LeCroy

wavepro

First Sight — Insight

LeCroy

WAVEPRO OSCILLOSCOPES

500 MHz -2 GHz Bandwidth
8 GS/s -16 GS/s Sample Rate
250 kpts - 64 Mpts/channel

WavePro™ — Takes You Inside the Signal

***WavePro* oscilloscopes offer the most extensive combination of capabilities to help you design, troubleshoot and understand your signals and designs and increase your productivity. The high-speed 16 GS/s A-to-D converters and 64 Mpts deep memory give the fastest and longest signal capture of any oscilloscope in its class.**

A simple to operate front panel layout and use of colors for probing and channel identification combine to simplify an engineer's bench work. One-touch operation gives the best signal viewing of multiple channel zooms and a clear understanding of signal faults with the new History/Analog Persistence function. The Wavepilot toolbar gives instant access to the power of LeCroy signal analysis. WaveAnalyzer Pro options turn the scope into a complete signal analyzer. And best of all, *WavePro* scopes come at affordable prices, offering tremendous value.

> *"I've used a lot of scopes. When I walked up to the WavePro scope, I knew exactly where to start. Then, when I saw how the probe illuminates with the same color as the signal trace, I knew LeCroy had really thought out and delivered on bringing usable information to a whole new level."*

> *"My circuits looked fine until I bought a LeCroy — it really opened my eyes to faster, better analysis. The jitter and timing analysis capabilities are fantastic. These multi-purpose tools easily find all sorts of circuit problems, like jitter and modulation effects."*

> *"I had spent 2 1/2 days trying to track down jitter on my clock distribution circuit. Then the LeCroy engineer brought in his scope with jitter analysis and showed me JitterTrack. Amazing. It showed me the signal and the problem areas of jitter and modulation all on the same screen, a view I'd never seen before. Seeing it gave me clues about fixing the design that afternoon."*

wavepro™

Extreme Vision — Maximum Insight

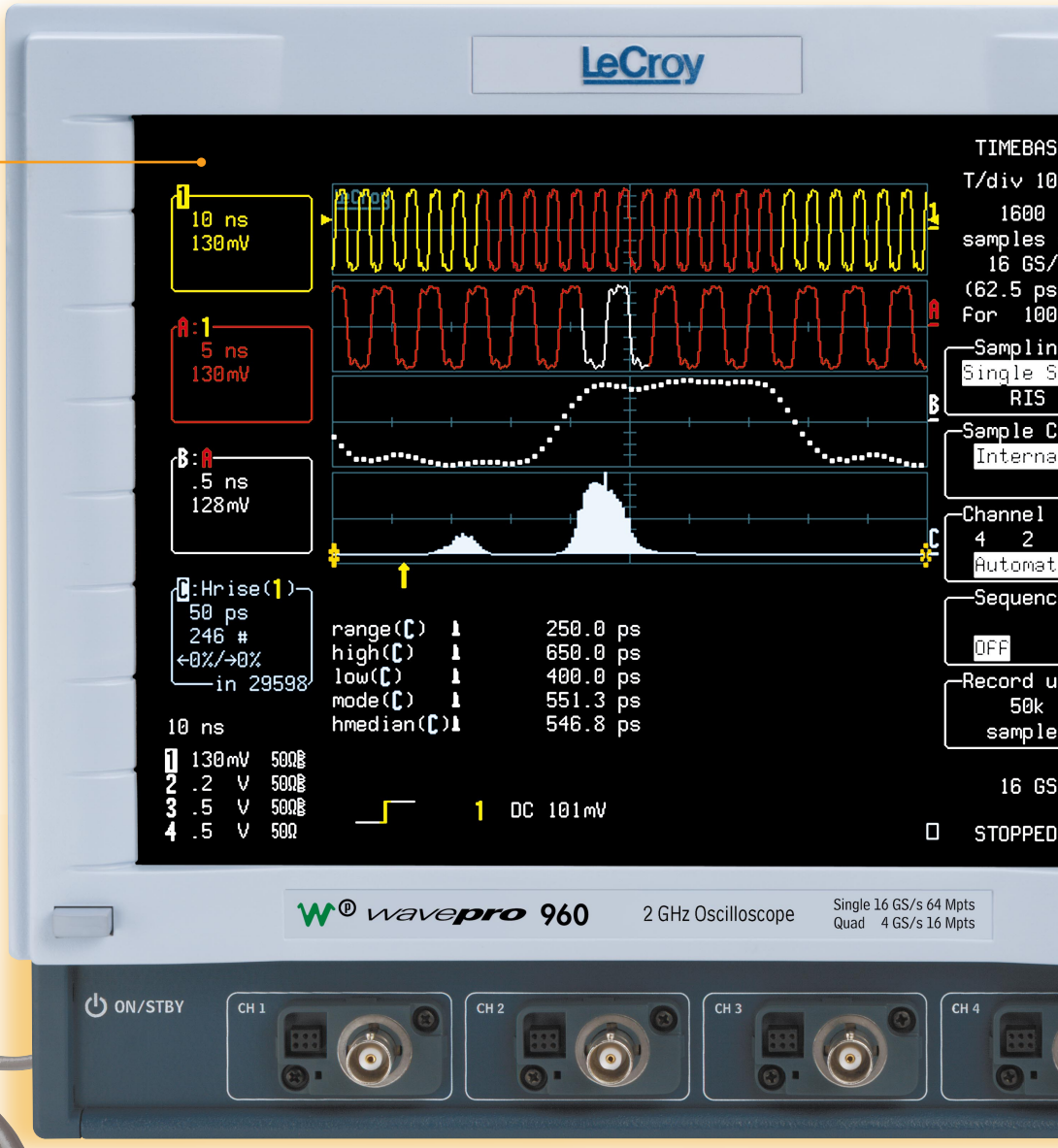
Large 10.4" TFT LCD Display

The large, sharp, bright color display makes it easy to see signal details.

Up to 2 GHz Bandwidth and 64 Million Sample Points of waveform data at 16 GS/s

Connectivity to Windows

- Connect your scope to Windows-based ScopeExplorer using the Ethernet (option), GPIB or RS-232 interfaces. Click and drag files or operate from the virtual front panel. Download new software updates via the web.



NEW

High Bandwidth Probes with AutoColor ID

Auto Setup

Press one button and automatically get your signal on the screen.

Fast, Easy Access

to powerful but simple features that help you solve real problems quickly!

Analog Persistence™

Press the green button to switch between analog view and digital view so you can visually explore the full depth of signal information. Display the *HISTORY* of persistence snapshots, then scroll, identify and analyze the tough problems.

QuickZoom

Automatically displays 10X magnified traces of all signals on multi-grids, ensuring maximum resolution and S/N ratio.

Full Screen

Maximizes the display area for signal viewing. It's great for visual signal analysis and measurements with cursors so you really see details and anomalies.

Wavepilot™ Toolbar

For easy access to powerful signal analysis capabilities that help you gain insight and track problems right to the source.

Cursors

Press to measure signals using a full complement of cursors with on-screen measurement display.

Measure

Automatically displays up to 26 signal parameters and the signal.

Graph

For fast insight into problems, display histograms, FFT spectrum analysis or LeCroy's TrackView capability.

Analysis Packages

- JitterPro
- Communications Mask Testing
- Optical Recording
- PowerMeasure
- Disk Failure Analysis

NEW

CUSTOM DSO

Create your own custom applications then assign them to soft-keys, making it easy to perform repetitive work fast and accurately.

All Performance
No Shortcomings

WavePro **oscilloscopes provide all you need to quickly capture, view, and analyze your signals — accurately and reliably:**

- **500 MHz – 2 GHz bandwidth**
- **8-16 GS/s max, single-shot sample rate**
- **50 GS/s for repetitive signals**
- **Up to 64 million data points to view signals**

WavePro **scopes provide a minimum of 8X oversampling and the deepest memory available in their class for superior signal acquisition and fidelity on long-duration signals.**

Simple, Fast Access to Powerful Capabilities

This new class of scopes brings you the power of LeCroy signal acquisition, viewing and analysis capabilities with simple one-button access. It's easier than ever to capture, view, and analyze high-speed signals of long time duration, with high resolution so you get accurate, precise results.

Easy to Use

The *WavePro* scope is designed to get you up and running quickly. Its color-coded front panel and simple menu system are easy to understand, so your focus is on the work, not the tool. Common tasks are automatic. Navigation is streamlined and intuitive. You'll easily master its powerful operations.

The Right Price

WavePro oscilloscopes raise the bar when it comes to performance capability, and value — you get more for your money than with any other scope in this class. And because the *WavePro* scope memory can be upgraded, you can extend its life to meet future needs.

Increase Your Productivity

The Wavepilot toolbar makes it easy and quick to magnify and view, to inspect or measure signal details, to perform automatic measurements on signals or to graph measurements in frequency spectra, histograms and trends. With TrackView, you can track problems to the source in both the time and frequency domain. Additional signal analysis capabilities let you datalog, integrate, chain math functions, and more. LeCroy's signal diagnostic and troubleshooting tools provide a complete solution for characterization, debug and signal analysis.

From Circuit to Scope

With new LeCroy HFP small, lightweight probes, you're assured of high bandwidth, low capacitance connections to your circuit. Interchangeable probe tips are included for SMD and circuit vias — making the HFP probes the best choice for use with *WavePro* scopes.

WavePro Color Digital Oscilloscopes

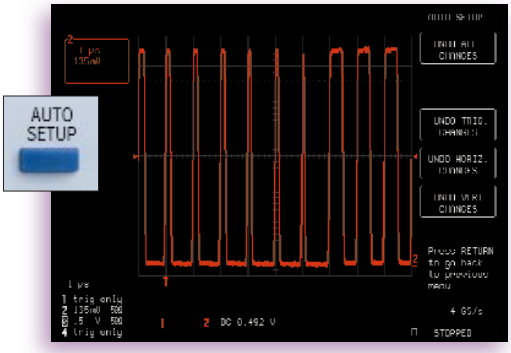
Model	Bandwidth	Channels	Max Sample Rate	Acquisition Memory
WavePro 960	2 GHz	Four	16 GS/s (1 Ch)	Standard 1 Mpts *Optional 4-64 Mpts (1 Ch)*
WavePro 950	1 GHz	Four	16 GS/s (1 Ch)	Standard 1 Mpts *Optional 4-32 Mpts (1 Ch)*
WavePro 940	500 MHz	Four	8 GS/s (2 Ch)	Standard 500 kpts *Optional 2-16 Mpts (1 Ch)*

Simplified Operation

Acquiring and displaying signals is easy. When you first see a *WavePro* scope, you will notice the front panel is clear, concise, and intuitive in operation. Getting signals on the screen is easy. Follow the color channel coding and press *Auto Setup*. Adjust horizontal or vertical settings to view the way you want, and unleash the power of LeCroy SMART Memory with the press of *QuickZoom*. If you are concerned with intermittent runts or timing problems, just press the green button and see infrequent signal anomalies.

Auto Setup

Simply connect your signal, press *AUTO SETUP*, and view. Horizontal, Vertical, and Trigger settings are automatically set. LeCroy SMART Memory ensures the highest time resolution for the time window displayed.



Many Ways to View your Signal

Capturing and viewing the signal is as easy as 1-2-3. Analog Persistence shows three dimensions of signal information. *HISTORY* lets you get further insight into the third dimension by recording snapshots of the signal into memory. Then analyze signals in the sequence they were captured to find the problem.

Full Screen

Spotting problems is easier because the *FULL SCREEN* tool maximizes the display viewing area. Toggle back and forth for the biggest view of any scope.

Quick Zoom

NEW

Press the *QUICK ZOOM* button, and view up to 4 zooms of up to 4 input signals. Magnify, inspect, search and scan your signal to see details and understand problems.

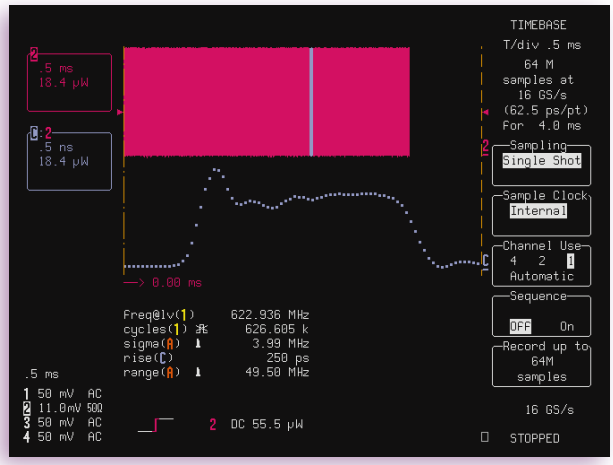
High Quality with Full Detail

Cameras and digital oscilloscopes have much in common when you want to capture an image (or a signal) without loss of detail. A professional camera (and a WavePro scope) can capture a wide view with excellent resolution.

High Speed, Precision, and Accuracy

The *WavePro* scope is the only one in its class capable of capturing, viewing and analyzing signals of 2 GHz bandwidth, with a sample rate of 16 GS/s (8x oversampling) and up to 4 ms duration. This lets you view and analyze the full signal and assures maximum signal fidelity to gain insight into your designs. The SMART Memory system automatically manages memory and sample rate, ensuring the most accurate view of the signal without aliasing.

The precision Analog-to-Digital converters and timebase sample your waveform every 62.5 picoseconds. That's one measurement in the time it takes light to move across an engineer's thumbnail. Every *WavePro* scope comes standard with 4 GS/s sample rate and 250 kpoints of memory on each channel. When you use a *WavePro* scope, it automatically samples at the maximum rate, with maximum memory depth based on the channels in use, so you don't even have to think about it. Extend your signal viewing up to 64 times longer with memory options from 4 Mpoints to 64 Mpoints. The *WavePro* scope's architecture gives you the right capability today with expandability for tomorrow.



With a sample rate up to 16 GS/s, you can precisely (5 ps resolution) measure critical sub-nanosecond timing over long time intervals. Oversampling at 8x the bandwidth, 64 Mpts for signal acquisition, and 4 zoom traces assure maximum signal fidelity and precise measurements on long acquisitions.

Wavepilot with Insight
Expand Your Vision

From beginner to expert, it is now easier than ever to apply the power of the unique analysis tools available from LeCroy. The Wavepilot toolbar provides single button access to powerful, easy-to-use signal analysis for real insight into problems.

Cursors

Turn *CURSORS* on, and turn the knob for manual adjustment and measuring between-sections of your signal.

Measure

Press *MEASURE* to display up to 26 parameters on the signal of your choice and quickly switch from trace to trace. *MEASURE* is context-sensitive, so when you display a histogram, you will see statistical parameters. *MEASURE* lets you expand your selection to over 40 parameters to characterize your signal.

Graph

The *GRAPH* button automatically displays a histogram, trend, FFT or TrackView. Setting up signal analysis is simple with the Wavepilot toolbar menus.

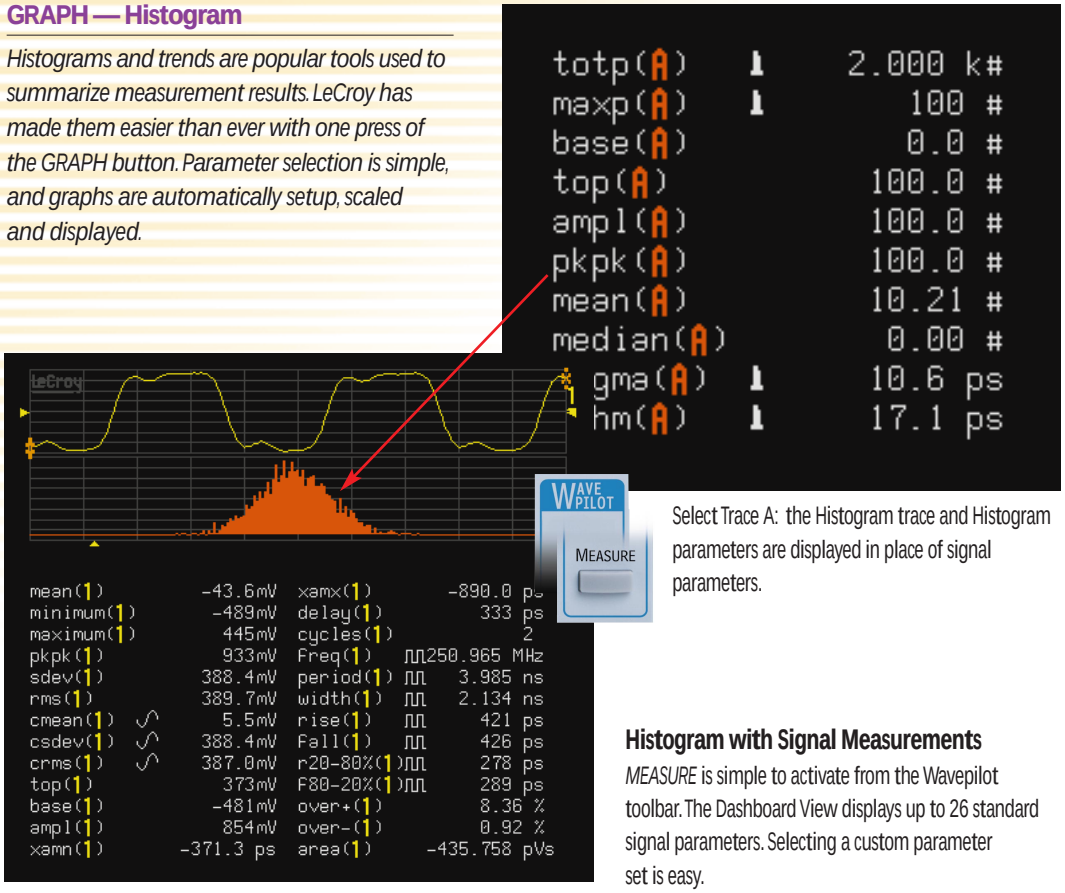
Application Packages

Direct access to select application-specific solution packages including telecommunications Mask Test, Jitter and Timing, and Data Storage solutions.

Expand your insight into any signal with one touch on the Wavepilot toolbar. Provides fast access into powerful signal analysis.

GRAPH — Histogram

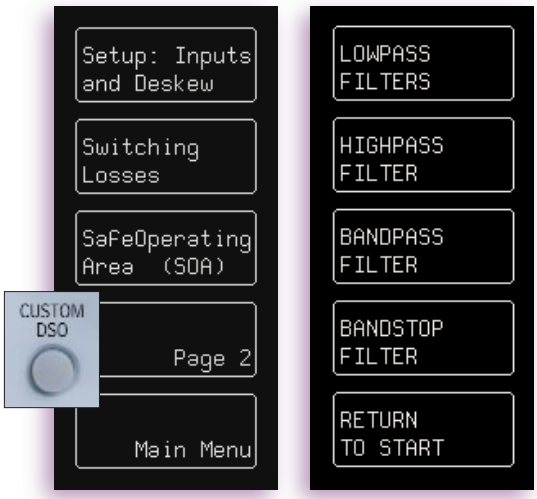
Histograms and trends are popular tools used to summarize measurement results. LeCroy has made them easier than ever with one press of the GRAPH button. Parameter selection is simple, and graphs are automatically setup, scaled and displayed.



Select Trace A: the Histogram trace and Histogram parameters are displayed in place of signal parameters.

Histogram with Signal Measurements

MEASURE is simple to activate from the Wavepilot toolbar. The Dashboard View displays up to 26 standard signal parameters. Selecting a custom parameter set is easy.



Create custom menus and your own applications with this new capability.

CustomDSO

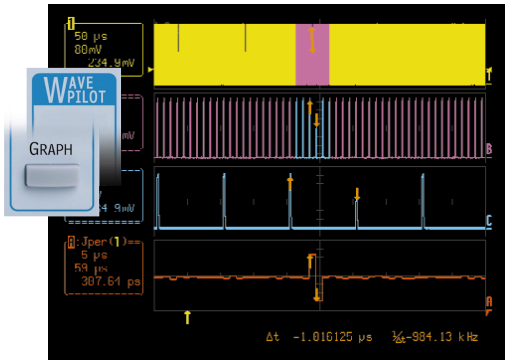
The *WavePro* scope is designed to keep things easy to use. When you want to increase productivity or personalize your scope, CustomDSO lets you set up your own screen menus and labels, as well as engineering test sequences. Incorporate a series of scope measurement steps so engineers and technicians in any department, regardless of technical background, can make measurements in a repeatable way. Edit your test sequences with Windows-based ScopeExplorer, see them on the scope screen, and store them into scope non-volatile memory. *WavePro* scopes come with good examples to get you started.

UNIQUE

TrackView and JitterTrack™

Show deviations directly synchronized to the signal — patterns you would never see without this view. Press the GRAPH button for easy access, and zoom in on both the "where" and the "why" of the problem; you can see it and fix it! Quickly gain insight into the source of timing and signal integrity problems.

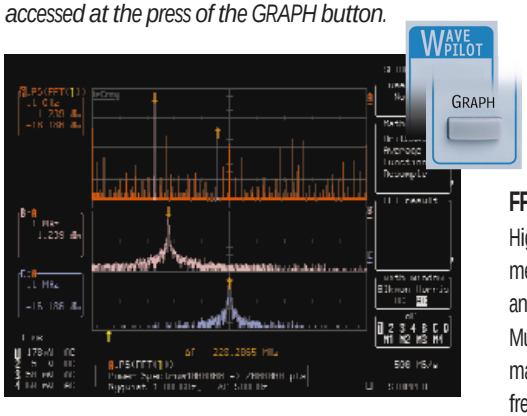
- *TrackView shows the time evolution of signal. Quickly locate the problem, and see a statistical view showing the range and distribution of voltage variations.*
- *The TrackView, Histogram and FFT functions in WavePro scopes provide insight into signals better than any other oscilloscope. The WaveAnalyzer Pro (WAVAPRO) option extends the measurement capability further, allowing longest measurements and additional views into the signal. Measuring the time evolution of jitter in a signal can reveal the exact location of timing problems.*



JitterTrack View
Shows timing variation as it tracks the signal, cycle by cycle.

FFT Spectrum Analysis

When you need to understand the frequency content of your signal, spectrum analysis is easily accessed at the press of the GRAPH button.



View the FFT of a waveform while the signal updates on the screen. The combination of long acquisition memory, high sample rate, and a wide variety of FFT windows gives you measurement flexibility to fully analyze your signal.

The Wavepilot CURSOR or MEASURE buttons make it easy to find peak frequencies and harmonics in the FFT.

FFT Spectrum Analysis
High sample rate and long memory enable high resolution and a wide frequency span. Multiple zoom traces and cursors make it easy to measure the frequency content.

Speed Up Debug and Analysis

UNIQUE

SMART Triggers®

The *WavePro* scope's trigger bar is simple to operate. Run the scope in normal or auto trigger modes or capture one-time events into scope memory up to 64 Mpts with a single-shot trigger. Triggering with *WavePro* is direct, easy to read and to understand.

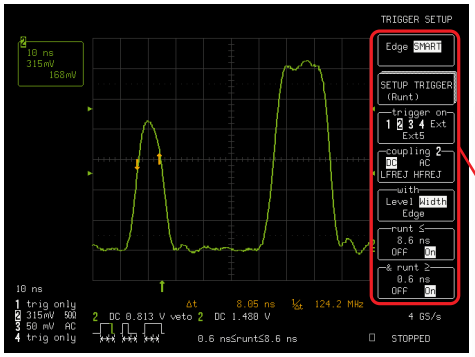
SMART-Trigger provides the flexibility needed to quickly trigger on the specific signal characteristic or pattern you are searching for. Trigger not only on what you expect but also on abnormal signals. Exclusion triggers can exclude normal signals and capture only the abnormal ones, speeding up the debug of your circuits and systems. Trigger on signals down to 600 ps. All *WavePro* oscilloscopes include SMART Triggers. Select multiple threshold levels, as well as the pulse width, for the flexibility you need to catch the waveform you want to view and analyze.

WavePro Basic Triggers

Name	Description
Edge	Select + or - slope and holdoff by time or events.
Window	Triggers when signal crosses outside the window in either direction.

WavePro SMART Triggers

Name	Triggers Conditions
Glitch	From 600 ps - 20 s and when pulse is >, <, or in or out of a range.
Interval	Between edges and ranges of 600 ps - 20 s.
Qualified	By edge or state on a channel or a pattern is present or absent.
Qual First	A single pulse qualifies a sequence of triggers.
Dropout	If input drops out after a time from 2 ns - 20 s.
Runt	Pulse levels, edge, widths from 600 ps - 20 s.
Slew Rate	Slope, dV, dT from 600 ps - 20 ns.
Pattern (logic)	Logical combination of up to 5 inputs. Effective when used in combination with Qualified.

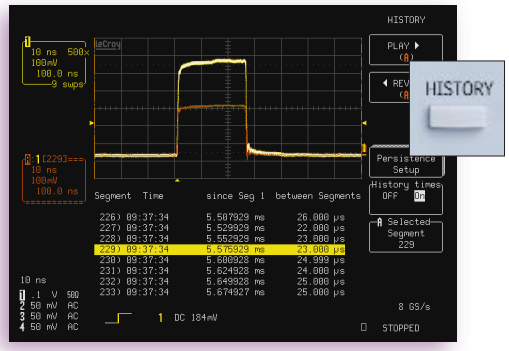


Runt triggering is great for capturing logic signals that exhibit inadequate levels or spurious signals, interfering with circuit operation. With the exclusion/inclusion feature, the scope will only trigger on runt signals that are outside/within a specified range of pulse width.

Use HISTORY Views to Find Intermittents

Pressing the *HISTORY* button converts the scope into a fast Analog Persistence fault-finder. The lifetime of your signal is written into the History memory and mapped on screen. You can measure each signal, see its trigger time, and identify rare events. Up to 8,000 events can be acquired for playback. This is great when you have intermittent problems and want to know if they occur at a rate related to other circuit or system timing events.

Press "play" to replay the signal history and automatically scan and search from sweep to sweep. Stop when you see something of interest. The display shows the Analog Persistence view of all acquired sweeps as well as the individual sweep under inspection. When used with a SMART Trigger such as runt or slew rate, you can easily determine the rate of occurrence. The time of the trigger event is displayed with a resolution of 1 ns.



HISTORY lets you see the intermittent, trigger on the problem and find how often it's disrupting your design.

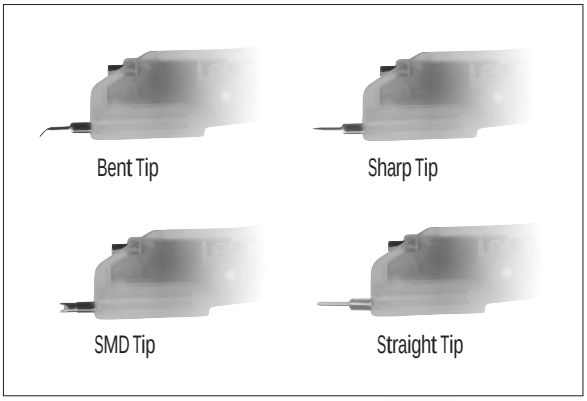
High Bandwidth Active Probes

NEW

Convenient, Hands-Free Probing

To access the ever-increasing variety of test points, today's probing solutions need to be versatile, small, and lightweight. The new HFP series of probes meets these needs with high bandwidth, miniature size and a variety of tip styles, making probing easier than ever.

In combination with these innovative probe tips, the unique HFP "Freehand" probe holder will hold the probe on test points to maintain signal fidelity. The end result of HFP "hands-free" probing is the enhanced ability to analyze waveforms instead of having to focus energy on keeping the probe itself in place.



Interchangeable HFP Probe Tips

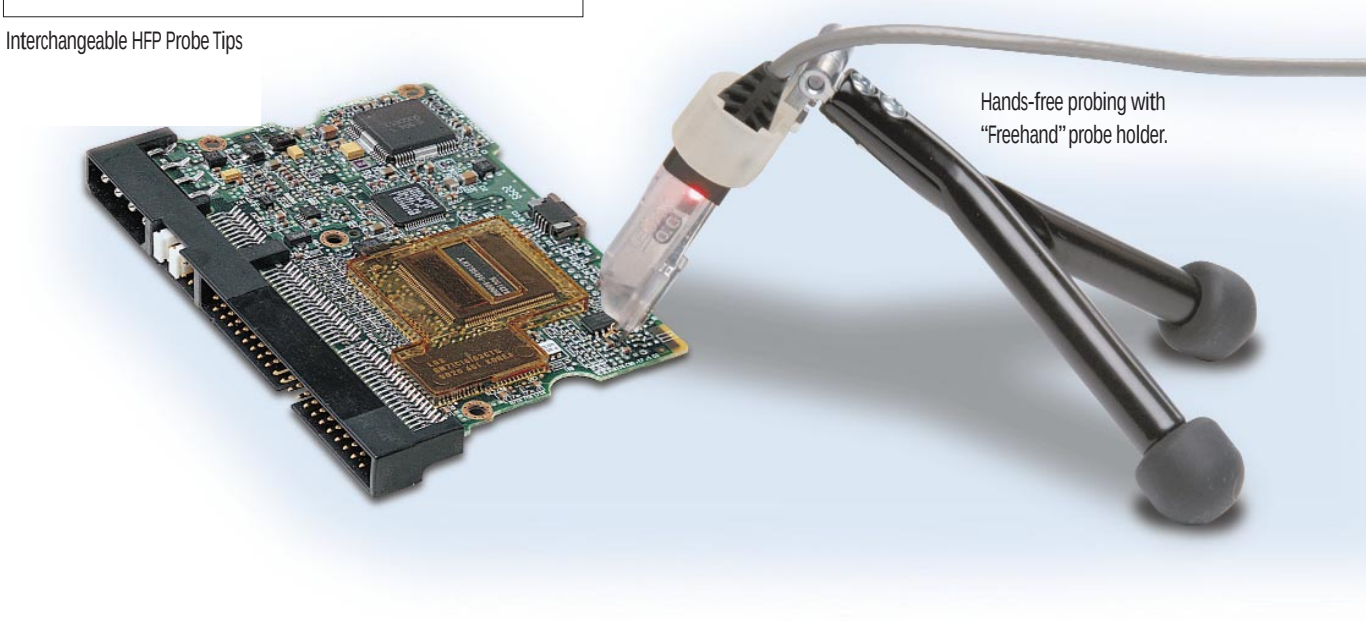
HFP 1000, HFP 1500, HFP 2500 Probe Models

Leading Specifications

- 1 GHz,1.5 GHz, and 2.5 GHz Bandwidth
- <1 pF Input Capacitance
- ±8 V Dynamic Range
- ±12 V Offset Range
- 4 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 Probe Color to the Trace Color

AutoColor ID

When the probe is connected to a *WavePro* scope, our new patent-pending AutoColor ID feature automatically senses and illuminates the probe head in that channel's trace color. You no longer need to worry about plastic rings or colored tape to identify which channel on the scope is connected to a particular test point.



Hands-free probing with "Freehand" probe holder.

WAVAPRO — Ultimate Signal Analysis

In today's high-bandwidth products, signal complexity is increasing. The Wavepilot toolbar and the Analysis Control Area both access the largest set of signal analysis tools and processing power in oscilloscopes today. Optional packages expand your oscilloscope to a complete signal analyzer.

NEW

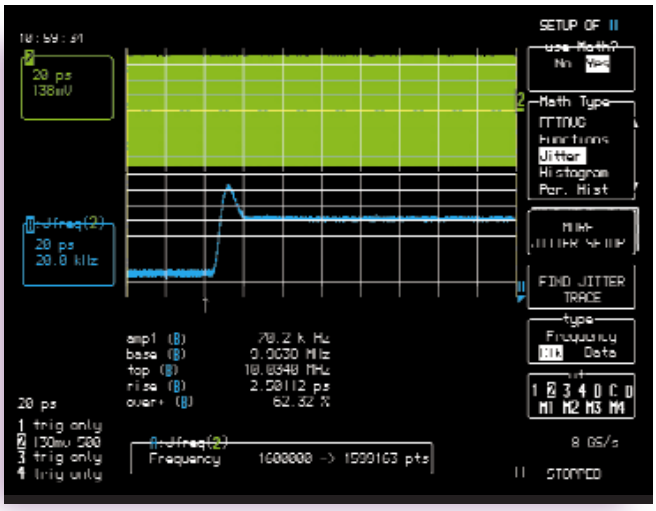
WaveAnalyzer Pro (WAVAPRO)

The WaveAnalyzer Pro option is the ultimate tool for characterization and troubleshooting in time, frequency, and statistical domains for design and research applications. It includes:

- WaveAnalyzer Signal Analysis (WAVA)
- Jitter and Timing Analysis (JTA)
- Digital Filter Package (DFP)

WaveAnalyzer Signal Analysis (WAVA)

Waveform averaging increases to one million sweeps. The FFT spectrum analysis is expanded to process all acquired data up to 25 Mpts and provides additional spectral views: FFT averaging, real and imaginary components, and more. Histograms and trends let you view and measure statistical variations of signal parameters.



JitterTrack clearly shows a PLL's step response, including frequency overshoot.

Jitter and Timing Analysis (JTA)

JTA has broad applications from high-speed clock measurements to lower-speed digital electronics or mechanically related measurements. Measure a wide variety of timing parameters: cycle-to-cycle, period, frequency, time interval, and width. Use JitterTrack to plot cycle-to-cycle jitter, interval error, period, or pulse width versus time. Use persistence trace histograms to measure jitter and noise on eye diagrams.

Digital Filter Package (DFP)

DFP implements a set of linear-phase Finite Impulse Response (FIR) filters. The package enhances your ability to examine important signal components by filtering out undesired spectral components such as noise.

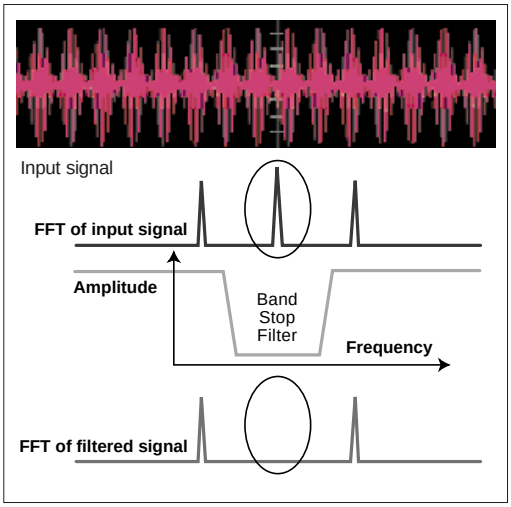
Use a digital filter design or math package such as MATLAB® or Mathcad® to design a custom filter, then download the filter coefficients into the *WavePro* scope with the DSO-Filter utility.

Filters include:

Low Pass	*Raised Cosine*
High Pass	*Raised Root Cosine*
Band Pass	*Gaussian*
Band Stop	*Custom*

Up to 4 filters can be cascaded

Design your own filters with DFP



Windows Connectivity

Connect your scope to Windows-based ScopeExplorer using the Ethernet (option), GPIB or RS-232 interfaces. Click and drag files, or operate from the virtual front panel. Update your software via the web.

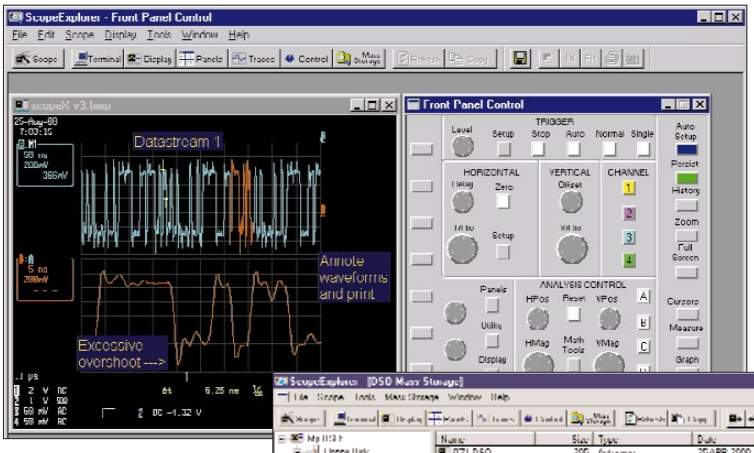
All it takes is a PC with Windows and a GPIB, RS-232-C, or the Ethernet option.

Windows Software to Enhance Your Productivity

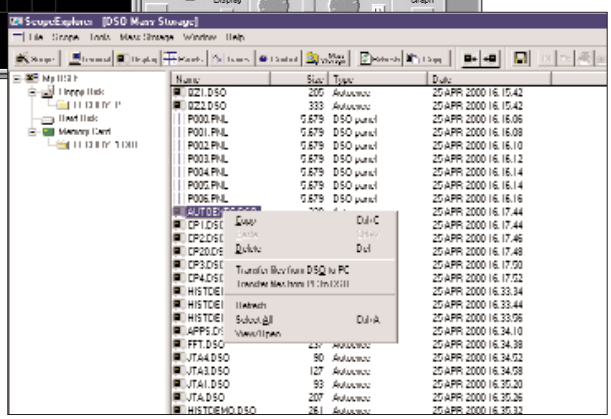
ScopeExplorer and ActiveDSO™ are Windows (95, 98, 2000, ME or NT) PC-based connectivity tools that make it easy to interface your *WavePro* scope with a PC via Ethernet, RS-232-C, or GPIB. It's easy to integrate scope data with Windows applications, as well as to control the *WavePro* scope from your PC.

ScopeExplorer

Annotate and print screen shots, drag and drop files, save and load scope setup panels, and run CustomDSO applications. Click on the print icon to send the file to the printer of your choice.



ScopeExplorer interactive front panel with familiar Windows PC operation.



ScopeExplorer provides access to WavePro's storage media to view, edit, save, load, and run scope setup and CustomDSO applications.

Access files on storage media, including PC-Cards, hard drives, and diskettes inserted in a WavePro scope.

ActiveDSO

ActiveDSO is a LeCroy software utility for ActiveX control of LeCroy digital scopes.

Exchange *WavePro* scope data with applications that support the ActiveX standard. Many applications (such as Excel, PowerPoint, Internet Explorer, Visual Basic, Visual C++ and Labview) allow users to incorporate ActiveX controls.

MaskMaker and DSO-Filter

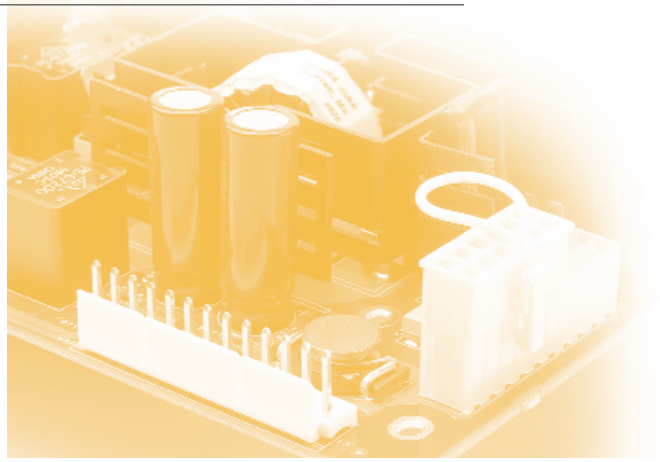
These easy-to-use Windows-based graphic utilities let you create and edit test masks and digital filters for use on *WavePro* scopes. Use MaskMaker with the PolyMask tolerance mask-testing option. You can even create XY masks.

With the DSO-Filter PC utility and DFP, you can specify a set of filter coefficients in an Excel spreadsheet and load them directly into the oscilloscope.

Powerful Applications

Power Supply

Nearly every type of electronic product incorporates some type of power supply. It may be a battery, AC-DC converter, switchmode power supply or other type of device. The stability and reliability of the power supply is of critical importance to product performance, maintenance costs and customer satisfaction. Factors of concern are battery life, safe operating area of power transistors, efficiency, the performance of soft-start circuits, dynamic on-resistance, emitted/conducted EMI, response to changes in load and robustness in non-standard operating conditions such as power surges.

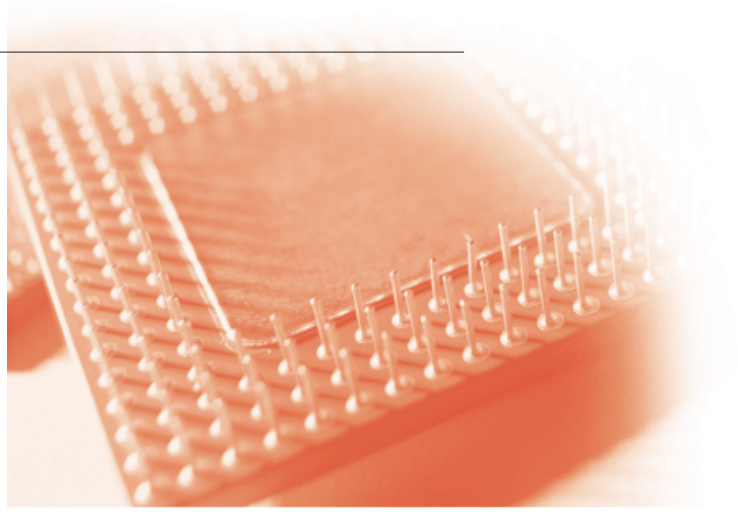


Communications

Communications products range from wireless devices to broadband networks and fiber-optic transmission lines. Though data speeds and encoding standards vary, all of these applications are driven by the need to accurately transmit and receive complex data streams. Emerging trends for transmission of video, audio and other complex sources of information—as quickly as possible—will continue to drive both the clock speed of communications protocols and the need for encoding methods that allow efficient data transmission.

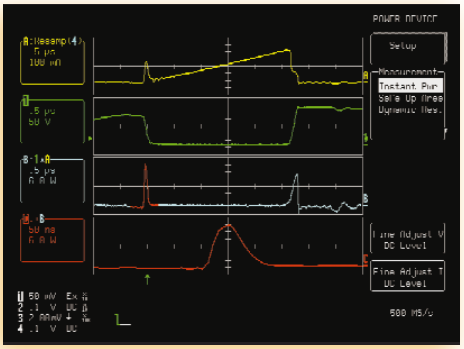
Microprocessors

Devices ranging from automobiles to refrigerators and computers have a microprocessor as the "brains" of their control system. These devices may be low speed, inexpensive chips or the latest high-cost, high-speed semiconductors. The functioning of the microprocessor is key to system performance and reliability. In general, the microprocessor needs to handle incoming instructions/data and send the proper responses back to the product in which it is embedded. As the level of demand grows for more sophisticated computations or for faster system operation, microprocessor speed increases and the complexity of tasks handled by the CPU also goes up.



Here are five solution packages from LeCroy targeted to your specific test applications. You'll find that these packages will bring precise measurements and fast analysis to your workflow.

Power Measurement Solutions

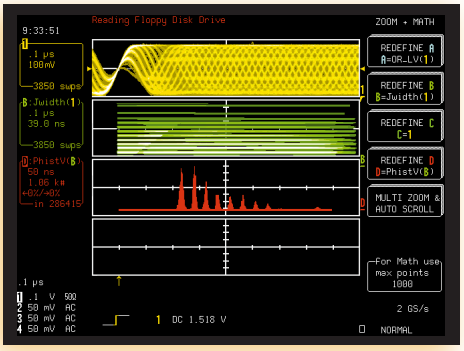


Current, voltage, instantaneous power and energy dissipation measurements.

With LeCroy PowerMeasure Systems, you can analyze power devices' performance while they are operating in circuit. The PowerMeasure System combines the required current and differential voltage measuring capability with unequalled DSO triggering, long record capture, and waveform math to make these difficult measurements as simple as the push of a very few buttons.

JitterPro (JPRO)

This analysis package provides a comprehensive set of precise timing measurements for clock, clock-to-data, and datastream analysis. JPRO includes all the capabilities of JTA plus the JitterWizard that turns a *WavePro* DSO into a dedicated jitter and timing analyzer. Get incredible ease of operation, combined with unparalleled analysis capabilities.



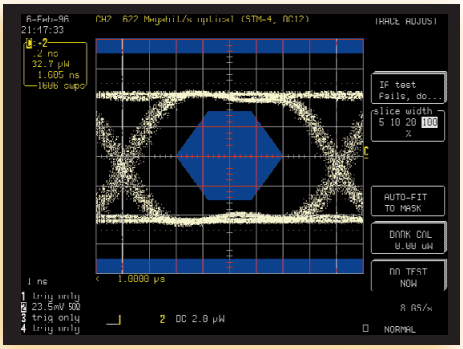
An example of a PlayStation-2 DVD. Channel 1 represents the data from the DVD, while the pulse/width modulation is shown on Trace B. Trace D is a histogram of B. The pulse widths are well defined within narrow bands, with no interference between adjacent ones.

Clock Certification & Test Module (CCTM)

CCTM is specified by Rambus Inc. as the first approved tool for compliance testing of DRCG (Direct Rambus® Clock Generator) jitter. All jitter measurements as required by Rambus are automatically configured and easily performed through the CCTM wizard.

Telecom Mask Test Packages

MT series Mask Testing options for optical and electrical communications signals are available with *WavePro* scopes. Mask Testing compares a trace against a mask template to check if it falls inside or outside the mask boundaries. Several actions may be initiated if the trace fails the test, including "stop," "output a pulse," and "datalog."

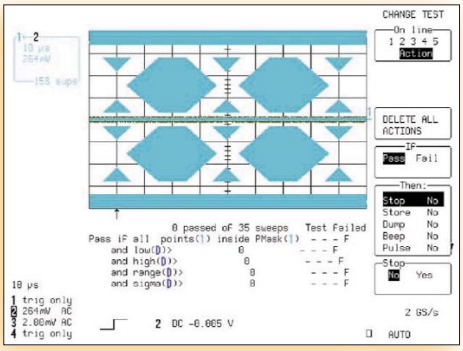


Mask Testing and extinction ratio measurements of OC-12 optical signal.

With the exclusive Finder Function, pulses, patterns or even random bit streams are easily isolated. MT packages take control of the WavePro scope, displaying only relevant test menus.

PolyMask

PolyMask is a powerful, general-purpose testing application that lets you view and test against complex masks. PolyMask locates and clearly depicts signal failures. In pass/fail testing, failures are highlighted with colored circles. Creating masks is greatly simplified with the MaskMaker utility, a simple program that runs on any PC with Windows. Masks can be used in either 8x10 or X-Y display mode (useful for applications such as power measurement.)



An Ethernet 100 Base-T mask created with the MaskMaker utility.

WavePro Oscilloscopes
Specifications

Vertical System	WavePro 960	WavePro 950	WavePro 940
Analog Bandwidth @ 50 Ω (-3 dB)	2 GHz*	1 GHz	500 MHz
Input Channels	4		
Bandwidth Limiters	20 MHz, 200 MHz		
Input Impedance	50 Ω ± 1.5%; 10 MΩ // 11 pF typical (using PP005 probe)		
Input Coupling	1 MΩ : AC, DC, GND; 50 Ω : DC, GND		
Maximum Input	50 Ω : 5 Vrms; 1 MΩ : 100 Vmax (peak AC ≤5 kHz + DC)		
Vertical Resolution	8 bits; up to 11 bits with enhanced resolution (ERES)		
Sensitivity	50 Ω : 1 mV – 1 V/div fully variable ; 1 MΩ : 1 mV – 2 V/div fully variable		
DC Accuracy	± 2.0% full scale + 1.5% offset value @ gain > 10 mV		
Offset Accuracy	± (1.5% + 0.5% of full scale + 1 mV)		
Offset Range	50 Ω or 1 MΩ : 1 mV – 4.99 mV/div: ±400 mV 50 Ω : 5 mV – 99 mV/div: ±1 V; 0.1 V – 1 V/div: ±10 V 1 MΩ: 5 mV – 100 mV/div: ±1 V; 101 mV – 2 V/div: ±20 V		
Isolation — Channel-to-Channel	> 250:1 at same V/div settings		
Timebase System			
Timebases	Main and up to four independent zoom traces simultaneously		
Ranges	200 ps/div – 1000 s/div		
Clock Accuracy	≤10 ppm		
Interpolator Resolution	5 ps		
External Clock Frequency	500 MHz maximum, 50 Ω, or 1 MΩ impedance		
Roll Mode – Operating Range	time/div 500 ms – 1000 s/div or sample rate < 100 kS/s max		
External Reference	10 MHz timebase reference clock available with input on rear panel		
External Timebase Clock	500 MHz maximum external sample clock input on front panel EXT BNC		
Acquisition System			
Single-Shot Sample Rate			
1 Channel Max.	16 GS/s	16 GS/s	8 GS/s
2 Channels Max.	8 GS/s	8 GS/s	8 GS/s
3 – 4 Channels Max.	4 GS/s	4 GS/s	4 GS/s
Maximum Acquisition Points/Ch	(1 Ch) / (2 Ch) / (3 – 4 Ch)		
Standard	1M / 500k / 250k	1M / 500k / 250k	500k / 500k / 250k
M – Memory Option	4M / 2M / 1M	4M / 2M / 1M	2M / 2M / 1M
L – Memory Option	16M / 8M / 4M	16M / 8M / 4M	8M / 8M / 4M
VL – Memory Option	32M / 16M / 8M	32M / 16M / 8M	16M / 16M / 8M
XL – Memory Option	64M / 32M / 16M	–	–
Acquisition Modes			
Random Interleaved Sampling (RIS)	50 GS/s for repetitive signals: 200 ps/div – 1 µs/div		
Single-Shot	For transient and repetitive signals: 200 ps/div – 1000 s/div		
Sequence	2 – 8000 segments		
Intersegment Time	Typically 30 µs		
Acquisition Processing			
Averaging	Summed averaging to 10^3 sweeps (standard). Continuous averaging up to 10^6 sweeps with weighting range from 1:1 to 1:1023 (option).		
Enhanced Resolution (ERES)	From 8.5 to 11 bits vertical resolution		
Envelope (Extrema)	Envelope, floor, roof for up to 10^6 sweeps		

* with sample speeds > 4 GS/s

Triggering System

Modes	Normal, Auto, Single, and Stop
Sources	Any input channel, external, Ext/5 or line; slope, level, and coupling unique to each source (except line trigger)
Slope	Positive, Negative, Window
Coupling modes	DC, AC, HF, HFREJ, LFREJ
AC Cutoff Frequency	7.5 Hz Typical
HFREJ, LFREJ	50 kHz typical
Pre-trigger delay	0 – 100% of horizontal time scale
Post-trigger delay	0 – 10000 divisions
Hold-off by time or events	Up to 20s or from 1 to 99 999 999 events
Internal trigger range	±5 div
Max trigger frequency	1 GHz (DC, AC), >1 GHz (HF) on WavePro 950, >2.0 GHz (HF) on WavePro 960
External trigger input range	±0.5 (±2.5 V with Ext/5 selected)
Maximum ext. input @ 50 Ω	±5 V DC or 5Vrms
Maximum ext. input @ 1 MΩ	100 Vmax (DC + peak AC < 5 kHz)

Automatic setup

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

Probes

Model PP005	10 : 1, 10 MΩ with autodetect (one per channel)
Probe System: Probus®	Automatically detects and supports a wide variety of differential amplifiers; active, high-voltage, current, and differential probes
Scale Factors	Up to 12 automatically or manually selected

Color Waveform Display

Type	Color 10.4" flat-panel TFT-LCD
Resolution	VGA 640 x 480 pixels
Screen Saver	Display blanks after 10 minutes (when screen saver is "on")
Real Time Clock	Date, hours, minutes, and 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; Full Screen gives enlarged view of each style.
Intensity Controls	Separate intensity control for grids and waveforms
Waveform Styles	Sample dots joined or dots only — regular or bold sample point highlighting.
Trace Overlap Display	Select opaque or transparent mode with automatic waveform overlap management.

Analog Persistence Display

Analog & Color-Graded Persistence	Variable saturation levels; stores each trace's persistence data in memory.
Trace Selection	Activate Analog Persistence on a selected trace, top 2 traces, or all traces.
Persistence Aging Time	Select from 500 ms to infinity.
Trace Display	Opaque or transparent overlap
Sweeps Displayed	All accumulated or all accumulated with last trace highlighted

Zoom Expansion Traces

Display up to Four Zoom Traces	
	Vertical zoom up to 5X expansion, 50X with averaging
	Horizontal zoom expand to 2 pts/div, magnify to 50000X
	Auto Scroll automatically scans and displays any zoom or math trace.

Rapid Signal Processing

Processor	PowerPC
Processing Memory	Up to 256 Mbytes
Realtime Clock	Dates, hours, minutes, seconds

WavePro Oscilloscopes
Specifications, Continued

Internal Waveform Memory

Waveform	M1, M2, M3, M4 (Store full-length waveforms with 16 bits/data point)
Zoom and Math	Four traces A, B, C, D with chained trace capability

Setup Storage

Front Panel and Instrument Status	Four non-volatile memories and floppy drive are standard. Hard drive and memory card are optional.
CustomDSO	Customize and access scope settings with up to 5 CustomDSO files stored in non-volatile Virtual Disk (VDisk).

Interface

Remote Control	Full control of all front panel controls and internal functions via RS-232-C, GPIB, or Ethernet
RS-232-C	Asynchronous transfer rate of up to 115.2 kbaud
GPIB Port	Full control via IEEE – 488.2; configurable as talker/listener for computer control and data transfer
Ethernet (optional)	10 BaseT Ethernet interface
Floppy Drive	Internal, DOS-format, 3.5" high-density
PC Card Slot (optional)	Supports memory and hard drive cards
External Monitor Port Standard	15-pin D-Type VGA-compatible
Centronics Port	Parallel printer interface
Internal Graphics Printer (optional)	Hard copy output in <10 seconds or strip chart mode up to 200 cm/div
Pass/Fail and Trigger Output	Front panel Cal BNC output provides choice of Cal Signal, Pass/Fail Condition, Trigger Ready, or Trigger Out signals

Outputs

Calibrator Signal	500 Hz – 2 MHz square wave or 25 ns pulse; 0.05 to +1.0 Volt into 1 MΩ output on front panel BNC
Control Signals	Trigger ready, trigger out, pass/fail status

Environmental and Safety

Operating Conditions	
Temperature	5 – 40 °C rated accuracy (41 to 104 °F)
	0 – 45 °C operating
	-20 – 60 °C non-operating
Humidity	75% max RH (non-condensing) up to 35 °C; 50% max RH (non-condensing) at 35 - 45 °C
Altitude	3 000 meters (10 000 feet) operating at 25 °C 4 500 meters (15 000 feet) non-operating
CE Approved	
EMC	EMC Directive 89/336/EEC; EN 61326-1 Emissions and Immunity
Safety	Low Voltage Directive 73/23/EEC; EN 61010-1 Product Safety (Installation Category II, Pollution Degree 2)
UL and cUL listed	UL Standard UL 3111-1 cUL Standard CSA-C22.2 No. 1010-1

General

Auto Calibration	Ensures specified DC and timing accuracy is maintained for 1 year minimum
Auto Calibration time	<500 ms
Power Requirements	90–132 V AC at 45–440 Hz; 180–250 V AC at 45-66 Hz; Power consumption: 350 VA max
Battery Backup	Front panel settings retained for two years minimum
Warranty and Calibration	Three years; calibration recommended yearly

Physical Dimensions

Dimensions (HWD)	264 mm x 397 mm x 453 mm; 10.4" x 15.65" x 17.85" (height excludes feet)
Weight	14 kg; 31 lbs (with internal printer)
Shipping Weight	22.2 kg; 49 lbs

Service

LeCroy service programs include unique service upgrades for LeCroy oscilloscopes, metrology modules customized for your company, and more. Whether you own one LeCroy instrument or hundreds, whether you need prompt attention from our service offices or an onsite service contract, LeCroy is committed to your success. Call your LeCroy service representative to discuss your company's specific requirements.

Math Tools (Standard)

Simultaneously perform up to four math (signal) processing functions; traces can be chained together to perform math-on-math.

absolute value
average (summed to 1000 sweeps)
difference
differentiate
enhanced resolution (to 11 bits vertical)
envelope
exp (base e)
exp (base 10)
FFT of 50 kpoint waveforms
floor
histogram of 200 events
identity
integrate
log (base e)
log (base 10)
negate
parameter trackview
product
ratio
reciprocal (invert)
resample (deskew)
rescale (with units)
roof
sin x/x
square
square root
sum
trend (datalog)

Measure Tools (Standard)

Dashboard displays up to 26 parameters; Display any five parameters together with their average, high, low, and standard deviations.

Included Parameters

Δ delay
Δ time @ level; % and volts
Δ time @ level from trigger
amplitude
area
base
cycle std. deviation
cycle mean
cycle median
cycle rms
cycles
data
delay
duration
duty factor
fall 90-10%
fall 80-20%
fall @ level; % and volts
first (left) cursor point
frequency
last (right) cursor point
maximum
mean
median
minimum
number of points
+overshoot
–overshoot
peak-to-peak
period
phase difference
rise 10-90%
rise 20-80%
rise @ level; % and volts
rms
std. deviation
top
width
xamn
xamx

Included JitterTrack and Histogram Timing Parameters

Pass/Fail

Test any five parameters against selectable thresholds. Limit testing is performed using masks created on the scope or PC. Set up a pass or fail condition to initiate actions such as hard-copy output, saving waveform to memory, GPIB SRQ, or pulse out.

Cursor Measurements

Type	Symbol	From	To
Relative time		First point on waveform	Any other point on waveform
Relative voltage		Select voltage level	Any other voltage level
Absolute time		Time and voltage relative to	Ground and trigger
Absolute voltage		Voltage	Ground

WAVEANALYZER PRO (WAVAPRO)

This package provides the most comprehensive set of signal analysis tools for expanding the capability of WavePro oscilloscopes. It includes:

- Histograms with 18 histogram parameters on 2 billion events
- Summed averaging to one million sweeps
- Continuous weighted averaging
- FFT capability expands the basic FFT to include:
  - FFT power averaging
  - FFT power density – real and imaginary
  - FFT on all acquisition points up to 25 Mpts
- Jitter and Timing Analysis (JTA)
- Digital Filter Package (DFP)

Other Application Solutions Available

JitterPro (JPRO)
Clock Certification and Test Module—for Rambus clock generator (CCTM)
Jitter and Timing Analysis (JTA)
WaveAnalyzer Package (WAVA)
Polymask Mask Testing (PMSK)
Advanced Optical Recording Measurements (AORM)
Disk Drive Measurements (DDM)
PRML Analysis (PRML)
PowerMeasure Analysis (PMA)

Software Utilities

ScopeExplorer
Easy-to-use utility that provides a simple but powerful way to control your scope remotely over RS-232-C, GPIB, or Ethernet.

ActiveDSO
ActiveX controls for flexible Windows applications programming with remote control.

MaskMaker
Create your tolerance mask offline with this graphic tool.

DSO Filter
Specify a set of filter coefficients offline and load them into the scope.

WavePro Oscilloscopes
Specifications, Continued

Basic Triggers	
Edge/Slope/Window/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 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	
Signal or Pattern Width	Triggers on glitches or on 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
Slew Rate	Triggers on edge rates; select limits for dV, dt, and slope
Runt	Positive or negative runts defined by two voltage limits and two time limits selectable between 600 ps and 20 ns
Hard-Copy	
Print Screen is activated by a front-panel button or via remote control. Store screen image files or print to external printers.	
Supported Printers include:	
B/W	LaserJet, DeskJet, Epson
Color	DeskJet 550C, Epson Stylus, Canon 200/600/800 series
An optional, internal high-resolution graphics printer is also available for screen dumps; stripchart output formats capable of up to 200 cm/div.	
Hard copy Formats	TIFF b/w, TIFF color, BMP color, and BMP compressed
Waveform Output	
Store waveforms to floppy disk or optional PC-Card hard drives and memory cards. Save any trace you choose and select Auto Store to automatically store the waveform after each trigger.	
Output Formats	The ASCII waveform output is compatible with spreadsheets, MATLAB, MathCad, etc. Binary output is also available for reduced file size.
Documentation	
Included with all WavePro Oscilloscopes:	Operations Manual — hard copy Remote Programming Manual — hard copy CD-ROM — PDF formatted manuals plus software utilities including: ScopeExplorer, ActiveDSO, MaskMaker and DSO-Filter.

Ordering Information

WavePro Digital Oscilloscopes	Product Code		
2 GHz, 16 GS/s, 250 kpts/ch, 4 Channel Color DSO	WAVEPRO 960		
1 GHz, 16 GS/s, 250 kpts/ch, 4 Channel Color DSO	WAVEPRO 950		
500 MHz, 8 GS/s, 250 kpts/ch, 4 Channel Color DSO	WAVEPRO 940		
Included with Standard Configuration:			
10:1 10 MΩ Passive Probe (1 per channel)	PP005		
Operator's Manual, Quick Reference Guide, CD-ROM with OM/RCM PDF manuals, and utility software	WAVEPRO-OPDOCS		
Remote Control Manual	WP-RCM		
Floppy Disk Drive			
GPIB, RS-232-C, Centronics Parallel Port, VGA Video Output Port			
Protective Front Cover			
Performance Certificate			
Three-Year Warranty			
Memory Options	**960**	**950**	**940**
M 4 Mpts max, 1 Mpts/ch	•	•	(2 Mpts max)
L 16 Mpts max, 4 Mpts/ch	•	•	(8 Mpts max)
VL 32 Mpts max, 8 Mpts/ch	•	•	(16 Mpts max)
XL 64 Mpts max, 16 Mpts/ch	•	–	–
Hardware Options			
Internal Graphics Printer	WAVEPRO-GP02		
10 BaseT Ethernet LAN option	WAVEPRO-LAN10BT		
PC Card Slot	PCSLOT		
PC Card Slot including 1 hard drive card and 1 memory card	PCMEDIA		
Software Options			
WaveAnalyzer Pro Analysis Package (includes WAVA, JTA, and DFP)	WAVAPRO		
WaveAnalyzer Analysis Package	WAVA		
ITU G.703 Fully Automated Mask Tester	MT01		
ANSI T1.102 Fully Automated Mask Tester	MT02		
ITU G.957 STM-1 and STM-4 Fully Automated Mask Tester with O/E converter and reference receiver	MT03		
Jitter and Timing Analysis Package	JTA		
JitterPro	JPRO		
Clock Certification Timing Module (requires JitterPro)	CCTM		
Digital Filter Package	DFP		
Disk Drive Measurements	DDM		
Supplementary Disk Drive Measurements	PRML		
Advanced Optical Recording Measurements	AORM		
PowerMeasure Analysis Software	PMA1		
Selected Accessories			
Graphic Printer Paper/10 Rolls	GPR10		
Oscilloscope Cart	OC-PRO		
I GHz Active Voltage Probe	HFP 1000		
I.5 GHz Active Voltage Probe	HFP 1500		
2.5 GHz Active Voltage Probe	HFP 2500		
Warranty & Calibration			
NIST Calibration Certificate	CCNIST		
MIL STD Calibration	CCMIL		
Swiss OFMET Standard	CCOFMET		
5-Year Repair Warranty	W5		
5-Year NIST Calibration Contract	C5		
5-Year Warranty & NIST Calibration	T5		