RK-AORM

AORM Minimum Recommended System Package:

WavePro 7200A with Memory Option-L	WavePro 7200A
AORM Advanced Optical Recording Measurements Package	AORM

DFP2 – DIGITAL FILTER PACKAGE

Example of a high-pass filter, used to block power supply hum (60 Hz frequency component) from a higher frequency signal. The cutoff frequency is set to 1 kHz with a narrow transition region of 1% (very steep). F1 displays the unfiltered signal, while F2 shows the filtered result. The FFT analysis of the signal before and after the filtration is displayed by traces F3 and F4. Notice the disappearance of the 60 Hz component which is indicated by the yellow circle.

This software works with

- **WaveExpert**
- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**
- **DDA**

With the Digital Filter Package 2 (DFP2), LeCroy provides a completely integrated, oscilloscope-based solution. The package includes a variety of finite impulse response (FIR) and infinite impulse response (IIR) filters, in addition to User-Defined (Configurable) filter designs. The user has complete control over all aspects of filter implementation.

Features:

- Wide variety of standard FIR and IIR filters
- Design your own custom filter
- Quickly emulate analog filters with an IIR digital filter
- Create multirate, multistage filters with narrow spectral constraints
- Reconstruct corrupted signals by applying matched (mirror) filters to compensate for known distortions
- Can be coupled with other LeCroy analysis packages for increased power and flexibility
- Eliminates need for off-line processing for digital filter implementation

Power is enhanced by using cascaded filters to produce the desired response characteristic. In addition, the custom design feature allows the user to design unique filters tailored to specific needs using common math packages such as MATLAB, Mathcad, and Excel. DFP2 can also be coupled with other LeCroy software products, such as XMAP, JTA2, or DDM2 to provide application specific solutions. For instance, a DFP2 band-pass filter can be coupled with the JTA2 package to measure jitter over a narrow frequency range.

DFP2 – DIGITAL FILTER PACKAGE

Applications
The DFP option has a broad range of applications:

System Identification
- Telephone channel identification
- Modem echo cancellation

Prediction
- CDMA interference
- Adaptive CDMA receiver
- Spectral whitening

Noise Cancellation
- ECG noise control
- Background noise

Low-pass filters eliminate the accumulated high-frequency noise and interference, canceling high-frequency background noise.

Band-stop filters eliminate a narrow band of frequencies.

Band-pass filters emphasize a selected frequency band.

High-pass filters are useful for eliminating DC and low-frequency components.

- Applications include disk drive and optical recording (emulation of the slicing function).

Raised cosine, raised root cosine, and Gaussian filters are low-pass filters with unique shapes.

- Raised cosine is one of a class of filters used to minimize intersymbol interference. The time domain impulse response crosses zero at all multiples greater than one over the bit period. Harmonics of the modulation frequencies are therefore canceled.
- Applying raised root cosine twice (or, for example, at the sending and receiving end of a signal) produces the same result as a raised cosine filter.

Custom design filters let the user design filter responses with virtually any desired characteristics. The required custom filter can be designed with a digital filter design or math package such as MATLAB or Mathcad. Filter coefficients can be downloaded into the oscilloscope with the DSOFilter utility. This utility can be downloaded from LeCroy's Web site at www.lecroy.com.

Low Pass Filtering Example
If the acquired signal has a shaped baseline, as shown in Figure 1, it is possible to use a low-pass filter to separate the baseline and then subtract it from the acquired waveform. In this example a low-pass filter (Trace F1) is used to extract the baseline which is then subtracted from the acquired signal in trace F2.

Improving Signal to Noise Ratio
The acquired waveform in Figure 2 (C2) is a 12.5 MHz damped sine badly contaminated with noise. The judicious use of band-pass filtering improves the signal-to-noise ratio significantly. Note that the fast Fourier transform (FFT) displays are used to assess the effects of the filtering operation. Trace F2 shows the spectrum of the acquired signal and trace F4 shows the spectrum of the filtered signal. The band-pass filter is used to reduce the acquired signal's bandwidth to 16 MHz, thereby eliminating large noise components outside the filters pass band. The recovered signal is shown in trace F3. While averaging could produce even better results it would require multiple acquisitions which are not always available.

DFP2 – DIGITAL FILTER PACKAGE

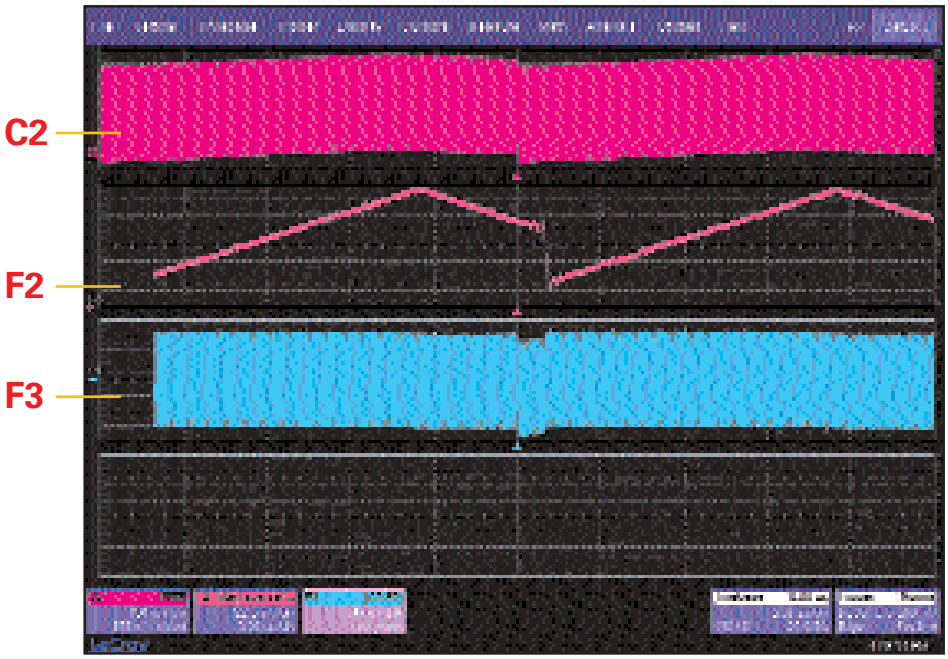


Figure 1

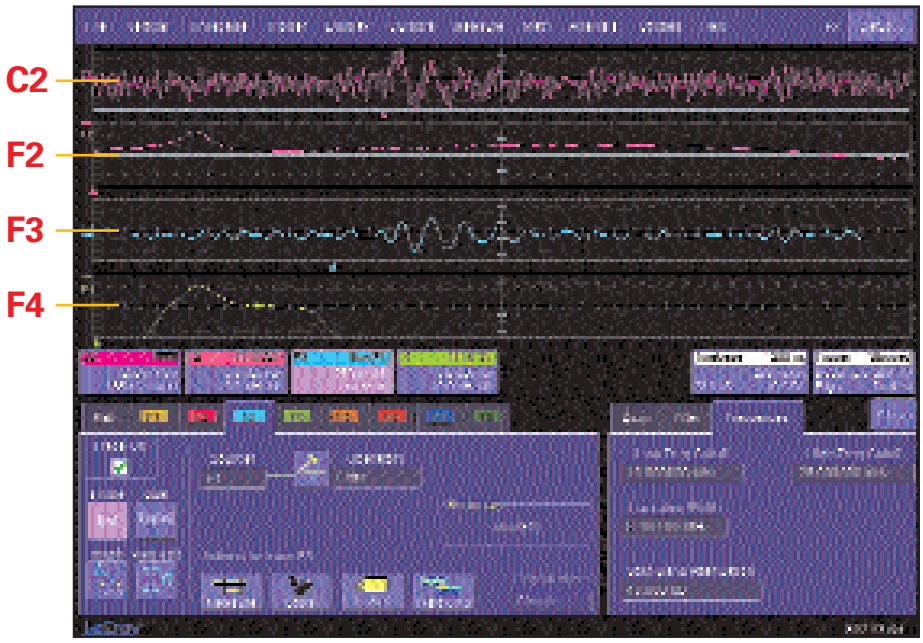


Figure 2

DFP2 – DIGITAL FILTER PACKAGE

Hardware Filter Simulation

The final example, shown in Figure 3, is the evaluation of a band limiting filter for a digital communications signal. In this measurement the effects of filter selection for a North American Digital Cellular (NADC) waveform are evaluated. Comparing a normally filtered signal (raised root cosine) against an unfiltered waveform with DFP filtering shows a near exact match. The user can vary the type of filter or adjust parameters to see the effect of other types of filter configurations. Channel 2 contains the NADC signal without filtering. Channel 3 is the same signal with the normal raised root cosine filter. The DFP raised root cosine filter is applied using trace F2. The overlapped traces F3 and F4 are used to compare the two versions of the signal.

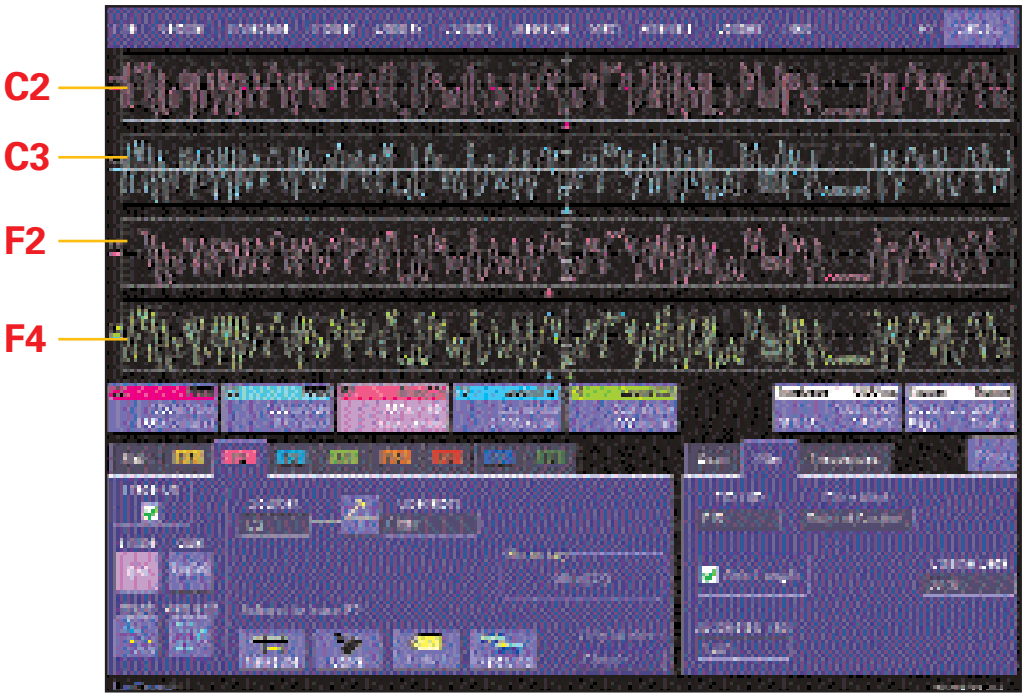


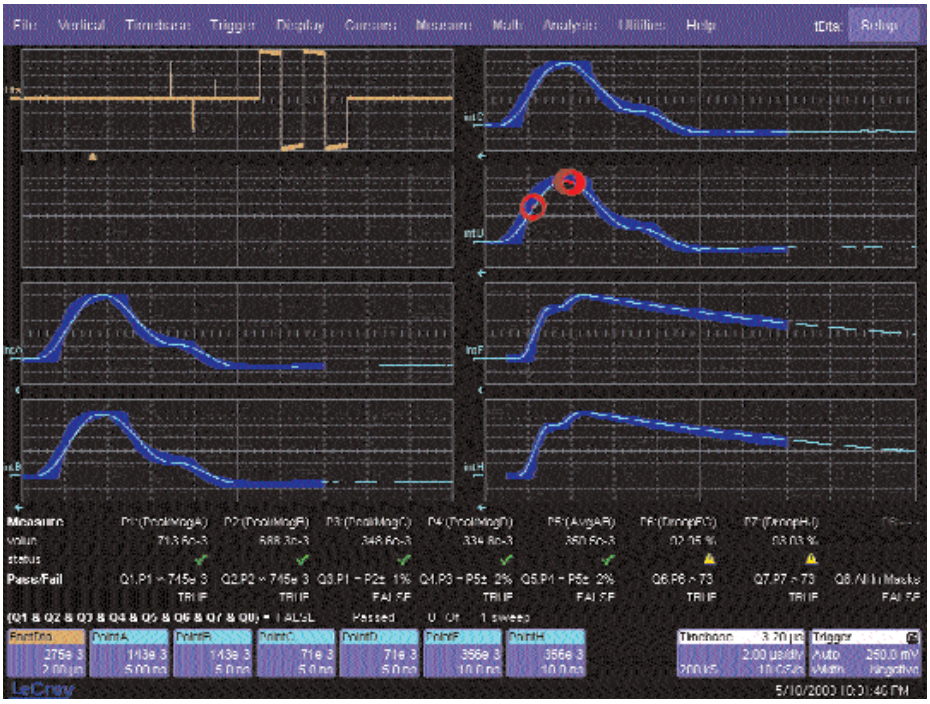
Figure 3

SPECIFICATIONS

FIR	
FIR Coefficients	2000 maximum
FIR Filter Types	High pass, low pass, band pass, band stop, raised cosine, raised-root cosine, Gaussian custom
IIR	
IIR Filter Types	Low pass, band pass, high pass, band stop, custom
IIR Rolloff Selections	Butterworth, Chebyshev, Inverse Chebyshev, Bessel

ORDERING INFORMATION	PRODUCT CODE
Digital Filter Software Package	DFP2

ENET – ETHERNET TEST PACKAGE



Example shows 100Base-T Mode 1 Mask Test.

This software works with

- **WaveMaster**
- **WaveRunner (≥ 1 GHz)**
- **WavePro**
- **SDA**
- **DDA**

ENET is a software option package that performs complete electrical testing for 1000Base-T and 100Base-TX Ethernet standards.

Jitter and pulse mask tests are performed with automatic waveform alignment, and all test results feature pass/fail indicators corresponding to the standard being tested. 10Base-T pulse mask testing is also supported, using the supplied compliance mask.

Features:

- Compliant with IEEE 802.3-2000 and ANSI X3.263 standards
- Eliminates the need for external math programs
- Speeds up testing by performing multiple tests on one acquisition
- Easy-to-use tests and calculations are performed inside the oscilloscope
- Complete tests for 1000Base-T and 100Base-TX, 10Base-T
- Mask testing

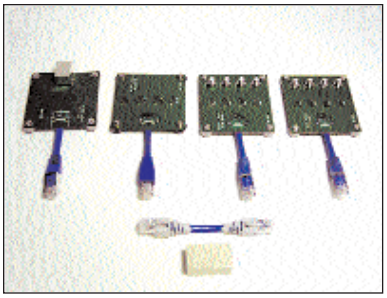
Document your test and compliance results with LeCroy's LabNotebook report generator.

Two test fixture kits provides for all the test loads and conditions as described in IEEE specification.

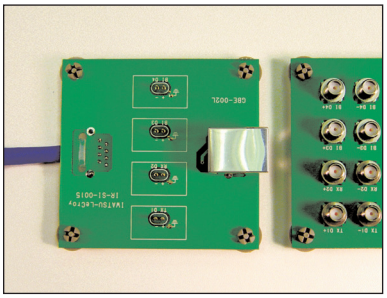
TF-10BT

The TF-10BT fixture set consists of four fixtures designed to support the test requirements for 10Base-T ethernet. The fixture set includes a twisted pair model along with three test loads. The test loads include 2 reactive loads (designated load 1 and load 2 in the IEEE802.3 specification) and a 100 ohm resistive load. The loads provide connection pins for a differential probe and are compatible with the AP034 and AP033 probes from LeCroy.

ENET – ETHERNET TEST PACKAGE



TF-10BT Fixture Set



TF-ENET Fixture Set

TF-ENET

TF-ENET includes a set of 2 test fixtures for testing ethernet signals on twisted pair cables (UTP) for 100Base-T and 1000Base-T.

The set includes a feed-through adapter for measuring live traffic signals and a terminated fixture for off-line testing. The terminated fixture includes removable 50 ohm terminations to allow direct connection to an oscilloscope or the application of a disturbing signal. Both fixtures include pins on each wire pair for attaching a differential probe.

SPECIFICATIONS

1000BASE-T TESTS

Mode 1:	pulse masks, droop
Mode 2:	master jitter
Made 3:	slave jitter
Mode 4:	distortion

100BASE-T TESTS

Duty cycle distortion
Jitter
Differential output voltage
Rise and fall time

10BASE-T TESTS

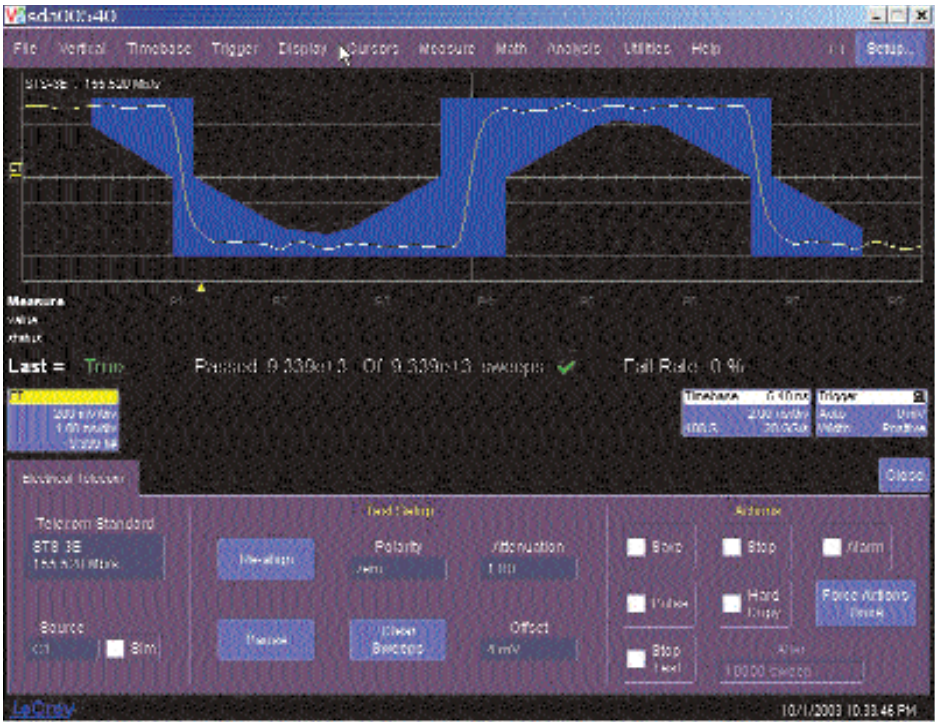
Mask testing

ORDERING INFORMATION	PRODUCT CODE
Ethernet Test Software Package	ENET

RECOMMENDED ACCESSORIES

1 GHz Active Differential Probe (÷1, ÷10, ÷20)	AP034
2.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP2500
Ethernet Compliance Test Fixture for 10Base-T	TF-10BT
Ethernet Fixture for 100Base-T/1000Base-T [Includes a Set of 2 Test Fixtures Signals on Twisted Pair Cables (UTP)]	TF-ENET

ET-PMT – PULSE MASK TEST PACKAGE



An ATM (155.2 Mb/s) pulse is measured using the STS-3E mask.

This software works with

- **WaveExpert**
- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **WaveSurfer**
- **SDA**
- **DDA**

The ET-PMT electrical pulse mask testing software for LeCroy oscilloscope performs automated compliance mask tests on a wide range of electrical telecom standards.

Features:

- Automatic PASS/FAIL testing
- Supports ANSI T1 and ITU standard pulse mask tests
- User-definable mask for custom signals
- Automatic mask alignment
- Multiple actions on failure

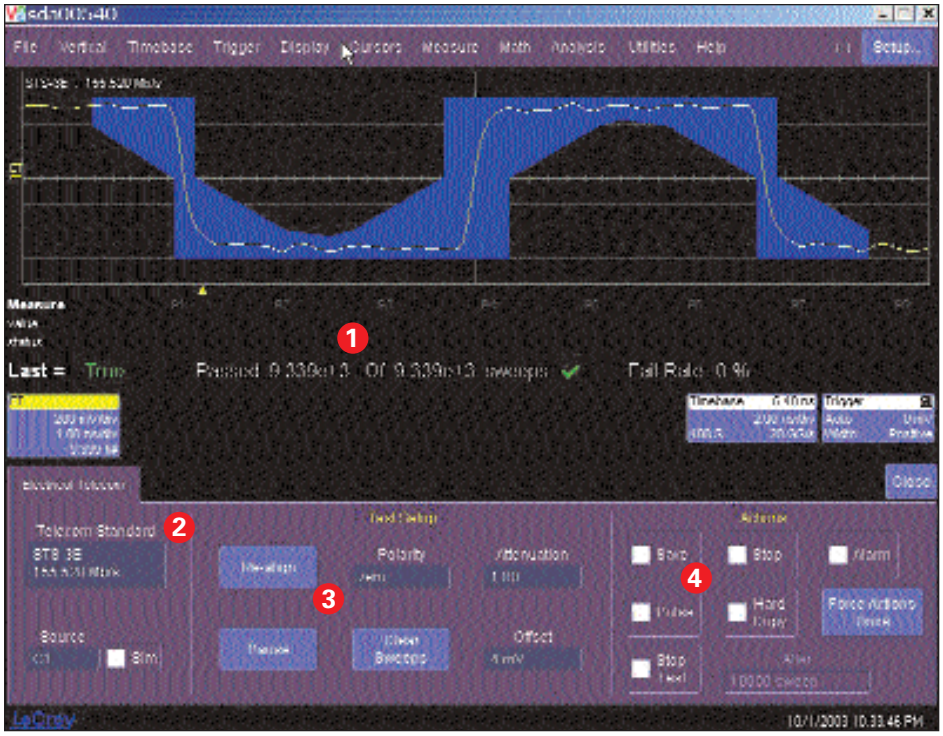
Fast, Accurate Conformance Testing

Signals are tested against standard masks and the software keeps track of the number of failures (signal excursions outside the compliance mask) as well as the percentage of failures relative to the number of sweeps. Unattended or long-term testing is supported through the use of automated actions on failure. These include storage of the failed waveform, outputting a pulse, printing a screen image, stopping the test, or generating an audible alarm. Any combination of these actions can be set to occur on a failure. The test can be programmed to terminate after a defined number of sweeps or to run indefinitely.

Future-proof Design

As telecom standards evolve, new pulse types and data rates are defined. In addition, many new applications for pulse mask tests are being developed for proprietary interfaces. The LeCroy ET-PMT software mask, alignment and pulse location functions are completely defined by a single Microsoft™ Access 2000™ data base. New mask test criteria can be added by simply editing this file to include the data rate, mask and any pulse finding criteria.

ET-PMT – PULSE MASK TEST PACKAGE



1. Failure rate and percentage
2. Support for ITU and ANSI telecom pulse masks
3. Automatic mask alignment, gain and offset
4. Multiple simultaneous failure actions

SPECIFICATIONS

Telecom Standards	E1 TP, E1 Coax, E2,E3, E4, STM1-E,DS-1, DS-3, STS-1,STS-3E
Actions on Failure	Save, stop, print, alarm, output pulse
Sweep Count for Testing	1 to 10e9

ORDERING INFORMATION	PRODUCT CODE
Electrical Telecom Test Software Package	ET-PMT
Upgrade Existing Oscilloscope to Include Pulse Mask Test	RK-ET-PMT
Telecom Adapter Kit 100 Ω Bal., 120 Ω Bal., 75 Ω Unbal.	TF-ET

PMA2 – POWERMEASURE PACKAGE

This software works with

- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**
- **DDA**

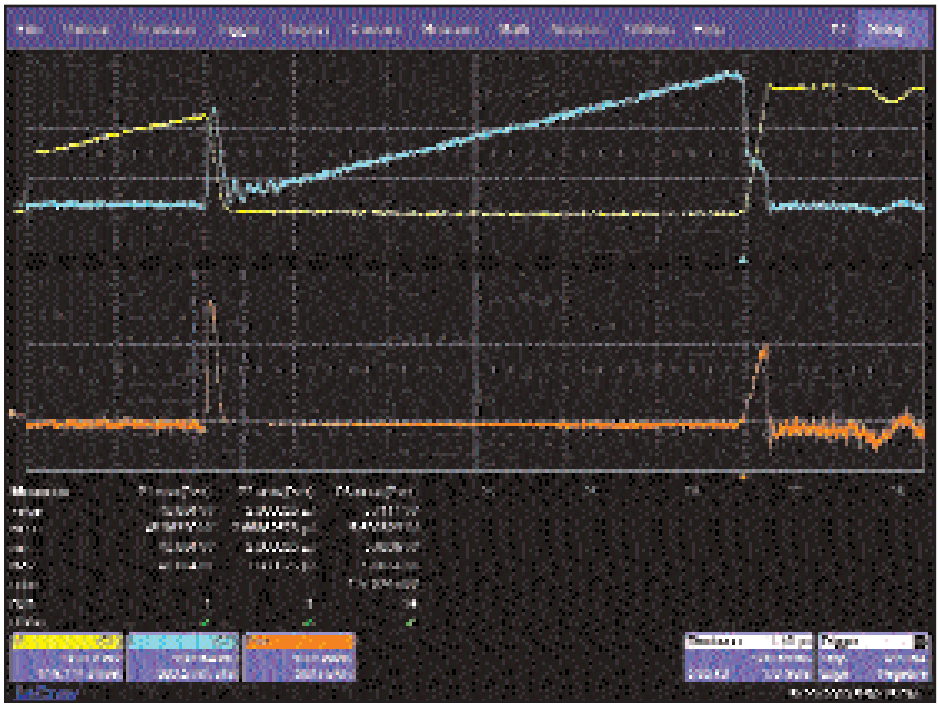
LeCroy's PMA2 PowerMeasure Analysis software provides exceptional ability to measure and analyze the operating characteristics of power conversion devices and circuits.

Features:

- Automatic setup and display of relevant waveforms and parameters
- Waveforms scaled and displayed in Volts, Amps, Watts, Ohms, etc.
- Power device performance analyzed in-circuit
- Measure and view the time domain response of the entire control loop
- Line harmonics testing to EN 61000-3-2
- Complete solutions available, including probes and differential amplifiers.
- Usable with a wide range of probes, amplifiers, shunts, and current shunt resistors.
- Gated measurement capability

PMA2 is used with LeCroy X-Stream oscilloscopes to make critical power switching device measurements, perform control loop modulation analysis, and measure line power harmonics. Specially designed LeCroy accessories, such as differential amplifiers, differential probes, current probes, and deskew fixtures, provide unparalleled measurement quality. PMA2 provides quick and easy setup of your voltage and current input. In many cases, no manual deskew is required, ensuring the highest accuracy of your measurements. Once set up, access to important analysis and measurements is only a button push away. All aspects of Device Analysis, such as various power losses, saturation voltage, high side gate drive, dynamic-on resistance, safe operating area, and others are easily performed. Modulation analysis allows you to intuitively understand control loop response, such as soft start performance or step response to line and load changes. Line Power Analysis allows simple and quick pre-compliance testing to EN 61000-3-2.

PMA2 – POWERMEASURE PACKAGE



PMA2 provides the capability to apply a gate (window) for a particular parameter around a portion of the waveform.

Power Device Analysis
Analyze power device performance while the device is operating in circuit, without requiring specially designed test fixtures or clipping circuits. Only LeCroy can provide the full range of measurement capability, including capture windows in the 100s of milliseconds at high sample rates for finding unusual violations during safe operating area measurements.

Modulation Analysis
Modulation Analysis functions produce a time domain display, which represents the modulated parameter in a time-vs-parameter value graphical plot. They are convenient tools for intuitively viewing the time domain response of the entire control loop, including any time constants added by the pulse width modulator. Modulation Analysis can be performed for duty cycle, period, frequency, and pulse width.

Line Harmonic Analysis
Line Power Analysis easily measures a power conversion device's incoming RMS line voltage, RMS current consumption (in watts and VA), Power Factor, Apparent Power, and Real Power. Line current harmonic measurements are made and compared to standard templates for EN 61000-3-2 Class A, B, C, or D equipment. Results can be displayed in either graphical frequency domain or tabular formats.

PMA2 – POWERMEASURE PACKAGE

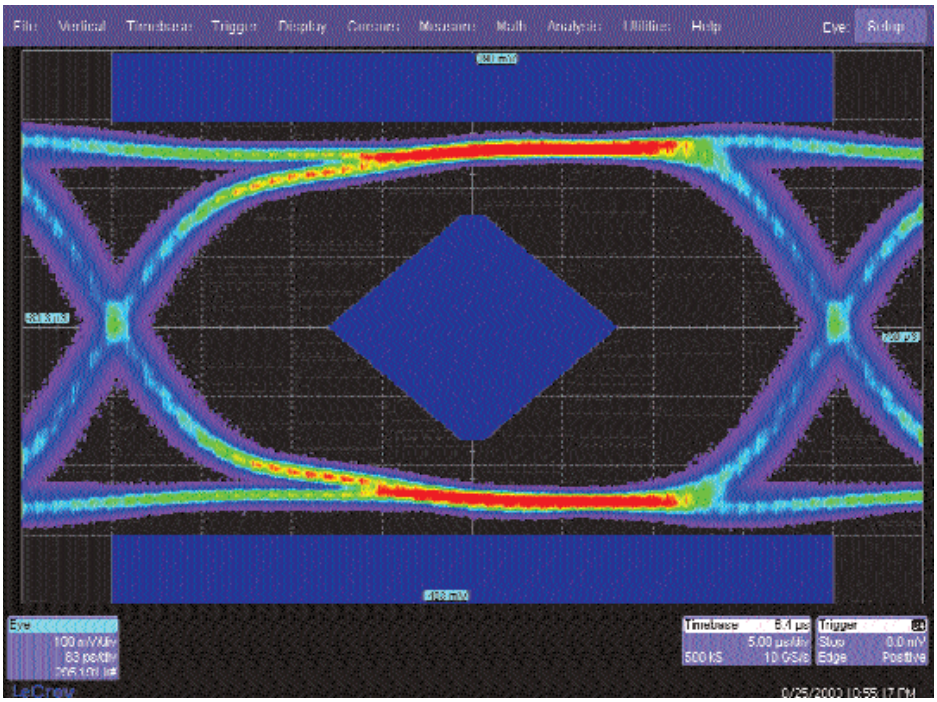
ORDERING INFORMATION	PRODUCT CODE
PowerMeasure Analysis Software Package	PMA2
DIFFERENTIAL AMPLIFIERS AND ACCESSORIES	
1 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A
2 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A-PR2
÷100 or ÷10 Selectable, 250 MHz Passive Differential Probe Pair	DXC100A*
÷1, 50 MHz Passive Differential Probe Pair	DXC200*
÷100, 250 MHz 2.5kv, High Voltage Probe Pair (requires DA101 for full performance)	DXC-5100*
÷10, 1 MΩ External Passive Attenuator (recommended with DXC5100)	DA101*
DA1855A with Rackmount (must be ordered at time of purchase, no retrofit)	DA1855A-PR2-RM
CURRENT PROBES	
15 A; 50 MHz Current Probe – AC/DC; 15 A rms; 50 A Peak Pulse	CP015
150 A; 10 MHz Current Probe – AC/DC; 150 A rms; 500 A Peak Pulse	CP150
500 A; 2 MHz Current Probe – AC/DC 500 A rms; 700 A Peak Pulse	CP500
30 A; 50 MHz Current Probe – AC/DC; 30 A rms; 50 A Peak Pulse	AP015
ACCESSORIES	
Deskew Calibration Source	DCS015
OTHER POWER ACCESSORIES	
HIGH-VOLTAGE DIFFERENTIAL PROBES	
1,400 V, 100 MHz Differential Probe	ADP305
1,400 V, 20 MHz Differential Probe	ADP300
15 MHz Differential Probe (÷10, ÷100)	AP031
HIGH-VOLTAGE PASSIVE PROBES	
÷1000; 100 MHz; 50 MΩ High-Voltage Probe 20 kV (40 kV Peak) max. Voltage DC and Peak AC	PPE20KV
÷100; 400 MHz; 50 MΩ High-Voltage Probe 2 kV max. Voltage DC and Peak AC	PPE2KV
÷100; 400 MHz; 50 MΩ High-Voltage Probe 4 kV max. Voltage DC and Peak AC	PPE4KV
÷100; 400 MHz; 50 MΩ High-Voltage Probe 5 kV max. Voltage DC and Peak AC	PPE5KV
÷1000; 400 MHz; 50 MΩ High-Voltage Probe 6 kV max. Voltage DC and Peak AC	PPE6KV
÷10/÷100; 200/300 MHz; 5 MΩ/50 MΩ High-Voltage Probe 600 V/1.2 kV max. Voltage DC and Peak AC	PPE1.2KV

* Must be used with DA Series Differential Amplifiers.

SDM – SERIAL DATA MASK PACKAGE

This software works with

- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**
- **DDA**



Eye pattern of serial ATA signal.

The SDM serial data mask package for LeCroy oscilloscopes adds eye pattern mask testing capability to oscilloscopes that are occasionally used to measure serial data streams.

The SDM package measures eye patterns by acquiring a long record of waveform data from the data stream under test. Once in the oscilloscope's memory, a software algorithm computes a reference clock from the signal data which tracks the long-term variations in the data rate in the same way as a "GOLDEN" PLL does in hardware. The loop bandwidth of this software golden PLL is adjustable as a ratio of the measured bit rate. This ratio is variable from 1/20 to 1/10,000. Mask violations are counted and indicated by red circles in the display. The mask margins are adjustable both vertically and horizontally.

The software capabilities included in the SDM package are standard features in LeCroy's SDA (Serial Data Analyzer) Series.

Features

- Software clock recovery eliminates trigger jitter
- Measure data rates up to 3.5 Gb/s
- Automatic mask alignment
- Adjustable mask margins
- Creation of user-defined masks

Support for Multiple Standards

The user selects compliance masks from a comprehensive list of standards and the eye pattern is tested against this mask. User-defined masks are also possible by simply editing the included data base file. The eye pattern is automatically aligned with the compliance mask.

All of the data for the eye pattern are collected in a single acquisition thus completely eliminating any trigger jitter from the measurement.

SDM – SERIAL DATA MASK PACKAGE

Pulse Mask Testing
Telecom signals such as DS1, DS3 and E1, require mask template testing for compliance. Ths SDA software package includes this type of testing as standard. Pulse masks are available for T1 and ITU communications signals up to 155 Mb/s. User defined masks are also possible by editing the mask data base file.

Pulse mask tests include automatic pass/fail detection and a readout of total failures as well as the ratio of failed sweeps. The sweep count is variable from 1 to 10e9. Multiple actions on failure are selectable including print, store, and trigger external equipment.

SPECIFICATIONS

SOFTWARE CLOCK RECOVERY

PLL bandwidth: .05 to 10-5 of the Data Rate

Jitter: 1ps rms typical (based on the WaveMaster sampling clock stability)

Data rates: Less than 3.5 Gb/s

STANDARD MASKS

SONET/SDH
OC1/STM0 • OC3/STM1 • OC12/STM4 • OC48/STM16

Ethernet IEEE Std. 802.3 and ANSI X3.263-1995
1000Base-SX Short Wave Optical
1000Base-LX Long Wave Optical

Fibre Channel Electrical
FC133E, FC266E, FC531E, FC1063E
Fibre Channel Optical
FC1063

IEEE 1394b (draft)
S400 Optical • S400b T1 • S400b T2 • S800 Optical • S800b T1 • S800b T2
S1600 Optical • S1600b T1

Serial ATA (draft)
G1, G1 Rx, G1 Tx
G2, G2 Rx, G2 Tx
DVI (rev. 1.0)
Transmit Normalized,
Receiver Low/High

Infiniband (draft)
2.5 Gb/s Optical
2.5 Gb/s Electrical

PULSE MASKS

ANSI T1
DS-1, DS-3, STS-1, STS-3E

ITU-T
E1, E2, E3, E4, STM1-E

ORDERING INFORMATION	PRODUCT CODE
Serial Data Mask Software Package	SDM

RECOMMENDED ACCESSORIES

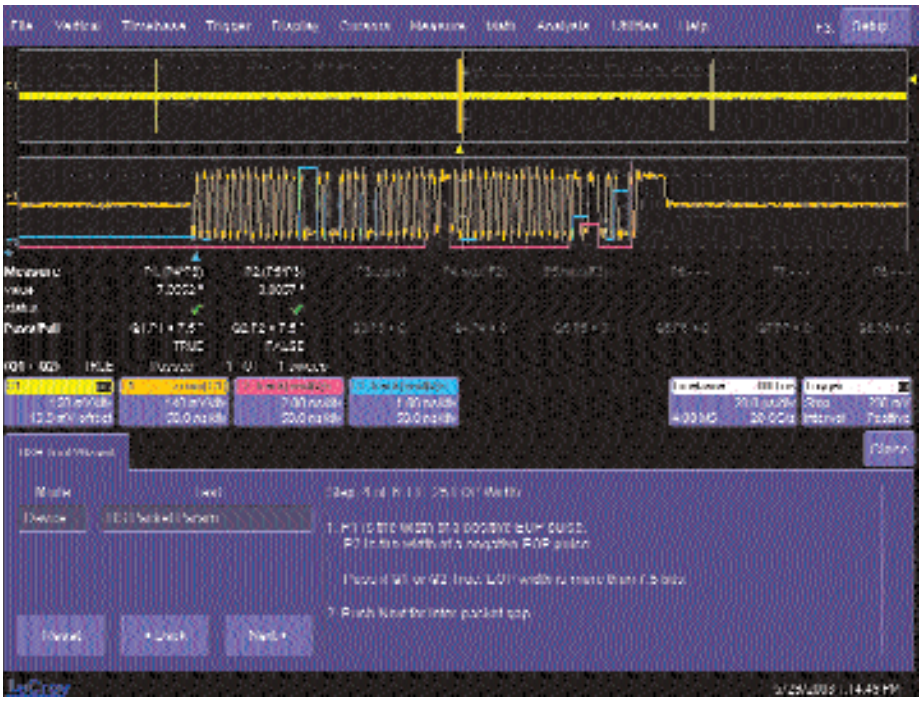
Short Wavelength O/E Converter (500–870 nm) (ProBus)	OE425
Long Wavelength O/E Converter (950–1630 nm) (ProBus)	OE455
Short Wavelength O/E Converter (500–870 nm) (ProLink)	OE525
Long Wavelength O/E Converter (950–1630 nm) (ProLink)	OE555

USB2 – COMPLIANCE TEST PACKAGE

This software works with

- **WaveMaster**
- **WaveRunner***
- **WavePro**
- **SDA**
- **DDA**

* WaveRunner 6200A model only



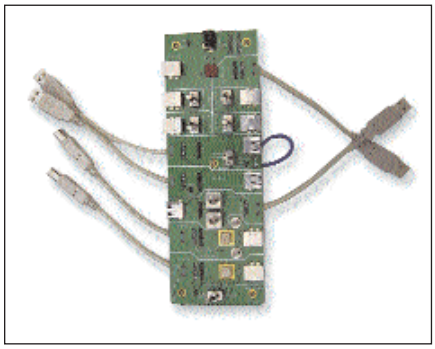
USB 2.0 Packet Parameters Test.

The USB package provides a complete acquisition and analysis system for USB 2.0 devices, hosts, and hubs, as specified in the USB-IF USB 2.0 Electrical Test Specification, version 1.0. The test software implements a full set of electrical tests for USB 2.0, including full-and-low speed tests. Ease of use is enhanced through step-by-step instructions embedded in the menu system of the application. The user is prompted when to change the test conditions and as how to interpret the test results. Each measurement is indicated by its designation within the specification, and the allowed values for each parameter are shown, as well as a pass/fail indication.

Features:

- Complete implementation of USB-IF test procedures
- Support for host, device, and hub testing
- Easy to use step-by-step procedure embedded in user interface
- Low and full-speed testing

Document your test and compliance results with LeCroy's LabNotebook report generator.



TF-USB Fixture Kit

LeCroy's TF-USB fixture kit provide sections for signal quality, inrush, droop, sensitivity, and disconnect. Supports full, low, and high-speed tests.

USB2 – COMPLIANCE TEST PACKAGE

SPECIFICATIONS

HS signal quality
HS packet parameters
HS J/K chirp timing
Suspend/resume/reset timing
Inrush current
Disconnect
Droop
LS and FS signal quality
Hub repeater tests

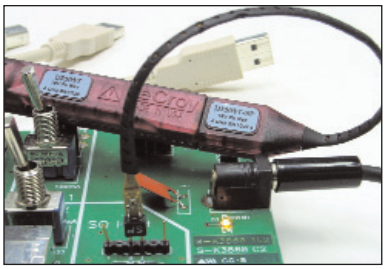
ORDERING INFORMATION

	PRODUCT CODE
USB 2.0 Compliance Test Software Package	USB2

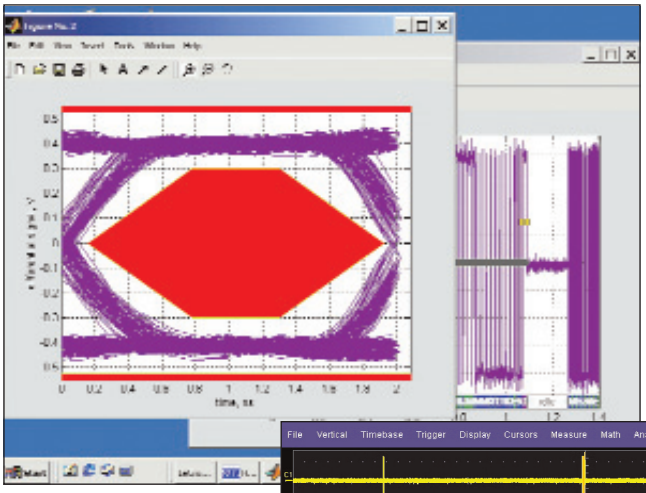
RECOMMENDED ACCESSORIES

2.5 GHz, 0.7 pF Active Probe (÷10), Small Form Factor	HFP2500
WaveLink 4 GHz Differential Probe with Adjustable Tip Module	D300A-AT*
WaveLink 4 GHz, 5 V Differential Probe with Small Tip Module	D350ST*
WaveLink ProBus Probe Body	WL300
1 MΩ Adapter includes PP005A Passive Probe	AP-1M
15 A; 50 MHz Current Probe – AC/DC; 15 A rms; 50 A Peak Pulse	CP015
USB 2.0 Testing Compliance Test Fixture	TF-USB

* For a complete probe, order a WL300 Probe Body with the Probe Tip Module.



D350ST probe in TF-USB fixture.



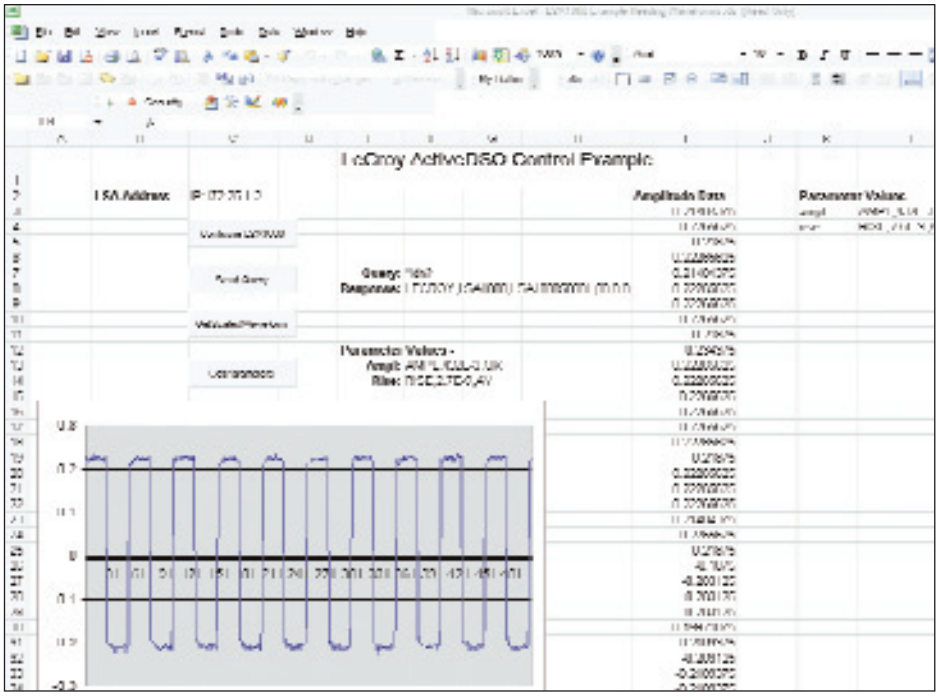
Signal quality tests are performed using the USB-IF MATLAB test scripts. Results are automatically stored in HTML format on the instrument.

The user interface features step-by-step instructions for all tests, along with pass/fail indications.

ACTIVEDSO

This software works with

- **WaveExpert**
- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**
- **DDA**



ActiveDSO may be used to read waveform data from the oscilloscope, and graph it directly within an Excel Spreadsheet.

ActiveDSO is a ActiveX™ control, available at no charge to LeCroy customers, that enables LeCroy oscilloscopes and LSA-1000 series embedded signal analyzers to be controlled by and exchange data with a variety of Windows applications that support the ActiveX standard. MS Office programs, Internet Explorer, Visual Basic, Visual C++, Visual Java, and Matlab (v5.3) are a few of the many applications that support ActiveX controls.

Features:

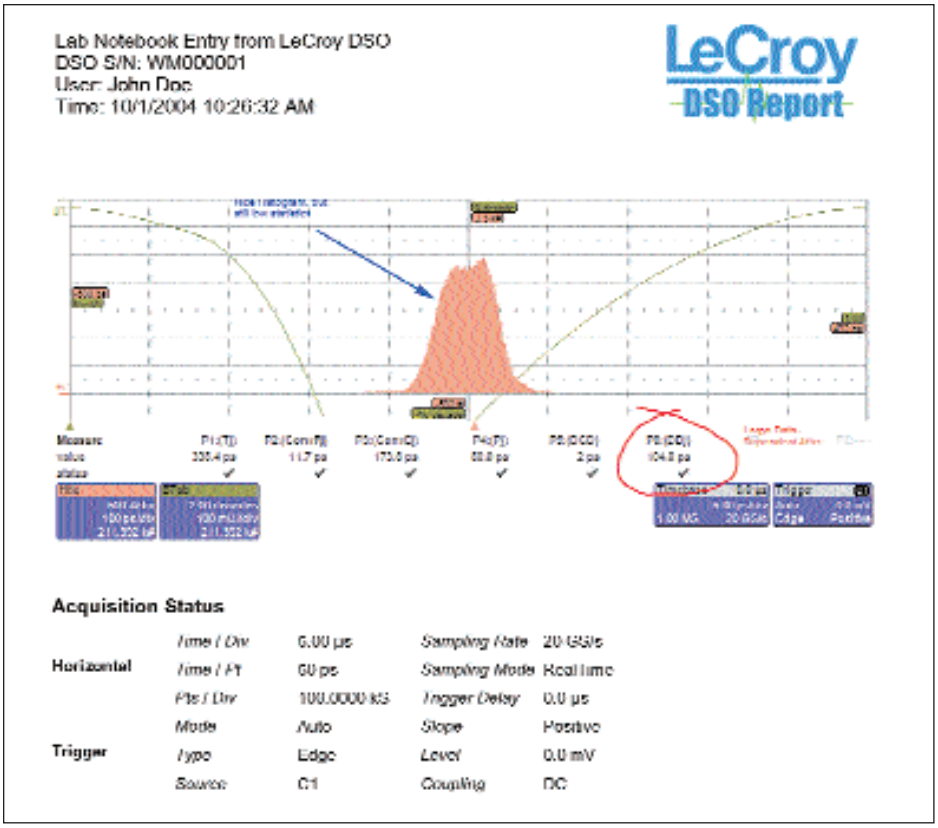
- Generate a report by importing oscilloscope data right into Excel or Word
- Analyze waveforms by bringing them directly into MathCad
- Archive measurement results on the fly in a Microsoft Access Database
- Automate tests using Visual Basic, Java, C++, Excel (VBA)

The ActiveDSO control can be used programmatically and as an embedded control. Software designers can create instances of the ActiveDSO control within their programs, and use the control's Methods and Properties for instrument communications, setup, and data transfer. With ActiveDSO, all details of the interface bus used to connect to the LeCroy instrument are encapsulated within the ActiveDSO control. The intricacies of programming for each of these interfaces is hidden from the user, allowing the software developer to focus on his or her application and to avoid the complexities of the lower-level interface calls.

The ActiveDSO control can also be embedded visually in any OLE automation compatible client. When included in a Microsoft Word document or PowerPoint presentation, it enables users to easily transfer the bitmap image of the instrument display into the document. Whether using the control programmatically or as an embedded object, ActiveDSO helps to integrate oscilloscope data into the application:

ActiveDSO can be easily downloaded from the LeCroy website at www.lecroy.com/tm/library/software/ActiveDSO/

LABNOTEBOOK™



Freehand notes can be written on the screen with a stylus right on the waveform and then saved in the report file. Simple and very efficient.

This software works with

- **WaveExpert**
- **WaveMaster**
- **WaveRunner**
- **WavePro**
- **SDA**
- **DDA**

LabNotebook enables users to efficiently create complete and detailed waveform reports in a LeCroy oscilloscope.

An all-in-one solution for annoting and sharing information, LabNotebook eliminates the multi-step processes that often involve several pieces of equipment, allowing users to stay focused on the content, not the process.

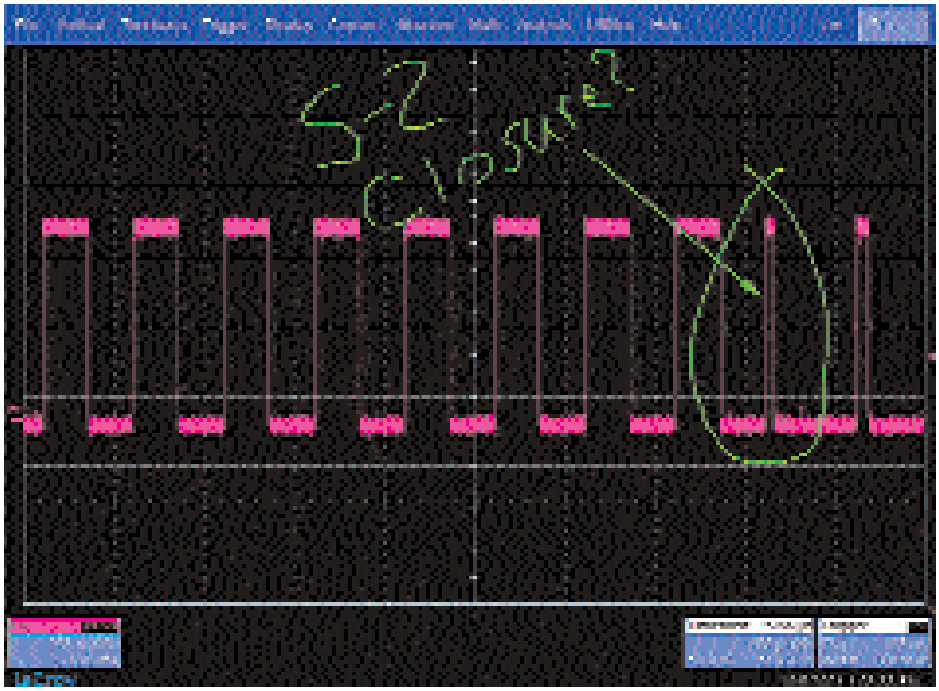
Features:

- Save all displayed waveforms
- Save the relevant oscilloscope setups with the saved waveform
- Add freehand notes with a stylus or as text
- Convert the complete report to pdf, rtf, or html
- Print or email reports

Additional Features:

- A default report layout
- Configuration of a customized report layout
- The ability to place a company logo or department name in the report
- Storing notebook entries for recall at any time
- Storing panel setups and parameter measurements
- Database backup to external media
- Storing reports and data separately for shared oscilloscopes

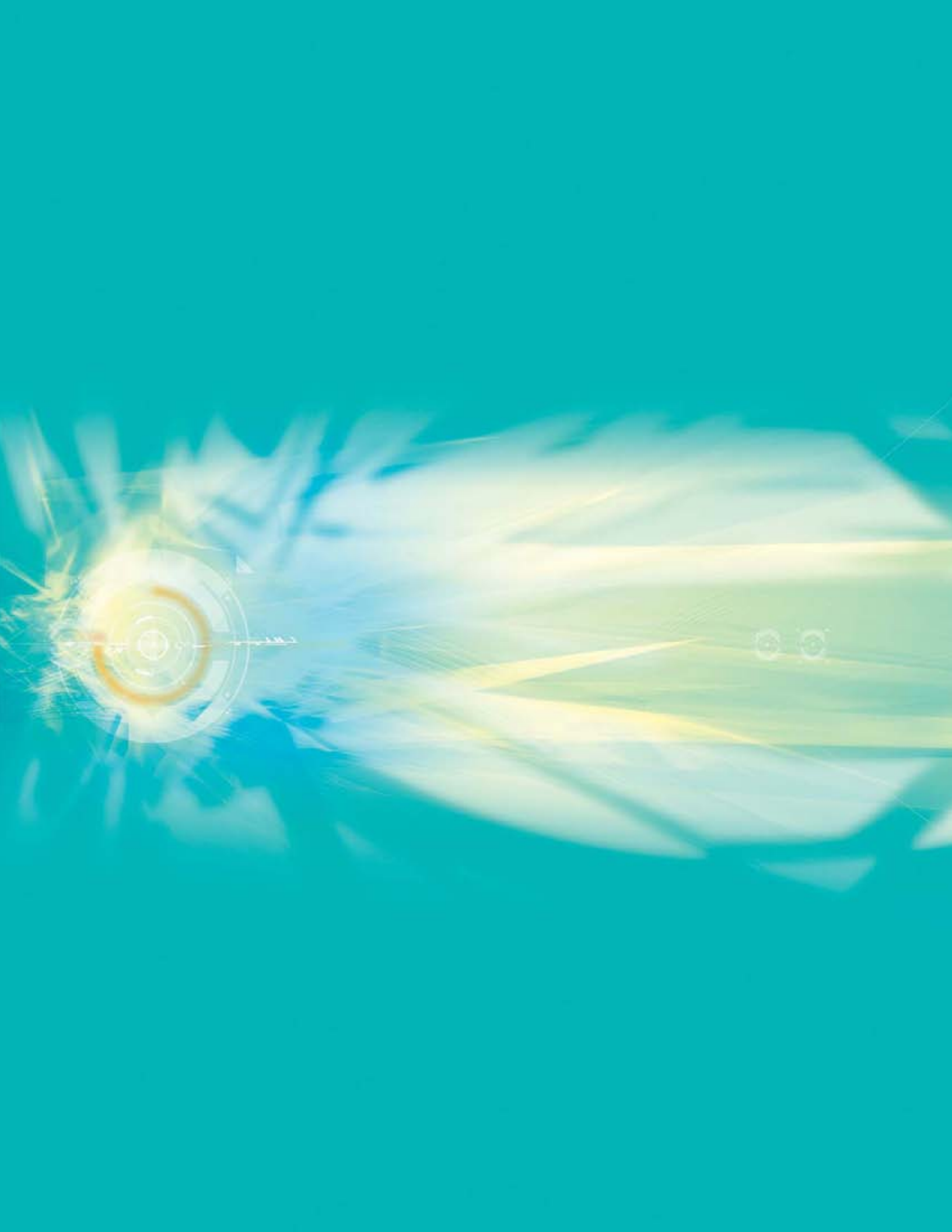
LABNOTEBOOK™



Annotate waveforms directly on the oscilloscope's touch-screen, before saving as a report, or emailing directly from the oscilloscope.

Create Notes with the Screen Capture
By pressing Hard Copy, users can annotate waveforms as they capture them. Once the notes are finished, they can be readily saved as a report and e-mailed directly from the oscilloscope.

Flashback Function
Users can employ the Flashback Function to recall the state of the oscilloscope, including saved waveforms and setup. Additional measurements are easily made using the keyword filter to find the correct notebook entry for recall.



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