

The LC584A Color Digital Oscilloscope – Powerhouse Performance at a Knockout Price



The LC584A family brings more raw horsepower to the task of troubleshooting long, complex signals than was previously available in any digital scope. It captures signals using 1 GHz amplifiers, sampling rates up to 8 GS/s, and 8 Mbytes of acquisition of memory.

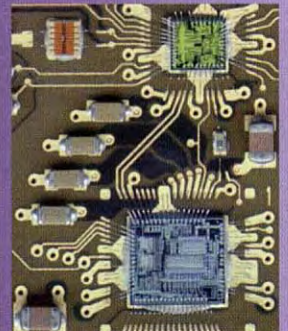
The LC platform is powered by a 96 MHz PowerPC microprocessor with up to 64 Mbytes of RAM.

Ten new proprietary ICs designed by LeCroy specifically for the LC584A family bring more power to troubleshoot problems while maintaining an easy-to-use front panel.

A premium quality color display with 9" viewing area accommodates the great variety of information that modern applications demand, with sharp detail, clarity and personal color choice.

- **1 GHz Bandwidth**
- **2 GS/s Single-Shot Sample Rate on 4 channels**
- **8 GS/s Maximum Sampling Rate**
- **Up to 8 Million Points of Acquisition Memory**
- **1 ms Maximum Sample Rate Window**
- **96 MHz PowerPC Microprocessor**
- **8 to 64 Mbytes System RAM**
- **9" Premium Quality Color Display Area**
- **Analog Persistence**
- **Full Screen Grid**
- **Transparent Color Mode**

LeCroy's new ADC technology captures analog signals and converts them to digital data measurements every 500 picoseconds.



Get the Complete Picture

10" CRT with 9" viewing area

Dedicated knobs for Timebase and Trigger Level

Fast graphics printer with landscape mode to view long signals

Auto Setup, Analog Persistence and Full Screen modes at the touch of a Button— no menus



High-bandwidth 1 GHz amplifiers with 2 GS/s ADCs and up to 2 Mbytes of acquisition memory on each channel

Advanced Trigger including capture of glitches down to 600 ps

PCMCIA Options for memory card, portable hard drive or ATA flash allow fast data storage and retrieval

Dedicated knobs for voltage sensitivity and offset



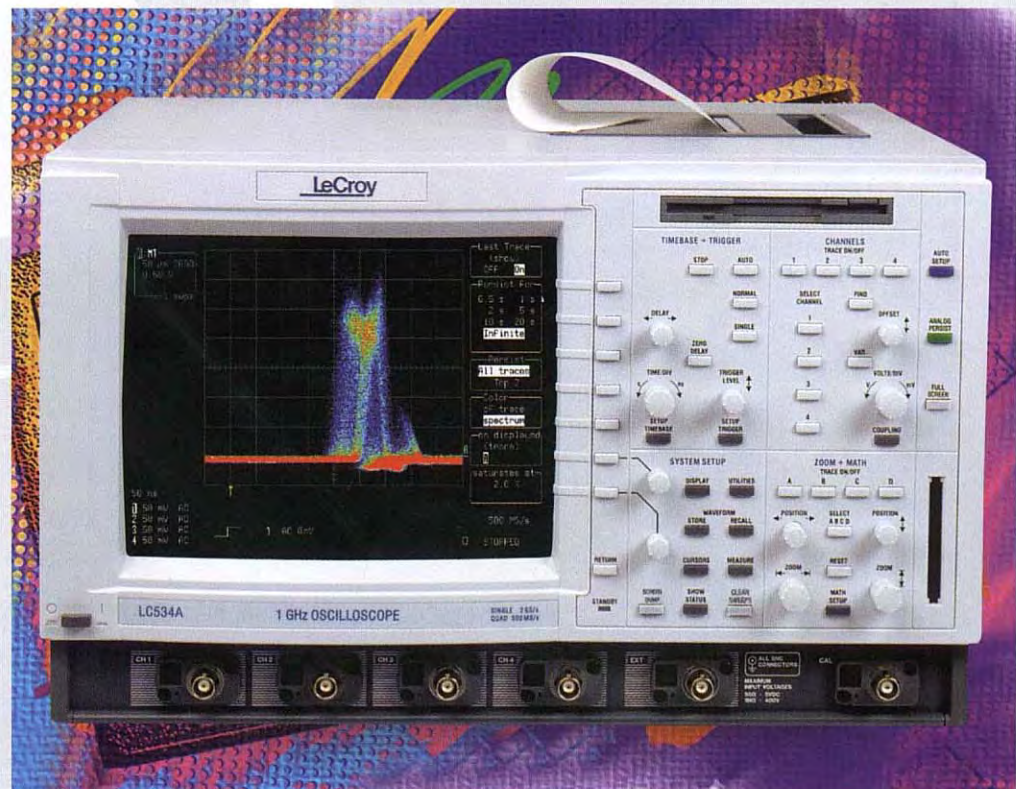
The LC Series of Premium Color Digital Oscilloscopes

- 500 MHz and 1 GHz Bandwidth
- 500 MS/s to 8 GS/s Single-Shot Sample Rate
- 50 k to 8 Mpoints of Acquisition Memory
- 8 to 64 Mbytes System RAM
- 4 ms Maximum Sample Rate Window
- 96 MHz PowerPC Microprocessor
- 9" Premium Quality Color Display Area
- Analog Persistence
- Full Screen Grid
- Transparent Color Mode

The LC series of DSOs is the first to be built on an innovative technology platform that explores new dimensions in signal **capture, viewing and analysis.**

The LC platform is powered by a 96 MHz PowerPC microprocessor supported by copious RAM and cache memory. LC series scopes offer high-performance

amplifiers and ADCs, complemented by LeCroy's unique memory management. SMARTMemory is the core of the LC series' integrated analysis system: a system that enables engineers to solve the challenging problems of state-of-the-art applications.



Unique Disk Drive Analyzers

- Drive-Specific Triggers
- PRML Channel Emulation
- Automatic PRML Channel Error Identification
- PRML Data Channel Quality Analysis
- User-Selected or Defined Drive Filtering
- IDEMA Standard Measurements (TAA, PW50, Overwrite and more!)
- Asymmetry Measurements
- Drive Analysis Graphs
- 1 GHz Bandwidth
- 2 GS/s on 4 Ch (8 GS/s interleaved)
- 4 Mpoint/Ch Acquisition Memory



LeCroy Disk Drive Analyzers (DDAs) are designed to meet the specific **capture, viewing and analysis** needs required by engineers and technicians performing disk-drive analysis. The DDA family provides all the capabilities of LeCroy LC family of oscilloscopes with additional disk drive-specific capabilities.

Included with LeCroy Disk Drive Analyzers are PRML data channel emulation, customized triggers for capture of disk drive signals, a rich set of drive-specific signal measurement parameters, and drive

analysis graphs. These allow you to rapidly evaluate the quality of your drive signals, find signal errors and determine the causes of errors or of insufficient quality.

An intuitive user interface has been designed for easy access to the DDA disk-drive capabilities. In addition, the instrument still retains nearly identical operation to popular LeCroy LC oscilloscopes for when you are not taking advantage of the DDA family's drive-specific capabilities.

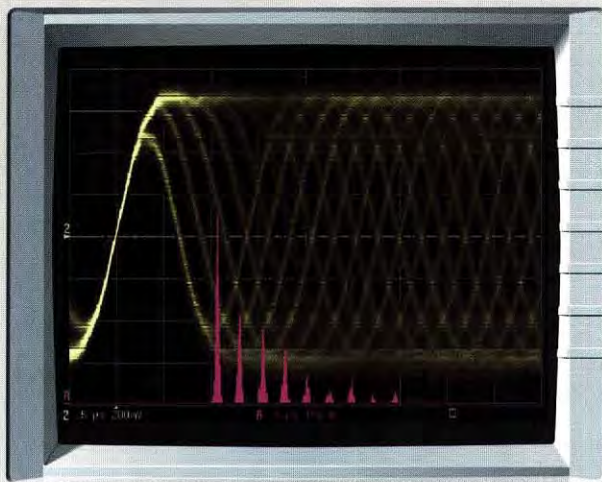
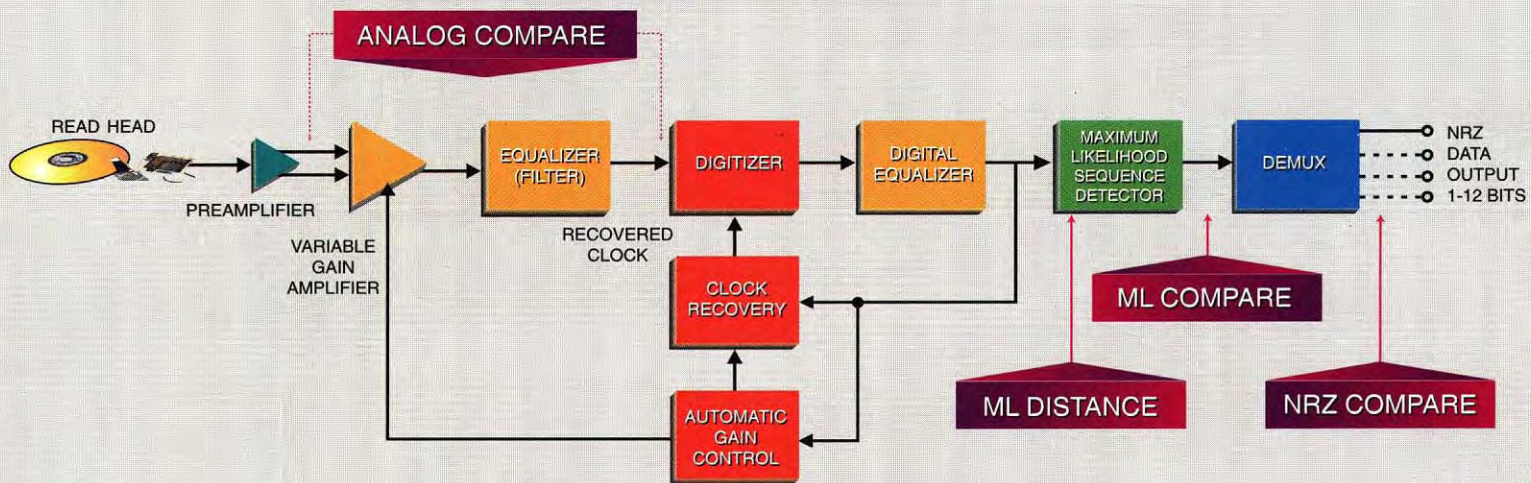
Disk Drive Failure Analysis Package

With DDFA you can "View" the head signal through the entire channel from the preamp, after equalization, at the Viterbi detector and, finally, as NRZ data.

- Locate Drive Errors Automatically
- Easily Find and Analyze even Rare, Intermittent Errors
- View How Far PRML Signals are from their Ideal Target Points



LeCroy's new Disk Drive Failure Analysis package can locate errors in heads, read channels or media using five error location methodologies. It can also identify the root causes of errors or insufficient head signal quality.



Optical Recording Measurement Package

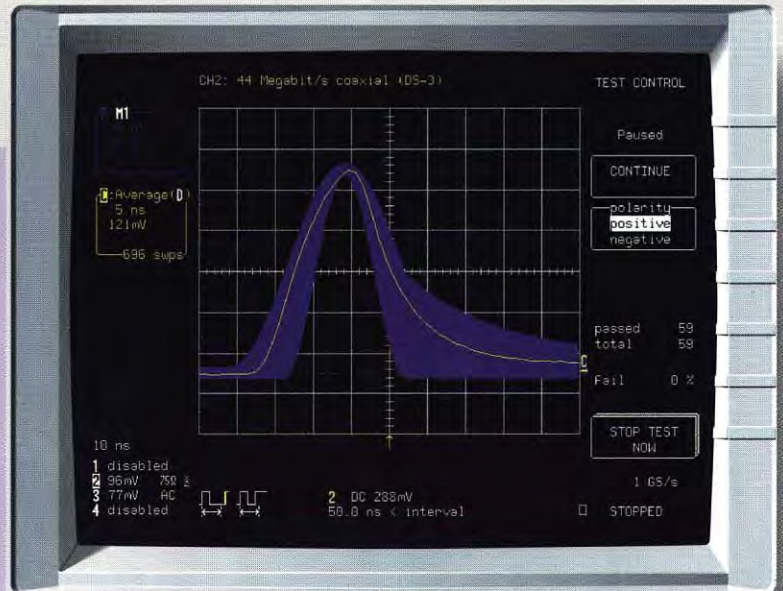
The **Optical Recording Measurement package** enables design engineers to quickly view, measure and analyze signals from CD-ROM, Magneto-Optical, and the new Digital Video Disk (DVD) drives. Engineers around the world are now using LeCroy test instruments to develop these exciting new technologies.



<http://www.lecroy.com> VISIT US AT OUR WEB SITE

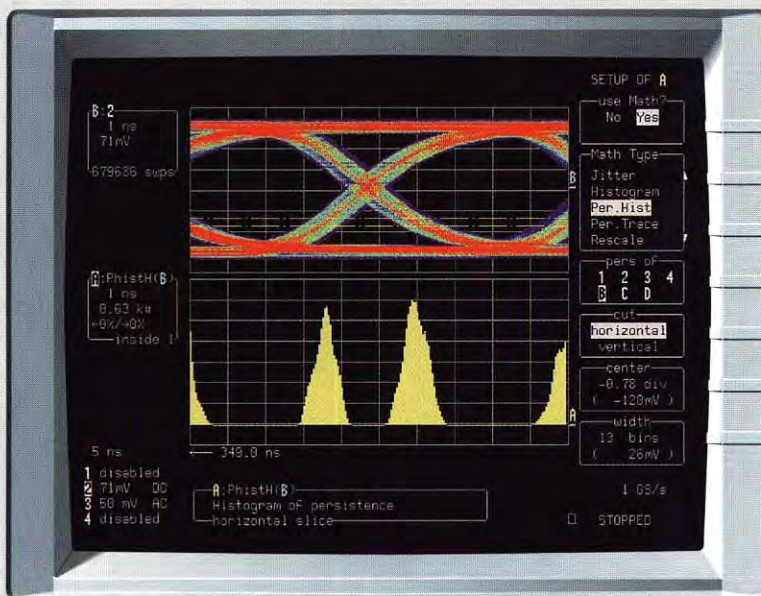
Solutions for Communications Problems

- **EASY TO USE** – Fully Automated
- **Works on Random-Bit Patterns**
- **Tests Positive and Negative Shape Pulses**
- **Self-Aligning**
- **Self-Scaling**
- **Includes all Necessary Balanced and Coax Adapters**
- **Dedicated Menus**
- **Full Remote Control Support for Automated Testing**



Mask Testing

LeCroy's powerful and innovative Mask Tester instantly transforms your digital oscilloscope into a dedicated mask-testing device specifically designed for manufacturing, type approval and field testing.



- **Powerful:** Exclusive Finder function allows pulses or patterns to be easily isolated - even from random-bit streams. Mask alignment is totally automatic, saving valuable testing time.
- **Easy to use:** The scope displays only the Tester's dedicated menus, blocking unneeded control and reducing setup errors.
- **Convenient:** Included in the package are all the twisted-pair and 75 Ω interfaces you'll need for quality cable termination and exact amplitude scaling.

Jitter Analysis

The LeCroy Jitter & Timing Analysis Package (JTA) is dedicated to providing accurate, high-confidence timing measurements on LeCroy oscilloscopes. JTA addresses the ever-growing need to precisely characterize a waveform's timing stability — essential to applications such as synchronous networks or digital systems.



The Benefits of Performance Digital Oscilloscopes

Digital scopes are key tools used in the diagnosis, test, and evaluation of electronic circuits and systems. LeCroy performance DSOs provide the ease of use, reliability, and performance required by engineers to quickly solve electronics problems. LeCroy's digital scopes integrate advanced digital signal processing technology and a powerful processor with software solutions to save you valuable time in solving problems. LeCroy's Performance DSOs provide the power needed to capture, view, and analyze signals while keeping the instrument easy to use.

CAPTURE

Capturing signals over a wide range of timebase settings at high sample rates while maintaining fast front panel responsive is made possible by LeCroy's long record lengths and a high-speed RISC microprocessor based system, which includes up to 64 Mbytes of RAM. LeCroy scopes offer the longest record length in the industry - 2 Mbytes of data acquisition memory per channel which can be combined to 8 Mbytes on a single signal. The LeCroy SMARTMemory system provides total memory management which:



- Dynamically assigns maximum acquisition memory to each active trace to keep sampling rate high
- Applies a patented max/min sorting algorithm to data records to quickly create a display which shows the important signal features
- Assigns resources of computational/storage RAM to the tasks selected.

LeCroy technology has been used to achieve the fastest DSO single-shot sampling rate on the market. The model 9362C at 10 GS/s can display the finest details on short, fast signals.

Capturing a signal at the appropriate timebase setting with the best accuracy coupled with rapid data resource assignment and processing enables you to solve problems faster.

VIEW

The bright, nine-inch display provided on all LeCroy DSOs offers you a large viewing area where you can really see the details in a signal. The 9300C series offers a high resolution amber display, while the LC series has both traditional color-graded persistence display and a new "analog persistence" intensity-graded color display mode. Engineers who spend much of their day in front

of an oscilloscope appreciate the larger view of the signal, and with a choice of 1, 2, 4 or 8 grids, it is easy to separate waveforms and numerical measurements. Seeing more details in a set of signals on the large viewing area of a LeCroy DSO helps you quickly gain insight into the source of a problem.

ANALYZE

LeCroy DSOs have the most advanced set of signal diagnostic, troubleshooting and documentation tools available, and in many cases, they can eliminate the need to transfer captured signals for analysis off-line. This includes the measurement of over 40 signal parameters, worst case analysis (maximum, minimum, average and standard deviation) on those parameters, an FFT package with capability to resolve 4 million time domain samples into the frequency domain, the ability to daisy chain math functions (such as squaring a waveform and then integrating). LeCroy offers an unmatched advanced math package with integration, differentiation, square root, absolute value, ratio, exponential, log and a set of six selectable digital filters. An optional histogramming and trend capability helps you fully characterize signal instabilities such as timing jitter or amplitude fluctuations. The Pass/Fail test package includes the abil-



ity to test each of the four input channels against separate test masks and to combine mask testing with go/nogo testing of key signal parameters.

Documentation tools include the ability to save data to floppy disk, GPIB, RS-232-C, internal memory, PC memory card, 170 Mbyte PCMCIA portable hard drive or an internal, high-speed graphics printer.

POWER TOOLS FOR ENGINEERS

Engineers who use a scope for troubleshooting and have not tried a LeCroy DSO will find substantial benefits in LeCroy's tool set. For example, LeCroy's Performance FFT package differs from those available from other vendors by offering the ability to compute frequency spectra based on up to 4 million time domain sample points. This translates directly into better frequency resolution and more insight into the frequency characteristics of the signal. Worst case parameter tracking offers you the chance to monitor key signal characteristics and display the average, maximum and minimum values of those parameters. This enables you to quickly identify worst case performance of pulse widths, amplitudes, timing jitter, or any other of over 40 signal characteristics. The large display of a LeCroy scope can show single, dual, quad, or octal grids. You can zoom in to see details on any part(s) of the signal, perform a math operation on any segment or the complete waveform, and even perform diagnostics that require "math-on-math" (such as squaring a waveform and then integrating it to find the total power). When searching for intermittents, the Exclusion Trigger allows LeCroy DSOs to avoid the deadtime inherent in other scopes which spend most of their time triggering on the normal signal. Engineers familiar with the aliasing problems caused by short memory will appreciate that all display/triggering modes of LeCroy DSOs take advantage of the full power of the data acquisition memory rather than limiting the acquisition to 500 points as found in the specialized view modes of some digital scopes.

THE POWER OF THE LECROY SCOPE ARCHITECTURE

LeCroy's Performance lines (LC564A, LC584A, LC574A, LC534A, LC374A, LC334A, 9384C, 9374C and 9354C) offer four channels of simultaneous sampling with up to 2 Mbytes of memory per channel. This may be combined to provide two channels at twice the sampling rate and 4 Mbytes of acquisition memory or one channel with four times the sample rate and 8 Mbytes record length. Long memories allow the digital storage oscilloscope to operate at the highest sampling rate over a wide range of timebase settings. To complement the long acquisition memories, these scopes can be fitted with up to 64 Mbytes of processing RAM for your most demanding analysis needs. The scope is thus capable of performing extensive waveform math and processing while still maintaining fast screen update rate and lively front panel controls. This capability is achieved through the integrated use of a 96 MHz PowerPC processor in the LC series, or a 32 MHz 68030/68882 combination in all 9300C series DSOs. Competing DSOs that lack LeCroy's integrated processing power and memory capacity are unable to effectively deliver this capability. Another vendor's DSOs might capture 500 kpoints of data but only be able to perform an FFT on 10 kpoints, high resolution computations on 50 kpoints, integrate 130 kpoints or store 250 kpoints to memory. Those types of barriers are eliminated in LeCroy digital scopes.

MASS STORAGE FOR DSOs

A PCMCIA Type III Hard Disk capability is optionally available for any LeCroy DSO. A removable hard disk of 170 Mbytes provides great capacity and flexibility for fast storage and retrieval of waveforms and instrument settings. This slot also supports ATA Flash memory cards. This facility is an integral part of a powerful and exceptional combination of available documentation features that include DOS-compatible 3.5" floppy disk and optional IC memory card interface (PCMCIA Type II port) and a built in high-speed graphics printer. These tools permit a

gain in productivity by making the data captured by a LeCroy scope easily accessible and transferable. GPIB, Centronics and RS-232-C interfaces are available for programming or printing/plotting. The optional internal graphics printer produces full-resolution screen dumps in under 10 seconds. In landscape mode, the printer can produce fully detailed hard copies of long waveforms by making printouts up to 100 feet long.

PROBES

All LeCroy scopes are supplied with LeCroy's ProBus Intelligent Probe Interface. This unique feature permits them to be used with a range of FET probes, controlling the probe from the scope's front panel. The FET probes provide extremely low (1 M Ω , 2 pF) circuit loading and up to 1 GHz bandwidth at the probe tip. Passive probes are provided as standard accessories with most models. FET probes with bandwidths up to 2.5 GHz are available. A wide range of optional probes are available including differential amplifiers with comparators, and differential probes with gain to 1000, CMRR to 100,000:1, and bandwidth to 250 MHz. A new DC-50 MHz current probe is effective for measurement of DC, AC and impulse currents. The PPE series of high-voltage probes provides a selection of models ranging from 100 to 300 MHz and 600 to 20 kV.

INNOVATIVE PEAK-DETECT CIRCUIT

Peak-detect is a common feature among many high-end DSOs, because it allows them to show fast phenomena that might otherwise be missed due to undersampling. One undesirable effect of most peak-detect systems, however, is a severe loss of horizontal (time) precision. This happens because detected peaks are known to have occurred during a certain interval, but the specific time at which they occurred is not known. Signals acquired with other manufacturers' peak-detect techniques therefore may not be successfully used for further analysis or processing.

LeCroy solves this problem by maintaining both peak-detected and nor-

mally sampled waveforms for each signal. So you get all the benefits of peak-detection without any loss of time precision. LeCroy is the only scope manufacturer to use this innovative technique. This feature is not available in the LC564A/584A series which are designed for troubleshooting of high-speed circuits.

SMART TRIGGER® AND WAVEFORM PROCESSING

Some DSO manufacturers put their best troubleshooting triggers only in their most expensive scopes. But many who use 200-400 MHz DSOs would prefer state-of-the-art triggering tools. All LeCroy DSOs include SMART Trigger capability. In addition to Edge and Window Trigger, the SMART Trigger offers Glitch, Pulse Width, Interval Width, State and Edge Qualified, Dropout, and TV triggers. Time and Events Holdoff are also provided. The scopes include LeCroy's Exclusion Trigger mode which allows you to set the oscilloscope to trigger only when an abnormal signal width or period occurs.

OPTIONAL ANALYSIS PACKAGES

An optional Parameter Analysis Package, option WP03, provides extensive statistical analysis capabilities. Detailed measurements can easily be performed on difficult to characterize waveform phenomena such as amplitude fluctuation and timing jitter. Live histogram displays represent the statistical distribution of selected waveform parameter measurements. The trend function draws line graphs to track the value of measured parameters. You can even use math functions such as differentiation to process the trend data.

The DDM and PRML disk drive packages are powerful firmware options that provide a unique integrated tool for engineers developing and testing high-density storage media. The Disk Drive Measurement (DDM) package,

developed specifically for those who design and test disk drives and magnetic tape, is based on the IDEMA Standard Measurements for Magnetic Media and includes calculations of Time Average Amplitude (TAA), Pulse Width at 50% (PW50), Resolution, and Overwrite. The Partial Response Maximum Likelihood (PRML) package is also for magnetic media testing and allows the calculation of Auto Correlation, Non-Linear Transition Shifts and Auto Correlation Signal-to-Noise. The advanced analysis can be displayed in histograms and as worst case parameters.

A new disk drive package from LeCroy, DDFA, adds powerful PRML signal failure detection and isolation capabilities to LeCroy oscilloscopes. DDFA provides several tools that can be used to automatically determine when a PRML signal failure occurs. In addition, once failures are detected, the corresponding head signal locations where the errors occur can be directly selected for display and analysis. DDFA also enhances the view of the head signal, through performing PRML drive channel emulation. An emulation of the drive channel noise and equalization filter is performed to display a more easily analyzed head signal. The head signal is annotated with markers that display the ideal PRML target points that the filtered signal should intersect. The difference between the head signal and the ideal target points provides a clear visual indication of PRML signal quality.

The ORM Optical Recording Measurements package allows engineers engaged in the design or test of optical recording media (CD-ROM, magneto-optical or DVD) to make measurements which are specific to that media. Data can be displayed as parametric measurements, histograms or trend lines.

Telecommunications Mask Test packages, with balanced and coax adaptors, are available for ITU G.703 and ANSI T1.102 standards. These telecommunications packages transform LeCroy oscilloscopes into dedicated telecommu-

nications mask testers. The input signal is automatically scaled and aligned within the mask, and our exclusive Finder search engine isolates pulses and patterns even in random-bit streams.

UPGRADE YOUR DSO

Digital scopes are capital equipment with a cost ranging from \$5K to \$35K. To protect the value of your investment, LeCroy offers an upgrade path to keep up with the latest technology. You can upgrade your DSO's hardware or software, or add analysis packages as your needs change or as new packages are offered. Suppose your next project involves longer, more complex signals. You will need more acquisition memory in your digital scope. Perhaps the application is driven by the need for really fast measurement results. You can add up to 64 Mbytes of RAM and add an analysis package. LeCroy is the only scope vendor that will upgrade DSOs to add more acquisition or processing memory. Maybe you would like to transfer a scope to manufacturing where I/O throughput for ISO9000 documentation is critical. LeCroy can add a PCMCIA portable hard drive, fast internal printer or IC memory card.

SUMMARY

If the ability to use a DSO to solve problems quickly is important to you, then a LeCroy Performance DSO should be on your list. LeCroy scopes offer outstanding abilities to capture, view and diagnose electronic problems. The measurement and documentation tools available for these scopes improve productivity and help companies get new products to market faster.



LC Series Selection Guide

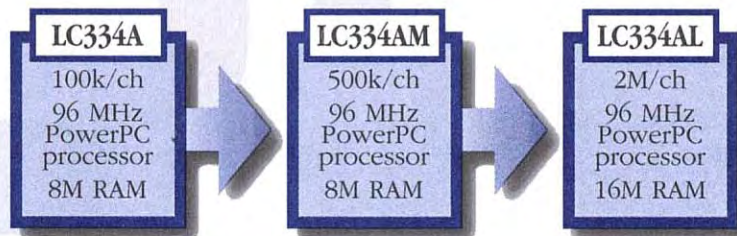
HIGH-PERFORMANCE COLOR DIGITAL OSCILLOSCOPES

LeCroy Model Number	Analog BW (Minimum)	Max Transient Sample Rate	Max Repetitive Sample Rate	Number of Channels	Memory per Channel
LC564A	1 GHz	4 GS/s	25 GS/s	4	100k/4 ch 250k/2 ch 250k/1 ch
LC584AL	1 GHz	8 GS/s	25 GS/s	4	2M/4 ch 4M/2 ch 8M/1 ch
LC584AM	1 GHz	8 GS/s	25 GS/s	4	500k/4 ch 1M/2 ch 2M/1 ch
LC584A	1 GHz	8 GS/s	25 GS/s	4	100k/4 ch 250k/2 ch 500k/1 ch
LC574AL	1 GHz	4 GS/s	10 GS/s	4	2M/4 ch 4M/2 ch 8M/1 ch
LC574AM	1 GHz	4 GS/s	10 GS/s	4	500k/4 ch 1M/2 ch 2M/1 ch
LC574A	1 GHz	4 GS/s	10 GS/s	4	100k/4 ch 250k/2 ch 500k/1 ch
LC534AL	1 GHz	2 GS/s	10 GS/s	4	2M/4 ch 4M/2 ch 8M/1 ch
LC534AM	1 GHz	2 GS/s	10 GS/s	4	500k/4 ch 1M/2 ch 2M/1 ch
LC534A	1 GHz	2 GS/s	10 GS/s	4	100k/4 ch 250k/2 ch 500k/1 ch
LC334AL	500 MHz	2 GS/s	10 GS/s	4	2M/4 ch 4M/2 ch 8M/1 ch
LC334AM	500 MHz	2 GS/s	10 GS/s	4	500k/4 ch 1M/2 ch 2M/1 ch
LC334A	500 MHz	2 GS/s	10 GS/s	4	100k/4 ch 200k/2 ch 400k/1 ch

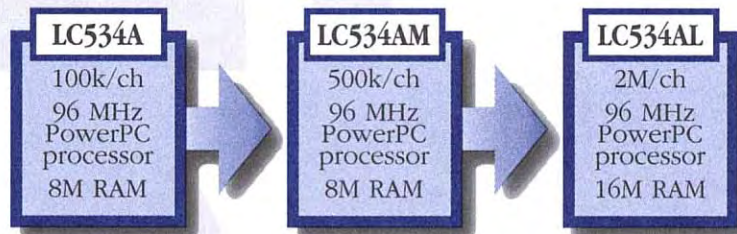


LC Series Upgrade Guide

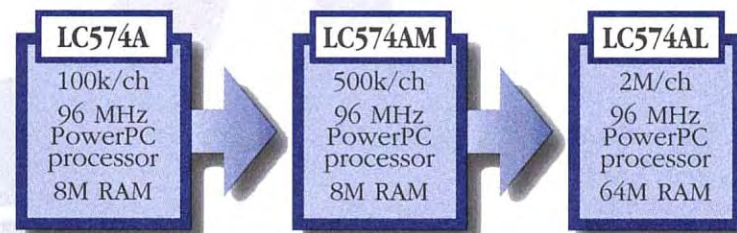
LC334A SERIES - 500 MHz; 4 CHANNEL DSOs



LC534A SERIES - 1 GHz; 4 CHANNEL DSOs



LC574A SERIES - 1 GHz; 4 CHANNEL DSOs



LC584A SERIES - 1 GHz; 4 CHANNEL DSOs



LC564A

LC584A

LC584AM

LC584AL

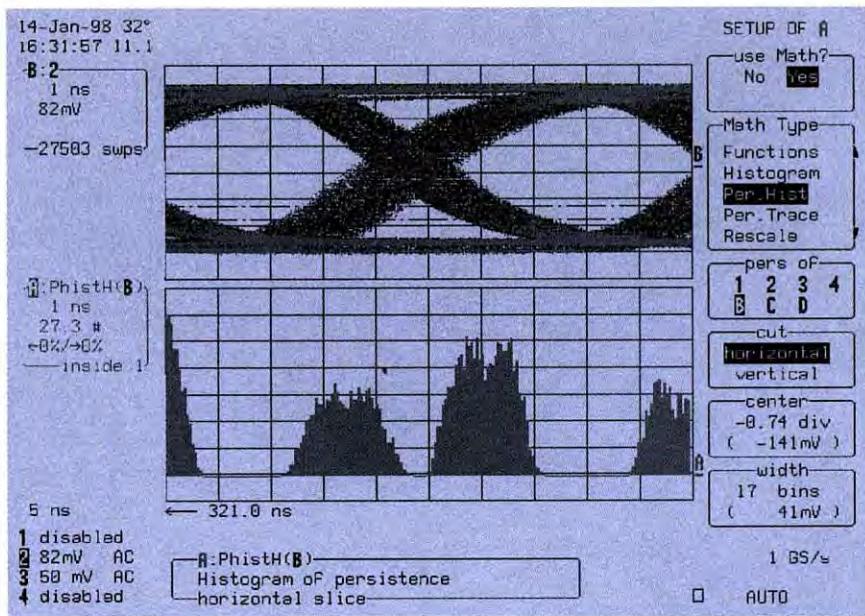
MAIN FEATURES

- 1 GHz Bandwidth
- Up to 8 GS/s Single-Shot Sample Rate
- Up to 8 Million Points of Acquisition Memory
- 600 ps Glitch Trigger
- 96 MHz PowerPC Microprocessor
- Advanced runt and Slew Rate Trigger
- Up to 64 Mbyte System RAM
- 9" Color Display with 8 Traces
- Analog Persistence
- Full Screen Grid
- Auto Scroll

Digital oscilloscopes from LeCroy are designed to save engineers valuable time in troubleshooting and problem-solving.

Each oscilloscope is an integrated and powerful system providing the capability to:

- Capture the key events with high resolution for longer time intervals
- View data like never before, giving you more information more quickly, with a large, color CRT and advanced display techniques
- Analyze your signal to get answers quickly and more accurately with a powerful processing system and math packages.



9" COLOR DISPLAY

LeCroy provides a very large, sharp oscilloscope screen that is 50% larger in total viewing area than a 7" screen.

Its powerful features include Analog Persistence, Color-Graded Persistence, Full Screen mode, Opaque or Transparent display, color association and personal color schemes. These provide the user with outstanding benefits that accelerate visual processing and effective communication of on-screen information.

HIGH-SPEED ACQUISITION

The design and debug of fast digital systems and the need to capture fast, transient signals require high speed signal capture. The high 8 GS/s sample rate, 1 GHz bandwidth and long memory of the LC584A series provide a flexible solution for capturing and viewing fast glitches and rise/falltimes.

LARGE SAMPLE RATE WINDOW

Having a high sample rate in a DSO is only the first step to preserving data integrity. The time window over which this sample rate is available is also of

critical importance. Long acquisition memory maintains the oscilloscope's highest sample rate for large time windows allowing the user to sample long signals with high horizontal resolution.

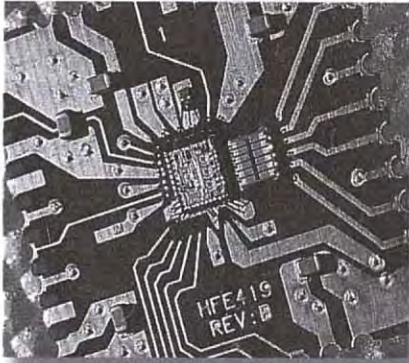
With up to 8 million points of acquisition memory, the maximum 8 GS/s sample rate of these oscilloscopes is maintained for a time window of 1 ms. This sample rate window enables the user to record long signals with high resolution.

OPTIMUM PERFORMANCE

SMARTMemory is a Total Memory Management system that dynamically allocates resources of microprocessor power, acquisition memory and processing RAM. The intelligent management provided by SMARTMemory guarantees optimal usage of oscilloscope resources.

The 96 MHz PowerPC microprocessor at the heart of these DSOs drives the system to produce results fast, providing rapid waveform update and super panel responsiveness.





High-performance signal conditioning devices preserve signal content.

QUICK DIAGNOSES

Capturing and viewing waveforms is fundamental to an oscilloscope. Productivity improvements are accessible by using built-in math functions to assist troubleshooting and diagnoses of circuit problems.

The signal analysis capability of these DSOs is enhanced by advanced waveform math, spectrum analysis, and waveform parameter analysis. This analysis capability greatly increases the speed with which circuit problems are clearly identified and solved.

ANALOG PERSISTENCE

At a push of the green button, the user can switch between an analog-style view and a digital view of signals on these oscilloscopes.

The depth of signal information can be explored along the third dimension of the waveform display to give the user a complete picture of waveform activity.

Unlike an analog oscilloscope, all signal data is captured and available in memory for analysis and measurements. Analog Persistence gives the user the best of both the analog and digital worlds of oscilloscopes.

FULL SCREEN GRID

These LeCroy DSOs not only have a very large 9" screen but also provide a display mode with an extra-large grid. In Full Screen mode, all of the screen area is used to display signals.

8-TRACE DISPLAY

An 8-trace display with any combination of math functions, zooms, reference memories or channels is a standard feature in the LC series.

Octal grid display is available in normal and Full Screen display modes, with and without parameters displayed.

AUTO SCROLL

Auto Scroll displays the captured signal with a zoom expansion and automatically moves it across the screen. Scroll speed, starting point and pausing are freely selectable.

EASY DOCUMENTATION

All waveform data and results of analysis can be quickly saved to floppy disk or to an optional memory card, ATA flash card, or a removable hard disk. This provides an efficient way to archive information and facilitates easy documentation of results.

An internal graphics printer (standard in LC584AL) outputs screen dumps in seconds providing the user with an immediate and clear record of signal activity.

SIGNAL CAPTURE

ACQUISITION SYSTEM

Bandwidth (-3 dB):

- @ 50 Ω: DC to 1 GHz
- @ 1 MΩ: DC to 500 MHz typ. at PP005 probe tip; DC to 1 GHz at probe tip with optional AP020 1 GHz FET probe

No. of Channels: 4

Sample Rate:

- LC584A/M/L: 8 GS/s (1 Ch), 4 GS/s (2 Ch), 2 GS/s (4 Ch)

- LC564A: 4 GS/s (2 Ch), 2 GS/s (4 Ch)

Acquisition Memory:

See table below.

Sensitivity:

- 2 mV/div to 1 V/div, 50 Ω, fully variable.
- 2 mV/div to 10 V/div, 1 MΩ, fully variable.

Scale factors: Choice of over 12 probe attenuation factors selectable via front panel menus.

Offset Range:

- 2.00 - 4.99 mV/div: ±400 mV
- 5.00 - 99 mV/div: ±1 V
- 0.1 - 0.99 V/div: ±10 V
- 1.0 - 10 V/div: ±100 V (1 MΩ only)

±20 V across the whole sensitivity range when using the AP020 FET probe.

DC Accuracy: Typically 2% of Full Scale.

Vertical Resolution: 8 bits

Bandwidth Limiter: 25 MHz and 200 MHz typical.

Input Coupling: AC (>10 Hz typ.), DC, GND

Input Impedance: 10 MΩ//15 pF max (using PP005 probe), or 50 Ω ±1%.

Max Input Voltage:

- 1 MΩ: 400 V (DC + peak AC @10 kHz)
- 50 Ω: ±5 V DC (500 mW) or 5 V RMS

ACQUISITION MODES

Random Interleaved Sampling (RIS):

25 GS/s. For repetitive signals from 200 ps/div to 1 μs/div.

Single shot: For transient and repetitive signals from 0.5 ns/div (4 ch), 1 ns/div (2 ch), 2ns/div (1 ch).

Sequence: Stores multiple events - each of them time stamped - in segmented acquisition memories.

Number of Segments Available:

- LC584A/564A 2 - 1000
- LC584AM/L 2 - 2000

Active Channels	Maximum Sampling Rate	Maximum Record Length			
		LC564A	LC584A	LC584AM	LC584AL
4	2 GS/s	100 k	100 k	500 k	2 M
2	4 GS/s	250 k	250 k	1 M	4 M
1	8 GS/s	N/A	500 k	2 M	8 M

Measurements

CURSOR MEASUREMENTS

Relative Time: A pair of arrow cursors measure time differences and voltage differences relative to each other.
Relative Voltage: A pair of line cursors measure voltage differences relative to each other.
Absolute Time: A cross-hair marker measures time relative to the trigger and voltage with respect to ground.
Absolute Voltage: A reference bar measures voltage with respect to ground.

AUTOMATED MEASUREMENTS

The following parametric measurements are available, together with their Average, Highest, Lowest values and Standard Deviation:

amplitude	cycles	fall	mean-	peak to peak	top
area	delay	f 80-20%	median	rise	width
base	$\Delta c2d-$, $\Delta c2d+$	f@level	minimum	r 20-80%	
cmean	Δ delay	first	overshoot+	r@level	
cmedian	Δ @level	frequency	overshoot-	rms	
crms	duration	last	period	std dev	
csdev	duty	maximum	phase	t@level	

PASS/FAIL: Pass/Fail testing allows any 5 items (parameters and/or masks) to be tested against selectable thresholds. Waveform Limit Testing is performed using masks which may be defined either inside the instrument or, for instance, by downloading templates created with ScopeExplorer. Any failure will cause preprogrammed actions such as Hardcopy, Save to internal memory, Save to mass storage device (card or disk), GPIB SRQ or Pulse Out.

TIMEBASE SYSTEM

Timebases: Main and up to 4 Zoom Traces.

Time/Div Range: 500 ps/div (at 8 GS/s), 1 ns/div (at 4 GS/s), 2 ns/div (at 2 GS/s) to 1,000 s/div.

Clock Accuracy: ≤ 10 ppm

Interpolator resolution: 10 ps

Roll Mode: 500 ms/div to 1,000 s/div

External Clock: Optional DC to 500 MHz rear panel fixed frequency clock input. (< 20 ns rise/falltime)

External Reference: Optional 10 MHz rear-panel input.

ADDITIONAL INFORMATION

INTERFACING

Remote Control: All front-panel controls as well as all internal functions are possible by GPIB and RS-232-C.

RS-232-C Port (Standard): Asynchronous up to 115.2 kBaud for computer/terminal control or printer/plotter connection.

GPIB Port (Standard): (IEEE-488.2)

Configurable as talker/listener for computer control and fast data transfer.

Centronics Port: Hardcopy parallel interface.

Hardcopy: Screen dumps are activated by a front-panel button or via remote control. Supported printers:

B/W: LaserJet, DeskJet, Epson

Color: DeskJet, Epson, Canon BJC 200/400/600

An optional, internal, high-resolution graphics printer is also available for screen dumps; stripchart output formats up to 2 m/div are achievable.

Hardcopy Formats: TIFF b/w, TIFF color, BMP color and BMP compressed.

Output Formats: ASCII waveform output. Compatible with spreadsheets, MATLAB, MathCad. Binary output is also available.

GENERAL

Auto-calibration ensures specified DC and timing accuracy.

Calibration Time: < 500 ms

Recommended Factory Calibration

Interval: 1 year

Temperature: 5° to 40°C rated accuracy (41° to 104°F). 0° to 45°C operating (32° to 113°F).

Humidity: $< 80\%$ non-condensing.

Altitude: Up to 4600 m (operating), 40°C (104°F) max.

Shock and Vibration: Conforms to selected sections of MIL-PRF-28800F, Class 3.

Power: 90-250 V AC, 45-400 Hz, 500 W.

Battery Backup: Front-panel settings maintained for two years.

Dimensions: (HWD) 10.4" x 15.65" x 17.85", 264 mm x 397 mm x 453 mm.

Weight: typ. 20 kg (44 lbs) net, typ. 28 kg (61.6 lbs) shipping.

Warranty: Three years.

CE Approval

EMC: Conforms to EN50081-1 (Emissions) and EN50082-1 (Immunity)



Signal Analysis

SIGNAL ANALYSIS

RAPID PROCESSING SYSTEM

Microprocessor: 96 MHz PowerPC 603e.
System RAM: 16 to 64 Mbytes.
Video Memory: 1 Mbyte.
Persistence Data Map Memory: 16 bits per displayed pixel (64k levels).

WAVEFORM PROCESSING

Up to four processing functions may be performed simultaneously. Functions available are: Add, Subtract, Multiply, Divide, Negate, Identity, Summation Averaging, Sine x/x.

Average: Summed averaging up to a million sweeps.
Envelope: Max, Min, or Max and Min values of up to one million sweeps.
Extrema: Roof, Floor, or Envelope values from 1 to 10⁶ sweeps.
ERES: Low-Pass digital filters provide up to 11-bit vertical resolution. Sampled data is always available, even when a trace is turned off.
FFT: Spectral Analysis with four windowing functions and FFT averaging.
Statistical Diagnostics*: The Parameter Analysis package permits in-depth diagnostics on waveform parameters. Live histogramming of any waveform parameter measurement is possible, and the histogram can be autoscaled to display the center and width of the distribution.
 Any of the above processes can be invoked without losing the data.
**Histogramming and Trending are part of the Parameter Analysis Package.*

INTERNAL MEMORY

Waveform Memory: Up to four 16-bit Memories (M1, M2, M3, M4).
Processing Memory: Up to four 16-bit Waveform Processing Memories (A, B, C, D).
Setup Memory: Four non-volatile memories. The floppy disk or optional cards or portable hard drive may also be used for high-capacity waveform and setup storage.

Safety: The oscilloscope has been designed to comply with EN61010-1 Installation Category (Over-voltage Category) II, 300V, Pollution Degree 2.

UL and cUL approved: UL standard: UL 3111-1; cUL Canadian Standard CSA-C22.2 No. 1010. 1-92.

SIGNAL VIEWING

Type: Color 10" Raster Scan CRT, 0.26mm dot pitch with a 9" viewing area.

Resolution: VGA (640 x 480 points)

Controls: Rear-panel presets for position, brightness and contrast. Menu controls for brightness and color selection.

Grid Styles: Single, Dual, Quad,

Octal, XY, Single+XY, Dual+XY, and Full Screen - an enlarged view of each grid style.

Graticules: Internally generated; separate intensity control for grids and wave-forms. Selectable blending of grid with displayed traces.

Waveform Style: Dot Join with optional sample point highlight or Dots only.

Persistence Modes: Color-graded persistence and Analog Persistence, infinite or variable with decay over time. In color-graded persistence, a color spectrum from red through violet is used to map signal intensity. With Analog Persistence, the brightness level of a single color denotes signal intensity. Each trace's persistence data is stored in 64k levels.

Trace Display: Opaque or transparent mode, with overlap management.

Number of Traces: 8 (any mix of channels, memories or Math functions).

Real-time Clock: Date, hours, minutes, seconds.

External Monitor: Rear-panel 15-pin socket for VGA compatible monitor.

Vertical Zoom: Up to 5x vertical expansion (50x with averaging, up to 40 μ V/div sensitivity).

Horizontal Zoom Factor: Waveforms can be expanded up to 5 points/screen.

TRIGGERING SYSTEM

Modes: Normal, Auto, Single, and Stop.

Sources: CH1, CH2, CH3, CH4, Line, EXT, EXT/5. Slope, Level and Coupling are unique for each source.

Slope: Positive, Negative, Bi-Slope (Window in & out).

Coupling: DC, AC (>10 Hz), HF (175 MHz - 2 GHz), LFREJ (>50 kHz), HFREJ (<100 MHz)

Pre-trigger recording: 0 to 100% of full scale (adjustable in 1% increments).

Post-trigger delay: 0 to 10,000 divisions (adjustable in 0.1 div. increments).

Holdoff by time: 2 ns to 20 s

Holdoff by events: 1 to 99,999,999

Internal Trigger Range: ± 5 div

Maximum Trigger Frequency: 1 GHz (DC, AC), >1 GHz (HF)

EXT Trigger Max. Input: 10 M Ω // 15 pF at probe tip (PP005): 400 V (DC + peak AC \leq 10 kHz).

50 Ω $\pm 1\%$: ± 5 V DC (500 mW) or 5 V RMS.

EXT Trigger Range: ± 0.5 V (± 2.5 V with EXT/5).

Trigger Output: Optional ECL rear-panel output (option CKTRIG). The calibrator output can provide a trigger status signal or a Pass/Fail test output.

SMART TRIGGER TYPES

Pattern: Trigger on the logic combination of 5 inputs - CH1, CH2, CH3, CH4, and EXT Trigger, where each source can be defined as High, Low or Don't Care. The Trigger can be defined as the beginning or end of the specified pattern.

Signal or Pattern Width: Trigger on glitches as short as 600 ps or on pulse widths within/outside two limits selectable from 600 ps to 20 s.

Slew Rate: Trigger on rising, falling edges within/outside two time limits selectable from 600 ps and 20 s.

Signal or Pattern Interval: Trigger on an interval between two limits selectable from 2 ns to 20 s.

Dropout: Trigger if the input signal drops out for longer than a time-out from 2 ns to 20 s.

Runt: Trigger on positive or negative runs within/outside two limits selectable from 600 ps to 20 s.

State/Edge Qualified: Trigger on any source only if a given state (or transition) has occurred on another source. The delay between these events can be defined as a number of events on the trigger channel or as a time interval.

TV: Allows selection of up to 1500 lines and field synchronization for PAL, SECAM, NTSC or non-standard video.

AUTOSETUP

Automatically sets sensitivity, vertical offset and timebase on all display channels.

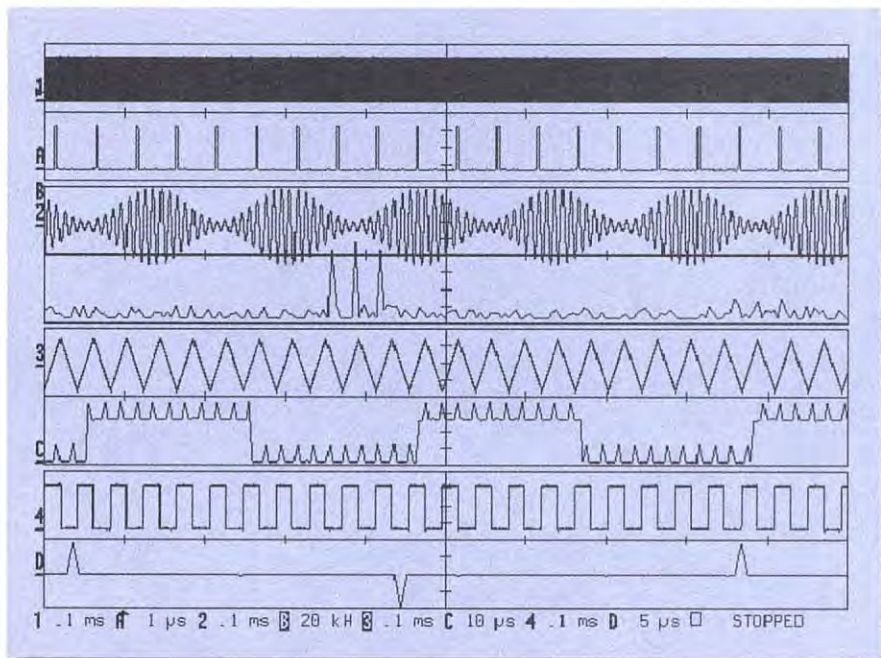
Autosetup Time: Approximately 3 seconds.

PROBES

Model: One PP005 probe supplied per channel.

Optional Probe: 1 GHz FET probe (AP020)

Probe calibration: Max 1 V into 1 M Ω , 500 mV into 50 Ω , frequency and amplitude programmable, pulse or square wave selectable, rise and falltime 1 ns typical. Alternatively, the calibrator output can provide a trigger output or a Pass/Fail test output.



LC564A/584A - ORDERING INFORMATION

DIGITAL OSCILLOSCOPES:

	PRODUCT CODE	PRICE
1 GHz, 2 GS/s, 100 kpts./ch, 4 channel Color DSO (4 GS/s; 250k max)	LC564A	\$ 19,990
1 GHz, 2 GS/s, 100 kpts./ch, 4 channel Color DSO (8 GS/s; 500k max)	LC584A	24,990
1 GHz, 2 GS/s, 500 kpts./ch, 4 channel Color DSO (8 GS/s; 500k max)	LC584AM	27,990
1 GHz, 2 GS/s, 2 Mpts./ch, 4 channel Color DSO (8 GS/s; 500k max)	LC584AL*	35,990

Included with Standard Configuration:

10:1 10 M Ω Passive Probe (1 per channel)	PP005	175 (each)
Operator's Manual	LCXXX-OM	85
Remote Control Manual	LCXXX-RCM	85
Hands On Guide	LCXXX-HG	45
Advanced Waveform Math Package	WP01	1,250
Spectrum Analysis Package	WP02	1,250
Parameter Analysis Package (Not included in LC564A)	WP03	1,250
Floppy Disk Drive	FD01	
Performance Certificate		
Three-Year Warranty		

Selected Probes & Accessories:

1 GHz 10:1 FET Probe	AP020	990
DC-15 MHz Differential Probe, 10:1/100:1	AP031	300
DC-15 MHz Differential Probe, 20:1/200:1	AP032	300
2.5 GHz 0.6pF Active Probe	AP54701A**	2,944
Probe Offset and Power Module	AP1143A**	1,568
1 GHz, 10:1, 500 Ω Passive Probe	PP062	95
ProBus 75 to 50 Ω Adapter	PP090	195

Software Options:

ITU G.703 Fully Automated Mask Tester	MT01	3,000
ANSI T1.102 Fully Automated Mask Tester	MT02	3,000
Jitter and Timing Analysis	JTA	1,875
Disk Drive Failure Analysis	DDFA	4,990
Disk Drive Measurements (includes Parameter Analysis Option WP03)	DDM	3,000
Supplementary Disk Drive Measurements	PRML	1,250
Optical Recording Measurements	ORM	3,000

Hardware Options:

Memory Card Reader and 512k SRAM Card	MC01/04	500
PCMCIA Type III Slot for Hard Drives and ATA Flash Cards	HD01	590
PCMCIA Hard Disk 170 Mbyte (requires HD01 option)	HD02	499
4MB ATA Flash Card (requires HD01 option)	4MBFC	399
Internal Graphics Printer	GP01	890
DC-500 MHz Ext Clock, 10 MHz Ref Input, Trigger Comparator Output	CKTRIG	490
64 Mbyte System Memory	64MBSM***	2,000

Manuals:

Service Manual for LC584A Series	LC584A-SM	125
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Warranty & Calibration:

NIST Calibration Certificate	LCXXX-CCNIST	225
MIL STD Calibration	LCXXX-CCMIL	325
Swiss OFMET Standard	LCXXX-CCOFMET	225
5 Year Repair Warranty	LCXXX-W5	545
5 Year NIST Calibration Contract	LCXXX-C5	725
5 Year Warranty & NIST Calibration	LCXXX-T5	975

* Includes Internal Graphics Printer

** Normally ordered together

*** Included with LC584AL



LC334A
 LC374A
 LC534A
 LC574A

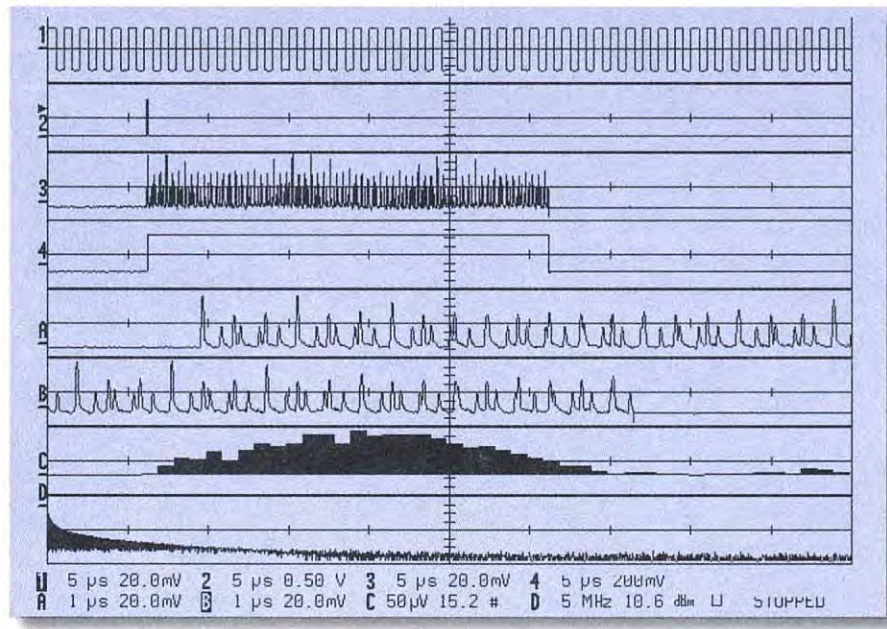
MAIN FEATURES

- 500 MHz and 1 GHz Bandwidth
- 2 GS/s and 4 GS/s Single-Shot Sample Rate
- 8 Million Points of Acquisition Memory
- 4 ms Maximum Sample Rate Window
- 96 MHz PowerPC Microprocessor
- 8 to 64 MB System RAM
- 9" Color Display with 8 Traces
- Analog Persistence
- Full Screen Grid

Digital oscilloscopes from LeCroy are designed to save engineers valuable time in troubleshooting and problem-solving.

Each oscilloscope is an integrated and powerful system providing the capability to:

- Capture the key events with high resolution for longer time intervals
- View data like never before, giving you more information more quickly, with a large, color CRT and advanced display techniques



- Analyze your signal to get answers quickly and more accurately with a powerful processing system and math packages.

9" COLOR DISPLAY

LeCroy provides a very large, sharp oscilloscope screen that is 50% larger in total viewing area than a 7" screen.

Its powerful features include Analog Persistence, Color-Graded Persistence, Full Screen mode, Opaque or Transparent display, color association, and personal color schemes. These provide the user with outstanding benefits that accelerate visual processing and effective communication of on-screen information.

HIGH-SPEED ACQUISITION

The design and debug of fast digital systems and the need to capture fast transient signals require high-speed signal capture. The LC574A four-channel, 1 GS/s, 1 GHz bandwidth DSO operates at a 4 GS/s sample rate for single-channel inputs. The high sample rate, bandwidth and the 1 GHz trigger bandwidth provide a flexible solution for capturing and viewing fast risetime signals.

LARGE SAMPLE RATE WINDOW

Having a high sample rate in a DSO is only the first step to preserving data integrity. The time window over which this sample rate is available is also of critical importance. Long acquisition memory maintains the oscilloscope's highest sample rate for large time windows allowing the user to sample long signals with high horizontal resolution.

With up to 8 million points of acquisition memory, the maximum sample rate of the LC574AL of 4 GS/s (2 GS/s in LC334AL and LC534AL) is maintained for a time window of 2 ms (4 ms in LC334AL and LC534AL). This sample rate window enables the user to record long signals with high resolution.

OPTIMUM PERFORMANCE

SMARTMemory is a total memory management system that dynamically allocates resources of microprocessor power, acquisition memory and processing RAM. The intelligent management provided by SMARTMemory guarantees optimal usage of oscilloscope resources.



The 96 MHz PowerPC microprocessor at the heart of these DSOs drives the system to produce results fast, providing rapid waveform update and super panel responsiveness.

QUICK DIAGNOSES

Capturing and viewing waveforms are fundamental to an oscilloscope. Productivity improvements are accessible by using built-in math functions to assist troubleshooting and diagnoses of circuit problems.

The signal analysis capability of these DSOs is enhanced by advanced waveform math, spectrum analysis, and waveform parameter analysis. This analysis capability greatly increases the speed with which circuit problems are clearly identified and solved.

ANALOG PERSISTENCE

At a push of the green button, the user can switch between an analog style view and a digital view of signals on these oscilloscopes.

The depth of signal information can be explored along the third dimension of the waveform display to give the user a complete picture of waveform activity.

Unlike an analog oscilloscope, all signal data is captured and available in memory for analysis and measurements. Analog Persistence gives the user the best of both the analog and digital worlds of oscilloscopes.

FULL SCREEN GRID

LeCroy DSOs not only have a very large 9" screen but also provide a display mode with an extra-large grid, up to 150% larger than common grid areas. In Full Screen mode, all of the screen area is used to display signals. This provides a magnificent view of up to 8 waveforms: signal details are seen more clearly and with greater ease.

8-TRACE DISPLAY

An 8-trace display with any combination of math functions, zooms, reference memories, or channels is a standard feature in the LC series.

Maximum Sample Rate and Acquisition Memories

Channel Use	Maximum Sample Rate			Memory per Channel			Active Channels
	LC334A LC534A	LC374A*	LC574A	LC334A LC374A* LC534A LC574A	LC334AM LC534AM LC574AM	LC334AL LC534AL LC574AL	
All Peak Detect OFF	500 MS/s	1 GS/s	1 GS/s	100 k	500 k	2 M	All
Paired Peak Detect OFF	1 GS/s	2 GS/s	2 GS/s	250 k	1 M	4 M	CH2 & CH3
Paired + Adapter Peak Detect OFF	2 GS/s	2 GS/s**	4 GS/s	500 k	2 M	8 M	One
All Peak Detect ON	100 MS/s data + 400 MS/s peaks			50 k data+ 50 k peaks	250 k data+ 250 k peaks	1 M data+ 1 M peaks	All

* No external adapter

** On CH2

Octal grid display is available in normal and Full Screen display modes, with and without parameters displayed.

EASY DOCUMENTATION

All waveform data and results of analysis can be quickly saved to floppy disk, memory card, ATA flash card, or a removable hard disk. This provides an efficient way to archive information and facilitates easy documentation of results.

An internal graphics printer (standard in "L" models) outputs screen dumps in seconds providing the user with an immediate and clear record of signal activity.

SIGNAL CAPTURE

ACQUISITION SYSTEM

LC334A/LC374A Bandwidth (-3 dB):
@ 50 Ω : DC to 500 MHz

LC534A/LC574A Bandwidth (-3 dB):
@ 50 Ω : DC to 1 GHz

Bandwidth (-3 dB): @ 1 M Ω : DC to 500 MHz typical at probe tip with optional 1 GHz FET probe for LC334A and with PP05 standard with LC374A, LC534A and LC574A.

No. of Channels: 4

No. of Digitizers: 4

Max. Sample Rate Window:

4 ms @ 2 GS/s in single-shot mode;
LC334AL, LC534AL.

2 ms @ 4 GS/s; LC574AL.

Sensitivity LC334A:

2 mV/div to 5 V/div, 50 Ω , fully variable.

2 mV/div to 5 V/div, 1 M Ω , fully variable.

Sensitivity LC374A/LC534A/LC574A:

2 mV/div to 1 V/div, 50 Ω , fully variable.

2 mV/div to 10 V/div, 1 M Ω , fully variable.

Scale factors: A wide choice of probe attenuation factors are selectable.

Offset Range LC334A:

2.00 - 9.99 mV/div: ± 120 mV

10.0 - 199 mV/div: ± 1.2 V

0.2 - 5.0 V/div: ± 24 V

Offset Range

LC374A/LC534A/LC574A:

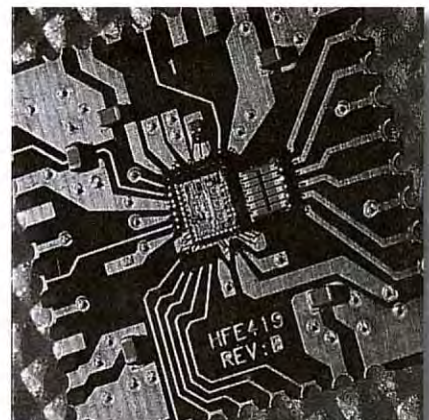
2.00 - 4.99 mV/div: ± 400 mV

5.00 - 99 mV/div: ± 1 V

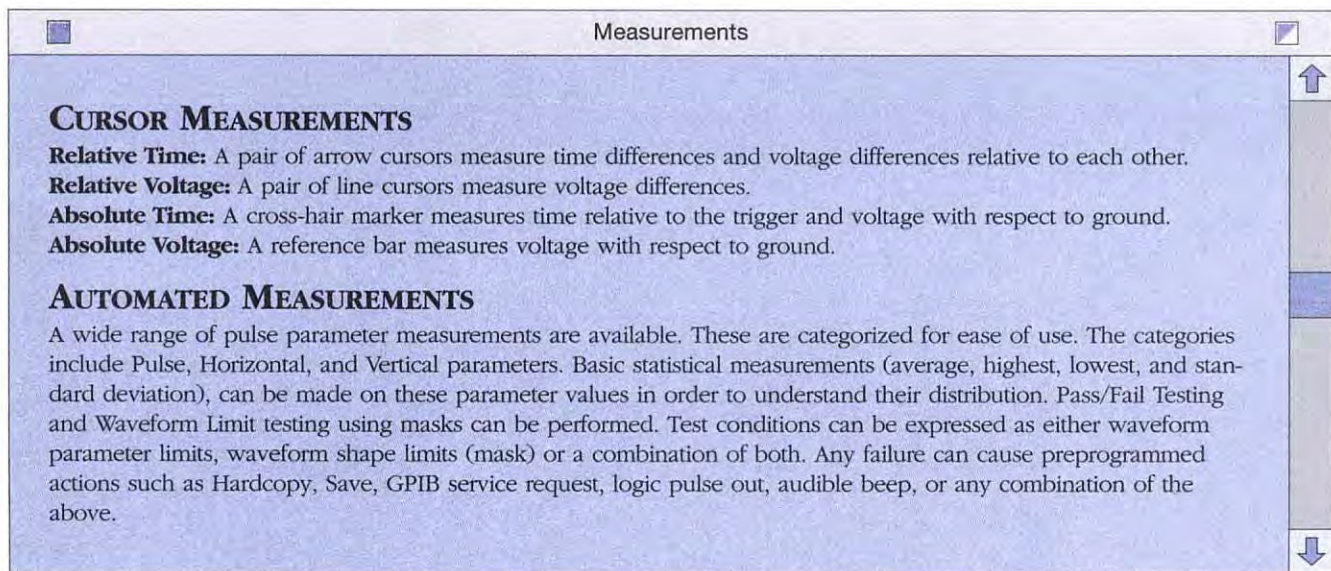
0.1 - 1.0 V/div: ± 10 V

1.0 - 10 V/div: ± 100 V

(1 M Ω only)



High performance signal conditioning devices preserve signal content.



DC Accuracy: Typical 1%

Vertical Resolution: 8 bits

Bandwidth Limiter LC334A: 30 MHz

Bandwidth Limiter LC374A/LC534A/LC574A: 25 MHz, 200 MHz

Input Coupling: AC, DC, GND

Input Impedance: 10 M Ω /15 pF for LC334A (system capacitance using PP005), 10 M Ω /11 pF for LC374A/LC534A/LC574A (system capacitance using PP005) or 50 Ω \pm 1%.

Max Input:

50 Ω : \pm 5 V DC (500 mW) or 5 V RMS
 1 M Ω on LC334A: 250 V
 1 M Ω on LC374A/LC534A/LC574A:
 400 V (DC + peak AC \leq 10 kHz)

SMARTMemory: This total memory management system dynamically manages acquisition memory to guarantee that signals are always sampled at the highest possible sample rate and that system RAM and microprocessor resources are always optimally employed.

Acquisition Modes

Random Interleaved Sampling (RIS):

For repetitive signals from 1 ns/div to 5 μ s/div (2 μ s/div for LC374A and LC574A).

Single shot: For transient and repetitive signals from 10 ns/div (1 ns/div for LC374A and LC574A) with all channels active.

Peak detect: At 400 MS/s, peak detect can capture high-speed events down to 1 ns, while simultaneously capturing normally sampled data.

Sequence: Stores multiple events - each of them time stamped - in segmented acquisition memories.

Dead Time between segments: Typically $<$ 30 μ s, max. 50 μ s

TIMEBASE SYSTEM

Timebases: Main and up to 4 Zoom Traces

Time/Div Range: 1 ns/div to 1,000 s/div.

Clock Accuracy: \leq 10 ppm

Interpolator resolution: 10 ps

Roll Mode: Ranges 500 ms to 1,000 s/div. For $>$ 50 kpoints: 10 s to 1,000 s/div.

External Clock: \leq 100 MHz (20-100 MHz for LC574A and LC374A) on EXT input with ECL, TTL or zero crossing

levels. Optional 50 MHz to 500 MHz rear-panel fixed frequency clock input.

External Reference: Optional 10 MHz rear-panel input.

ADDITIONAL INFORMATION

INTERFACING

Remote Control: Possible by GPIB and RS-232-C for all front-panel controls, as well as all internal functions.

RS-232-C Port: Asynchronous up to 115.2 Kb/s for computer/terminal control or printer/plotter connection.

GPIB Port: Configurable as talker/listener for computer control and fast data transfer, up to 300 kbytes/sec. Command Language complies with requirements of IEEE-488.2.

Centronics Port: Hardcopy parallel interface is standard.

PC Card (PCMCIA I/II/III) Ports: For memory cards, ATA compatible flash cards and removable hard disks - optional.

	Model		Segments
LC334A/LC374A	LC534A	LC574A	500
LC334AM	LC534AM	LC574AM	2,000
LC334AL	LC534AL	LC574AL	2,000

Number of segments available



Signal Analysis

SIGNAL ANALYSIS

A comprehensive and easy-to-use set of diagnostic tools are available. Calculations are performed rapidly, and results can be presented on-screen or stored to disk.

Rapid Processing System

Microprocessor: 96 MHz PowerPC 603e.
System RAM: 8 to 64 Mbytes.
Video Memory: 1 Mbyte.
Cache Memory: 32 kbyte.
Persistence Data Map Memory: 16 bits per displayed pixel (64 k levels).

WAVEFORM PROCESSING

Up to four processing functions may be performed simultaneously. Standard functions available are: Add, Subtract, Multiply, Divide, Negate, Identity, Summation Averaging and Sine x/x. The source information for a math function trace can be data from an acquisition channel or from another math function trace. This allows display of traces which "daisy chain" math functions.

Average: Up to 10⁶ averages are possible.
Extrema: Roof, Floor, or Envelope values from 1 to 10⁶ sweeps.
ERES: Six low-pass digital filters provide up to 11-bit vertical resolution. Sampled data is always available, even when a trace is turned off.
FFT: Spectrum Analysis with five windowing functions and FFT averaging.
Statistical Diagnostics*: The Parameter Analysis package permits in-depth diagnostics on waveform parameters. Live histogramming of any waveform parameter measurement is possible and the histogram can be autoscaled to display the center and width of the distribution.

Any of the above processes can be invoked without losing the data.
 *Histogramming and Trending are part of the Parameter Analysis Package.

INTERNAL MEMORY

Waveform Memory: Up to four 16-bit Memories (M1, M2, M3, M4), whose length corresponds to the length of the channel acquisition memory.
Zoom & Math Memory: Up to four 16-bit Waveform Processing Memories (A, B, C, D), whose length corresponds to the length of the channel acquisition memory.
Setup Memory: Four non-volatile memories. The floppy disk or optional memory cards, Flash card or removable hard disks can also be used for high-capacity waveform and setup storage.

Floppy Disk: High-density 3.5" floppy disk drive (DOS format) is standard.

VGA Compatible Display: 15-pin D-type VGA compatible connector for external color display.

Hardcopy: Screen dumps are activated by a front-panel button or via remote control. TIFF and BMP formats are available for importing to desktop publishing programs. The following printers and plotters can be used to make hardcopies:

B/W: HP LaserJet, HP DeskJet 500, Epson FX.

Color: HP DeskJet 550C, Epson Stylus, Canon BJC. An optional, internal, high-resolution graphics printer is also available for screen dumps; a stripchart output format with 2 meters per division is also possible.

Output Formats: ASCII waveform output is available in seconds, compatible with spreadsheets, MATLAB, MathCad. Binary output is also available.

GENERAL

Auto-calibration ensures specified DC and timing accuracy.

Temperature: 5° to 40°C (41° to 104°F) rated 0° to 50°C (32° to 122°F) operating.

Humidity: 80% for temperatures up to 31°C decreasing linearly to 50% relative humidity at 40°C.

Altitude: Up to 2000m (operating), 40°C max.

Power: 90-132 V AC, 180-250 V AC, 45-66 Hz, 400 W.

Battery Backup: Front-panel settings maintained for two years.

Dimensions:

(HWD)10.4" x 15.65" x 17.85" (264 mm x 397 mm x 453 mm)

Weight: 20 kg (44 lbs) net, 28 kg (61.6 lbs) shipping.

Warranty: Three years.

CE Approval: EMC: Conforms to EN50081-1 and EN50082-1.

UL and cUL approved: UL standard: UL 3111-1; cUL Canadian Standard CSA-C22.2 No. 1010, 1-92.

Safety: The oscilloscope has been designed to comply with EN61010-1 Installation Category (Over-voltage Category) II, Pollution Degree 2.

SIGNAL VIEWING

Type: Color 9" Raster Scan CRT, 0.26 mm dot pitch.

Resolution: 640 x 480 points.

Display Area: 170 mm x 125 mm - 50% greater than that of a 7" display.

Controls: Rear-panel presets for position, brightness and contrast. Menu controls for brightness and color selection.

Grid Styles: Single, Dual, Quad, Octal, XY, Single+XY, Dual+XY, and Full Screen - an enlarged view of each grid style.

System Memory Configurations

Model			System RAM
LC334A/LC374A	LC534A	LC574A	8 Mbytes
LC334AM	LC534AM	LC574AM	8 Mbytes
LC334AL	LC534AL		16 Mbytes
		LC574AL	64 Mbytes

Maximum Horizontal Zoom Factors

Model			Zoom Factors
LC334A	LC534A		4,000x
LC334AM	LC534AM	LC374A/LC574A	20,000x
LC334AL	LC534AL	LC574AM	100,000x
		LC574AL	400,000x

Graticules: Internally generated; separate intensity control for grids and waveforms. Selectable blending of grid with displayed traces.

Waveform Style: Dot Join with optional sample point highlight or Dots only.

Persistence Modes: Color-graded persistence and Analog Persistence, infinite or variable with decay over time. In color-graded persistence, a color spectrum from red through violet is used to map signal intensity. With Analog Persistence, the brightness level of a single color denotes signal intensity. Each trace's persistence data is stored in 64 k levels. Analog Persistence is only available in four channel mode on LC334A models.

Trace Display: Opaque or transparent mode, with overlap management.

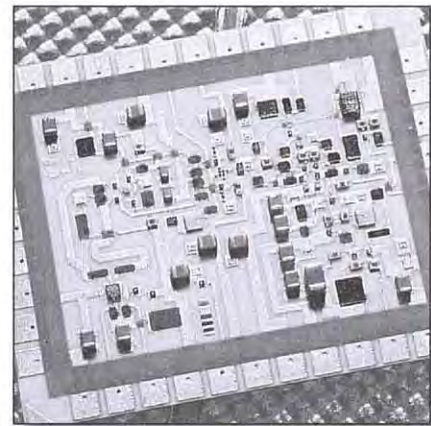
Number of Traces: 8 (any mix of channels, memories or Math functions).

Real-time Clock: Date, hours, minutes, seconds.

External Monitor: Rear-panel 15-pin socket for VGA compatible monitor.

Vertical Zoom: Up to 5x vertical expansion (50x with averaging, up to 40 μ V/div sensitivity).

Horizontal Zoom:
LC334A/LC534A: Waveforms can be expanded to give 2-2.5 points/division.



Precision sampling devices maintain signal integrity in the digital world .

This allows zoom factors up to 100,000x for the 'M' models and up to 400,000x for the 'L' models when channels are combined.

LC374A/LC574A: Waveforms can be expanded to give 0.4-0.5 points per division. Zoom factors up to 2,000,000x with all channels combined on the LC574AL.

TRIGGERING SYSTEM

Modes: Normal, Auto, Single, and Stop.

Sources: CH1, CH2, CH3, CH4, Line, EXT, EXT/10. Slope, Level and Coupling are unique to each source.

Slope: Positive, Negative.

Coupling: AC, DC, HF, LFREJ, HFREJ

Pre-trigger recording: 0 to 100% of full scale (adjustable in 1% increments).

Post-trigger delay: 0 to 10,000 divisions (adjustable in 0.1 div. increments).

Holdoff by time: 10 ns to 20 s

Holdoff by events: 0 to 99,999,999

Internal Trigger Range: \pm 5 div

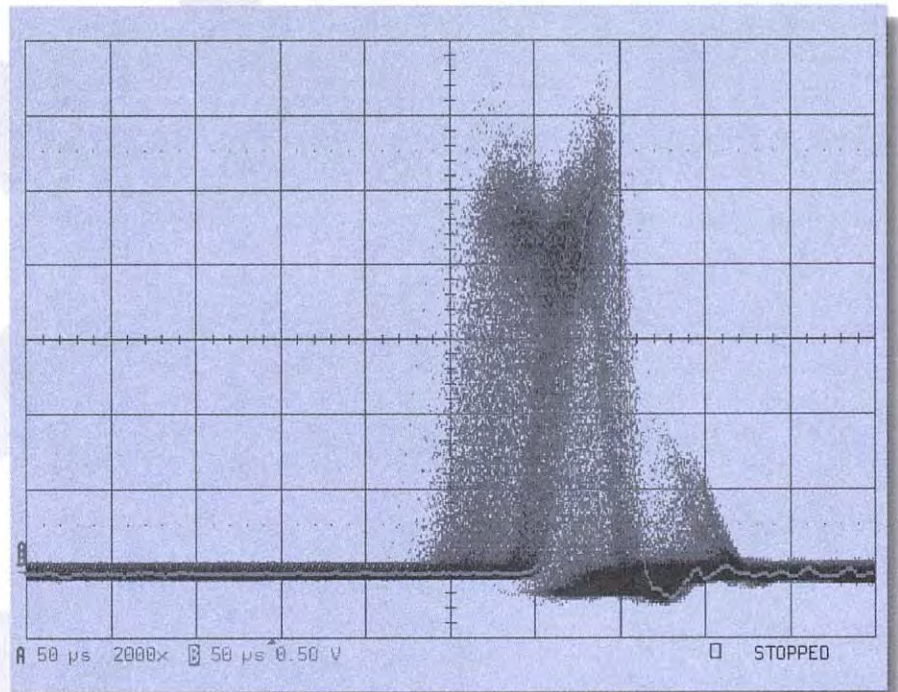


EXT Trigger Max Input LC334A:10 M Ω //15 pF

(system capacitance using PP005):

50 V (DC + peak AC \leq 10kHz)50 Ω \pm 1%: \pm 5 V DC (500 mW) or 5 V RMS.**EXT Trigger Max Input****LC374A/LC534A/LC574A:**10 M Ω //11pF

(system capacitance using PP005):

400 V (DC + peak AC \leq 10 kHz)50 Ω \pm 1%: \pm 5 V DC (500 mW) or 5 V RMS.**EXT Trigger Range:** \pm 0.5 V (\pm 5 V with Ext/10).**Trigger Timing:** Trigger Date and Time are listed in the Memory Status Menu.**Trigger Comparator:** Optional ECL rear-panel output. Alternatively, the calibrator output can provide a trigger output or a Pass/Fail test output.**SMART TRIGGER TYPES****Pattern:** Trigger on the logic combination of 5 inputs - CH1, CH2, CH3, CH4, and EXT Trigger, where each source can be defined as High, Low or Don't Care. The Trigger can be defined as the beginning or end of the specified pattern.**Signal or Pattern Width:** Trigger on width between two limits selectable from $<$ 2.5 ns to 20 s. Will typically trigger on glitches 1 ns wide.**Signal or Pattern Interval:** Trigger on interval between two limits selectable from 10 ns to 20 s.**Dropout:** Trigger if the input signal drops out for longer than a time-out from 25 ns to 20 s.**State/Edge Qualified:** Trigger on any source only if a given state (or transi-*Analog Persistence gives the user an analog style view of signals on a digital oscilloscope.*

tion) has occurred on another source. The delay between these events can be defined as a number of events on the trigger channel or as a time interval.

TV: Allows selection of both line (up to 1500) and field number (up to 8) for PAL (SECAM), NTSC or nonstandard video.**Exclusion Trigger:** Trigger on intermittent faults by specifying the normal width or period of a signal. The oscilloscope will trigger only on aberrations which are shorter or longer than normal.**AUTOSETUP**

Pressing Autosetup sets timebase, trigger and sensitivity to display a wide range of repetitive signals, (Frequency above 50 Hz; Duty Cycle greater than 0.1%).

Autosetup Time: Approximately 2 seconds.**Vertical Find:** Automatically sets sensitivity and offset for selected channel.**PROBES**

One PP005 probe is supplied per channel. DC to 500 MHz typical (350 MHz typical for LC334A) at probe tip, 500 V max.

Probe calibration: Max 1 V into 1 M Ω , 500 mV into 50 Ω , frequency and amplitude programmable, pulse or square wave selectable, rise and falltime 1 ns typical. Alternatively, the calibrator output can provide a trigger output or a Pass/Fail test output.

LC334A/374A/534A/574A - ORDERING INFORMATION

Digital Oscilloscopes:

500 MHz, 500 MS/s, 100 kpts./ch, 4 channel Color DSO
 500 MHz, 500 MS/s, 500 kpts./ch, 4 channel Color DSO
 500 MHz, 500 MS/s, 2 Mpts./ch, 4 channel Color DSO

500 MHz, 1 GS/s, 100 kpts./ch, 4 channel Color DSO

1 GHz, 500 MS/s, 100 kpts./ch, 4 channel Color DSO
 1 GHz, 500 MS/s, 500 kpts./ch, 4 channel Color DSO
 1 GHz, 500 MS/s, 2 Mpts./ch, 4 channel Color DSO

1 GHz, 1 GS/s, 100 kpts./ch, 4 channel Color DSO
 1 GHz, 1 GS/s, 500 kpts./ch, 4 channel Color DSO
 1 GHz, 1 GS/s, 2 Mpts./ch, 4 channel Color DSO

Product Code

LC334A	\$ 16,490
LC334AM	19,490
LC334AL	27,490
LC374A	19,990
LC534A	19,490
LC534AM	22,490
LC534AL	30,490
LC574A*	23,490
LC574AM*	26,490
LC574AL*	34,490

Included with Standard Configuration:

10:1 10 M Ω Passive Probe (1 per channel)
 Operator's Manual
 Remote Control Manual
 Hands On Guide
 Advanced Waveform Math Package
 Spectrum Analysis Package
 Floppy Disk Drive
 Performance Certificate
 Three-Year Warranty

PP005	175 (each)
LCXXX-OM	85
LCXXX-RCM	85
LCXXX-HG	45
WP01	1,250
WP02	1,250
FD01	

Probes & Accessories:

Current Probe 150 A
 1 GHz 10:1 FET Probe
 800 MHz 5:1 FET Probe
 2.5 GHz 0.6pF Active Probe
 Probe Offset and Power Module
 1 GHz, 10:1, 500 Ω Passive Probe
 ProBus 75 Ω to 50 Ω Adapter

AP011	1,250
AP020	990
AP021	990
AP54701A**	2,944
AP1143A**	1,568
PP062	95
PP090	195

Software Options:

Parameter Analysis Package (includes Histogramming and Trending)
 Disk Drive Measurements
 Supplementary Disk Drive Measurements
 Optical Recording Measurements
 Disk Drive Failure Analysis

WP03	1,250
DDM	3,000
PRML	1,250
ORM	3,000
DDFA	4,990

Hardware Options:

Memory Card Reader and 512k SRAM Card
 PCMCIA Type III Slot for Hard Drives and ATA Flash Cards
 PCMCIA Hard Disk 170 Mbyte (requires HD01 option)
 4MB ATA Flash Card (requires HD01 option)
 Internal Graphics Printer
 500 MHz Ext Clock, 10 MHz Ref Input, Trigger Comparator Output
 64 Mbyte System Memory

MC01/04	500
HD01	590
HD02	499
4MBFC	2,000
GP01***	890
CKTRIG	490
64MBSM***	2,000

Manuals:

Service Manual for LCXXXA

LCXXX-SM	125
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Warranty & Calibration:

US Military Standard
 US NIST Standard

LCXXX-CCMIL	325
LCXXX-CCNIST	225

* Includes Internal Graphics Printer and Parameter Analysis Package

** Normally ordered together

*** Included with LC574AL



“Mega” Waveform Processing (MWP)

MAIN FEATURES

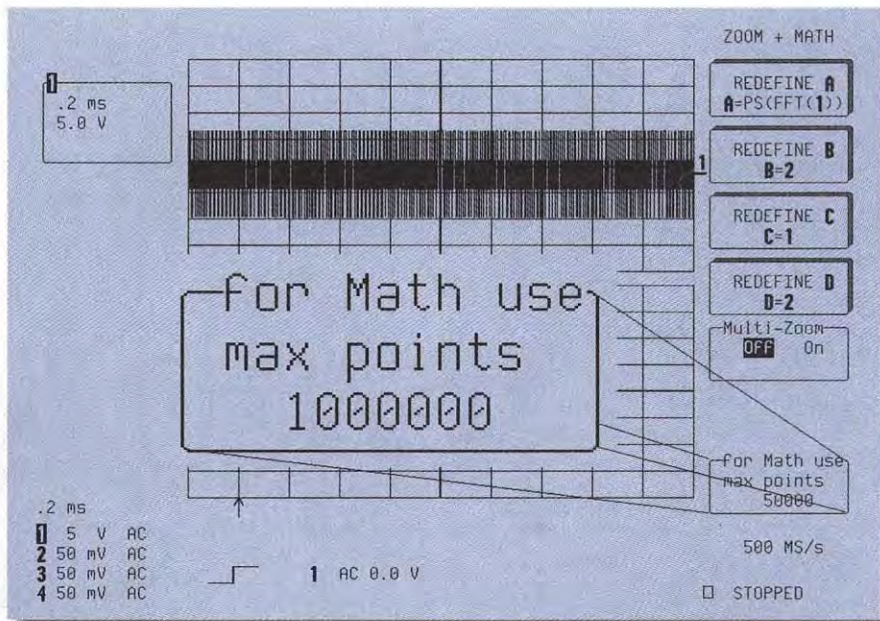
- Up to 64 Mbytes of Processing RAM
- High-Speed Processor/Coprocessor
- Larger System Memory Extends Math Processing Capacity on Long Waveforms
- Waveforms up to 8 Mbytes Can be Read Back into the Oscilloscope
- Improved Processing Speed
- System Memory is Dynamically Allocated to Traces
- Upgrade Older Scopes to New Performance Levels

WHY MORE MEMORY?

The example illustrated in the screenshots on the next page clearly demonstrates the advantage of processing memory for the FFT computation. For a given time window and a given acquired record length, more processing memory dramatically expands the frequency spectrum of an FFT.

SYSTEM MEMORY

The MWP option increases the standard system memory to 8 MBytes for MWPM and to 16 MBytes for MWPL. Model 930X-64 upgrades memory length to 64 MBytes.



SMARTMEMORY

ALLOCATION

With up to 64MB of system memory, the MWP option dramatically improves the processing power of the machine. And with the SMART Memory allocation, all of this memory can be dynamically dedicated to one demanding task, an FFT for example, freeing up the memory unused by other traces.

EXTENDED PROCESSING

The “No Math on Large Waveforms” message has been consigned to the archives. The MWP option stretches the math processing frontier for digital oscilloscopes. You can now upgrade a 9314AL to average a 1 million point “mega” trace just like a 9314CL, or you can upgrade a 9374CL to perform a 6 Mpoint FFT. MWP also extends the capacity of the oscilloscope’s internal memories.

PROCESSOR

The MWP option also upgrades the 16 MHz 68020/68881 processor system of a 9304A, 9310A, or 9314A, to a 32 MHz 68EC030/68882 system.

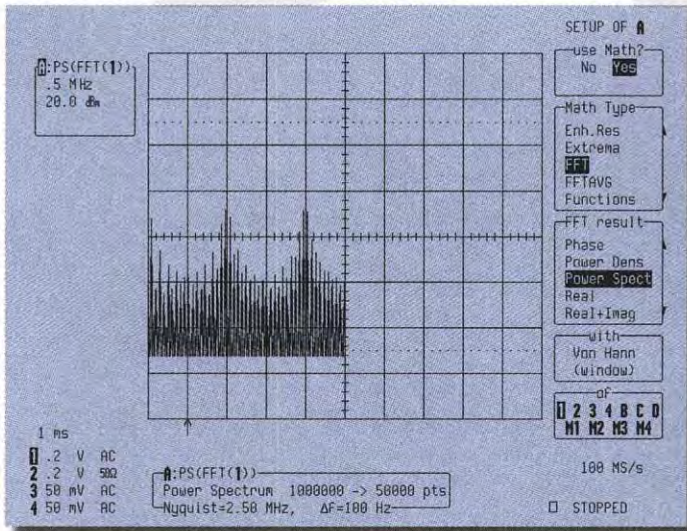
FASTER UPDATE

The high-speed processor used in MWP upgrades is the same one installed in the 93XXC Series. It enhances the processing speed of 9304C, 9310C, 9314C and 9320 scopes to yield an essential improvement in the overall DSO response.

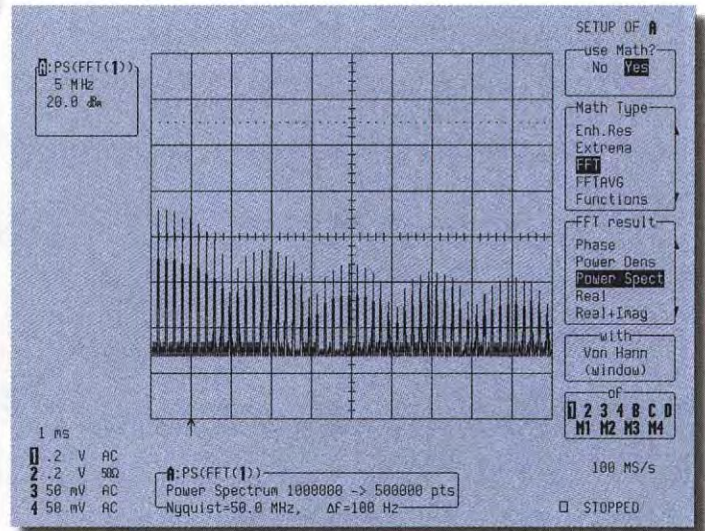
NEW VERSION SOFTWARE

The MWP option allows to upgrade 9304A, 9310A or 9314A with new software version 7.2.2





Without MWP option: The FFT processing of a 1 Mpoint record length is limited to 50 k in older scopes; as a result the spectrum is limited to 2.5 MHz.



With MWP option: The same signal processed with a 500 kpoint FFT shows a full spectrum of 50 MHz.

MASS STORAGE SPECIFICATIONS

9304A, 9310A, 9314A

Task Example	Without MWP	With MWP
Retrieve a 1 M waveform saved on a floppy to the scope	Impossible, requires more than 2 Mbyte of memory	Possible
Perform and FFT on a 200k waveform	Possible, by limiting the input points, which also limits the resulting FFT bandwidth	Possible without reducing the input points. The FFT spectrum will cover the full bandwidth
Average 1000-point waveforms at a 100 Hz sweep rate	Impossible for 9304C, 9310C or 9314C scopes, the maximum rate is 80 Hz: some events will be missed	Possible, the maximum rate can actually reach 125 Hz, a 56% improvement

HARDWARE OPTIONS - ORDERING INFORMATION

9300 SERIES - HARDWARE OPTIONS:

32 MHz 68030/68882 with 8 Mbytes RAM
 32 MHz 68030/68882 with 16 Mbytes RAM
 64 Mbyte RAM Upgrade

LC SERIES HARDWARE OPTIONS

64 Mbyte RAM Upgrade for LC Series

PRODUCT CODE	PRICE
93XX-MWPM	\$ 990
93XX-MWPL	1,490
930X-64	3,500
LCXXX-64MB	3,500



CKTRIG Hardware Option for the 9350C, 9370C, 9384C & LC Series oscilloscopes

MAIN FEATURES

- *High-speed 500 MHz External Clock Input*
- *10 MHz External Clock Reference Input*
- *Edge Trigger Comparator Output*
- *BNC, Rear-Panel Mounted Connectors*



EXTERNAL CLOCK

This feature allows the 9350C, 9370C, 9384C and LC series DSOs to be externally clocked at a fixed rate from 50 MS/s to 500 MS/s, enabling full phase control over the acquired signal. The sample rate can be fine-tuned to the exact speed required by the application.

EXTERNAL REFERENCE

The external reference allows the scope to be phase-synchronized to an external 10 MHz reference, either to match the stability of the external source or to phase lock the acquired signal. Several DSOs can then be synchronized using a simple source as reference.

TRIGGER COMPARATOR

The trigger comparator outputs a pulse for each valid edge-trigger condition on the trigger signal. This is an invaluable feature for event-counting and throughput applications.

In applications as diverse as capturing radar signals and making advanced measurements on magnetic media using PRML methods, there can be requirements to sample the data at specified frequencies. The 9350C, 9370C, 9384C and LC series scopes have the ability to accept a data sampling clock through the front panel at frequencies up to 100 MS/s. This is applied through the BNC connector that is normally used for the external trigger. The CKTRIG option is for those applications requiring a higher-speed sample clock (up to 500 MS/s) or when the external trigger input is required for triggering the scope.



EXTERNAL CLOCK INPUT

Input signal requirements:

- Amplitude:** 800 mV p-p
- Frequency range:** 50 MHz to 500 MHz
- Offset:** 0 V
- Input impedance:** 50 Ω

Calibration must be initiated for each external clock change.

The negative pulse width must be less than 5 ns (2 ns recommended).

Swept Clock: Only a fixed-frequency external clock is supported. Swept clocks will cause offset errors (10% worst-case).

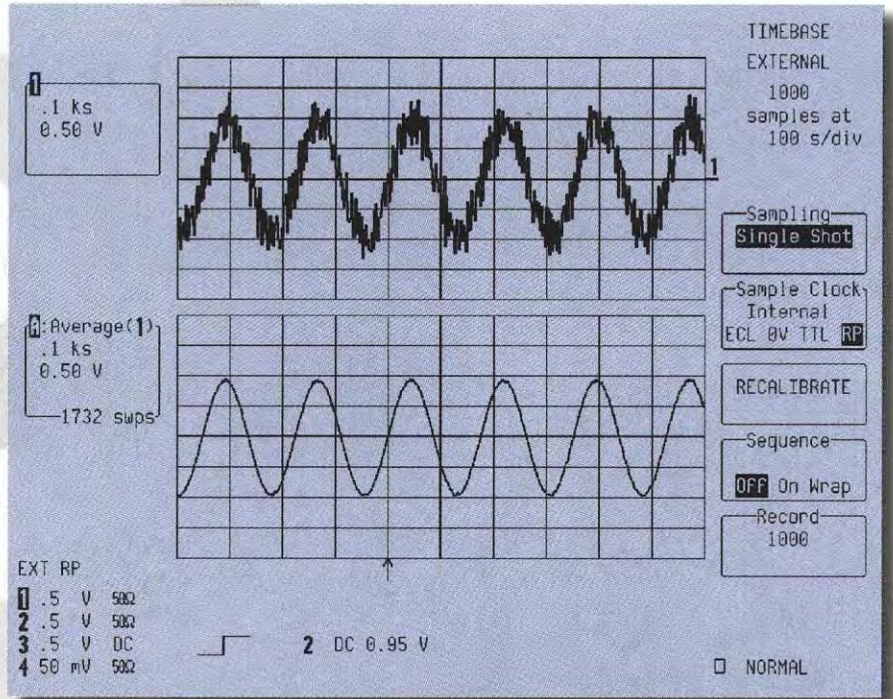
EXTERNAL CLOCK REFERENCE INPUT

Signal Requirements:

- Amplitude:** 800 mV p-p
- Frequency range:** 10 MHz ±5%
- Offset:** 0 V
- Input impedance:** 50 Ω

TRIGGER COMPARATOR OUTPUT

The comparator operates in a 'time-over-threshold' mode and generates a pulse edge of the same polarity as the polarity of the selected triggering edge each time a valid EDGE TRIGGER condition is met on the trigger signal. The



This figure shows how synchronous sampling can eliminate interfering signals. In the picture above, a 455 kHz communications signal with interference and noise is sampled using the Rear Panel ("RP") external sampling clock input available in the CKTRIG option. The top trace shows a single shot of the signal. The interference source has a frequency very near the carrier of the desired signal. The sample clock has been set to be synchronous with the known frequency of the underlying signal. The effects of the noise and interference have been eliminated in the lower trace, which is an average of 1732 acquisitions. The measurement is successful, because the user was able to set the sampling at a frequency where both the noise and interference would average to zero, while the underlying data remained constant.

duration of the pulse will be equal to the time the trigger signal is above/below the trigger level.

Output signal characteristics:
ECL, 50 Ω, series-terminated.

Note: This feature does not operate in SMART Trigger mode.

ORDERING INFORMATION

9300 SERIES HARDWARE OPTIONS:
External Clock, Reference Clock

1C SERIES HARDWARE OPTIONS
External Clock, Reference Clock

PRODUCT CODE	PRICE
CKTRIG	\$ 490
CKTRIG	490



Advanced Waveform Math Package - WP01

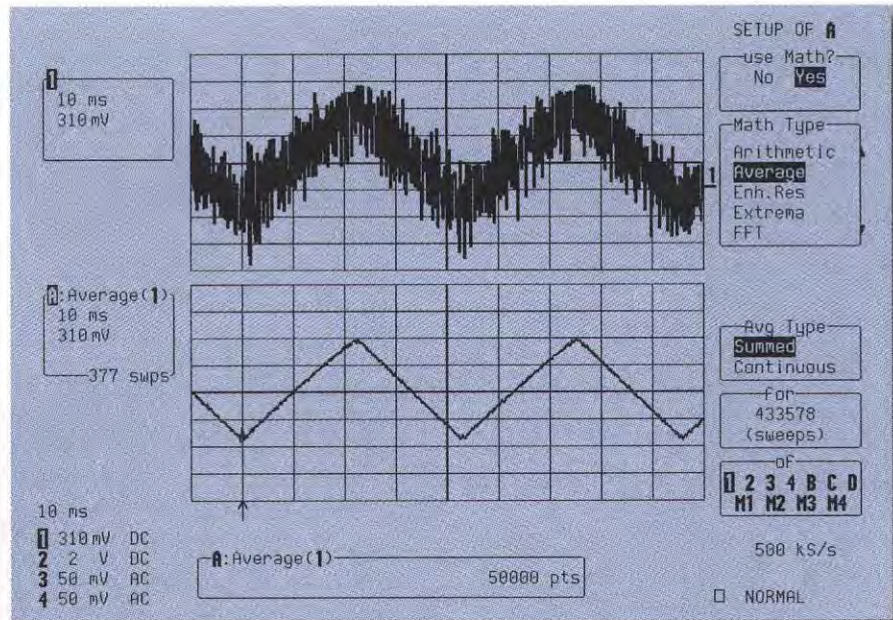
MAIN FEATURES

- *High-Precision Averaging up to 1 Million Sweeps*
- *Extended Digital Filtering Capabilities*
- *Rescale Function, with $(ax + b)$ Correction Factor*
- *Envelope Mode*
- *Integration*
- *Differentiation*
- *Log(e) and Log(10)*
- *Exp(e) and Exp(10)*
- *Absolute Value, Reciprocal*
- *Square, Square root*
- *Powerful Function Chaining Feature*

The LeCroy Advanced Math Waveform Processing package features a powerful toolset that extends the processing power inside LeCroy oscilloscopes well beyond the capabilities of a traditional instrument.

In fact, all the processing is built-in to eliminate the need for external computers and controllers. High-speed micro-processors and up to 64 Mbytes of RAM are used to ensure real-time updates of computed waveforms on the screen.

The package is fully programmable over GPIB or RS-232-C interfaces, and hard copies can be made directly on to a wide range of printers (including the optional internal printer), plotters or graphic formats. Data can also be saved to floppy disk (standard) and PCMCIA portable hard drive option.



EXTENSIVE SIGNAL AVERAGING

Advanced Math offers two powerful, high-speed averaging modes that can be used to reduce noise and improve the signal-to-noise ratio. Vertical resolution can be extended by several bits to improve dynamic range and increase the overall input sensitivity to as much as 50 $\mu\text{V}/\text{div}$.

In summed averaging, up to 1,000,000 sweeps are repeatedly summed, with equal weight, in a 32-bit accumulation buffer for improved accuracy. The accumulated result is then divided by the number of sweeps.

With continuous/exponential averaging, a weighted addition of successive waveforms can be performed with weighting factors from 1:1 to 1:1023. The averaging goes on indefinitely with the contribution of "older" sweeps gradually decreasing. The method is particularly appropriate to reduce noise on signals drifting very slowly in time or amplitude.

ENHANCED RESOLUTION BY DIGITAL FILTERING

This allows low-pass finite impulse response filtering of the digitized signals, with 6 different cutoff frequencies per sampling rate setting. As a result, the vertical resolution of the captured signals – single-shot or repetitive – increases from 8 bits to 11 bits in 0.5-bit steps. This feature is ideal for stripping off unwanted high-frequency noise on transient events.

RESCALING

This feature allows an input signal to be rescaled using an $(ax + b)$ correction factor to compensate for gain and offset. This is very useful when dealing with various types of transducers, for reading the correct temperature or pressure value directly from the scope's cursor.

ENVELOPE MODE

This display mode shows the signal envelope by retaining only the highest and lowest amplitudes for every sampling interval, over a user-definable number of sweeps. It is ideal for visualizing the time or amplitude jitter in a signal.



POWERFUL MATH TOOLSET

In addition to the basic arithmetic functions found in the standard models, WPO1 adds an impressive set of functions (+, -, ÷) such as integration, differentiation, logarithms and exponential – in both bases 10 and e – square, square root, reciprocal, ratio and absolute value. All these functions are updated automatically each time a new waveform is acquired, showing a “live” representation of a computed trace. This would be impossible to achieve on a separate computer.

FUNCTION CHAINING

When more than one math function is needed in the equation, all LeCroy digital scopes support function chaining and allow the user to multiply, for instance, the “Voltage” and the “Current” channels and to integrate the result to get an instantaneous energy curve.

REMOTE CONTROL

All of the waveform processing can be controlled via GPIB or RS-232-C remote control. The function traces do not even need to be called up on screen to be updated, an important feature that speeds up the computation.

GENERAL

Max. number data points: Up to 8 million. Only limited by the available amount of system memory (indicated in the “memory used” status menu).

Min. number data points: Data points can be reduced down to 50 in the processing function to improve update rate.

Vertical Zoom: x50 maximum.

Horizontal Zoom: maximum zooming to a point where 20 - 25 samples of the source trace occupy the full screen.

Maximum Sensitivity: 50 μ V/div after vertical expansion.

SUMMATION AVERAGING

Number of Sweeps: 1 to 1,000,000

Speed: up to 200,000 points/s.

CONTINUOUS AVERAGING

Possible Weighting Factors: 1:1, 1:3, 1:7, 1:15, 1:31, 1:63, 1:127, 1:255, 1:511 and 1:1023

ENHANCED RESOLUTION

Choice of six low-pass filters to improve vertical resolution improvement from 8 to 11 bits in 0.5-bit steps.

Resulting bandwidth:

0.5 bit	$0.5 \div \text{Nyquist BW}$
1 bit	$0.241 \div \text{Nyquist BW}$
1.5 bit	$0.058 \div \text{Nyquist BW}$
2 bit	$0.029 \div \text{Nyquist BW}$
2.5 bit	$0.016 \div \text{Nyquist BW}$

Nyquist BW = $1/2 \div \text{sample frequency}$.
Rescale (ax + b) rescaling with a and b ranging from $\pm 0.00001 \text{ E-15}$ to $\pm 9.99999 \text{ E+15}$.

ARITHMETIC

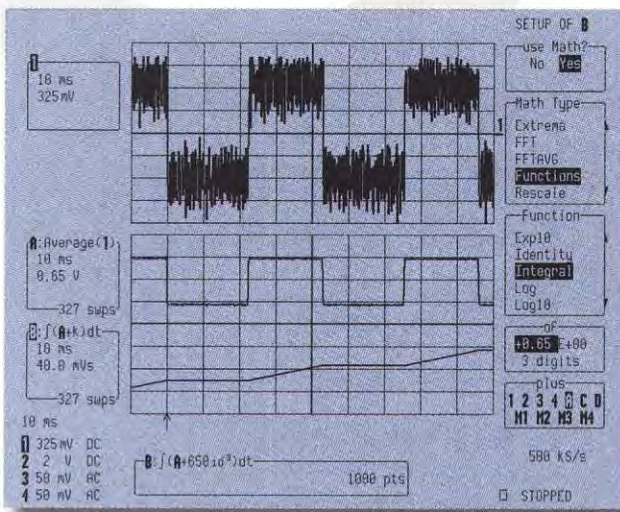
Addition, subtraction, multiplication and ratio on any two waveforms.

FUNCTIONS

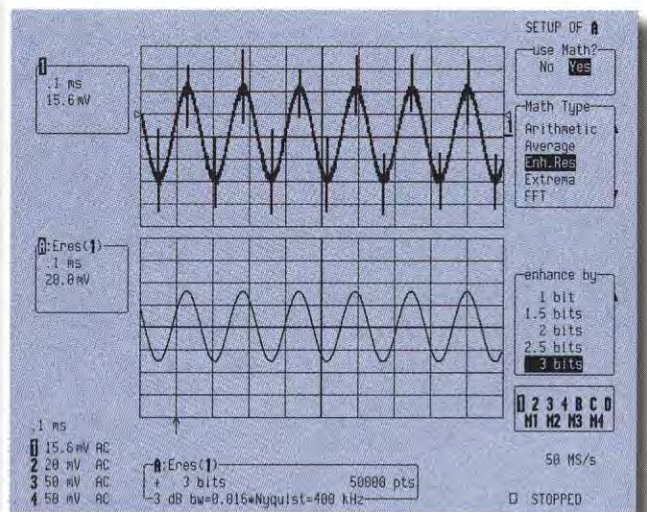
Identity, negation, integration (including additive constant), differentiation, square, square root, logarithm and exponential (base e and 10), sine x/x, reciprocal and absolute value of any waveform.

EXTREMA

This shows the signal envelope by retaining only the highest and lowest amplitudes for every sampling interval. It logs all extreme values of a waveform over a programmable number of sweeps. Maxima and minima can be displayed together or separately by choosing roof or floor traces.

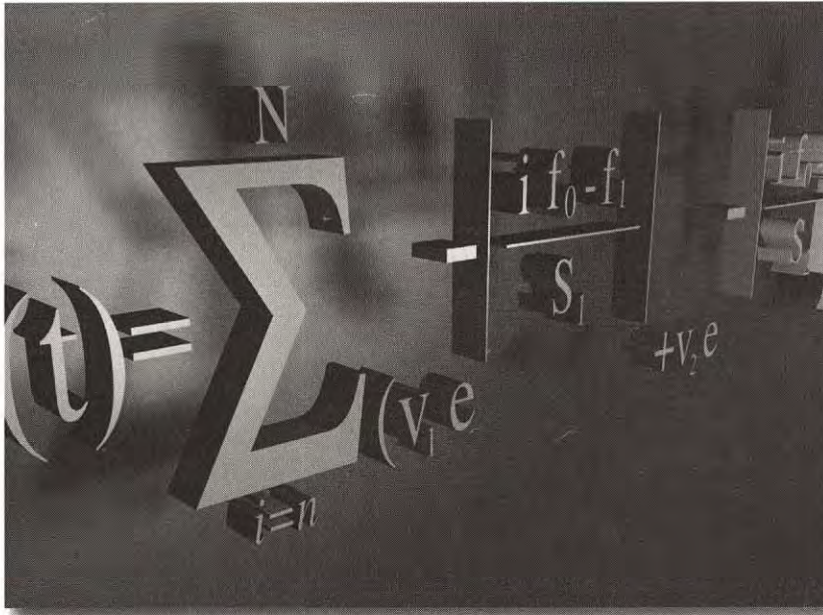


To illustrate the function chaining ability, the noisy signal in Channel 1 has been averaged in Trace A to remove undesired noise, and the result integrated in Trace B.



High-frequency glitches in Channel 1 have been dramatically reduced in Trace A by using the low-pass filtering properties of the Enhanced Resolution Function.





Number of Sweeps: 1 to 1,000,000.

FUNCTION CHAINING

Up to four functions can be automatically chained using traces A, B, C and D. Using memories M1 to M4 for intermediate results, any number of operations can be chained manually or via remote control.

REMOTE CONTROL

All controls and waveform processing functions are fully programmable using simple commands over the oscilloscope's GPIB or RS-232-C interfaces.

SOFTWARE OPTIONS - ORDERING INFORMATION

SOFTWARE OPTIONS:
Advanced Math Package

PRODUCT CODE
WP01

PRICE
\$ 1,250

Included as standard in LC Series Oscilloscopes, and models 9384CTM, 9374CTM and 9354CTM.



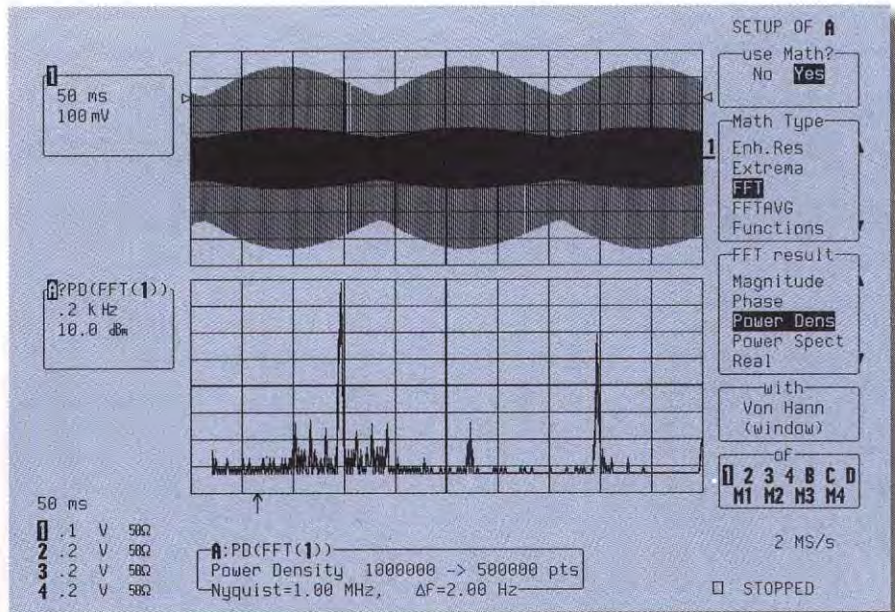
Spectrum Analysis Package - WP02

MAIN FEATURES

- Frequency Range From DC up to the Instrument's Full Bandwidth
- Simultaneous FFTs on Up to 4 Channels
- Perform FFT on Up to 4 Million Time Domain Samples
- Frequency Resolution Down to 100 μ Hz
- Frequency Domain Averaging
- Wide Selection of Scaling Formats and Window Functions
- Full Support of Cursors and Automatic Waveform Parameters
- Full Pass/Fail Testing Support

The Spectrum Analysis package provides LeCroy oscilloscopes with a powerful frequency-domain toolset that extends its processing capabilities well beyond the realm of a standard instrument. In fact, all the processing is built-in to eliminate the need for external computers and controllers.

High-speed microprocessors and up to 64 Mbytes of RAM are used to perform computations. Fast Fourier Transforms (FFTs) convert time domain waveforms into frequency domain records to reveal valuable spectral information such as phase, magnitude and power. The package is fully programmable over GPIB and RS-232-C interfaces, and



hard copies can be made directly to a wide range of printers (including the optional internal printer), plotters or graphic formats. Data can also be saved to optional floppy disk or PCMCIA portable hard drive.

FEATURES AND BENEFITS

Why FFT in a scope?

The FFT package on a LeCroy DSO has at least four clear advantages over common swept spectrum analyzers:

- It can show the spectrum of a transient signal.
- Both time and frequency information can be monitored simultaneously.
- Phase information is available.
- The price is attractive.

It has two definite advantages over FFT analyzers:

- It can show higher-frequency components.
- Both time and frequency information can be monitored simultaneously.

BROAD SPECTRUM COVERAGE

The frequency spectrum ranges from DC to the full bandwidth of the oscilloscope for repetitive signals and to one half of the maximum sampling frequency for transients.

MULTI-CHANNEL ANALYSIS

All input channels can be analyzed simultaneously to look for common frequency-domain characteristics in independent signals.

VERSATILE SCALING FORMATS

Frequency-domain data can be presented as magnitude, phase, real, imaginary, complex, log-power and log-PSD (Power Spectral Density).

STANDARD WINDOW FUNCTIONS

Use rectangular for transient signals; von Hann (Hanning) and Hamming for continuous waveform data; Flattop for accurate amplitude measurements; Blackman-Harris for maximum frequency resolution.



FREQUENCY DOMAIN

AVERAGING

Up to 50,000 FFT sweeps can be averaged to reduce base-line noise or to enable analysis of phase-incoherent signals or signals which cannot be triggered on.

FREQUENCY CURSORS AND WAVEFORM PARAMETERS

Cursors can be set on the FFT trace to show up to 0.004% frequency resolution (up to 0.002% for 10,000 point memory) and measure power or voltage differences to 0.2% of full scale. Automatic waveform parameters can also be applied to FFT traces.

PASS/FAIL TESTING ON FFT TRACES

Pass/Fail testing is fully supported on FFT traces. The instrument can be setup to test incoming spectra against tolerance masks. In case the signal "fails," the instrument can be programmed to perform a choice of actions (screen dump, waveform storage, pulse out, etc.).

RESCALING

This allows an input signal to be rescaled using an $(ax + b)$ correction factor to compensate for gain and offset. This is very useful, when dealing with various types of transducers, for reading the correct temperature or pressure value directly from the scope's cursor.

FUNCTION CHAINING

When more than one math function is needed in the equation, all LeCroy digital scopes support function chaining. For example, it would allow the user to perform digital filtering or sine x/x interpolation and then apply FFT analysis.

REMOTE CONTROL

All of the waveform processing can be controlled via GPIB or RS-232-C remote control. The function traces do not even need to be called up on screen to be updated, an important feature that speeds up the computation.

GENERAL

Max. number data points: only limited by the available amount of system memory (indicated in the "memory used" status menu). Up to 6 million

FOURIER PROCESSING

Fourier processing is a mathematical technique which enables a time-domain waveform to be described in terms of either frequency-domain magnitude and phase or real and imaginary spectra. It is used, for example, in spectral analysis where a waveform is sampled and digitized, then transformed by a Discrete Fourier Transform (DFT). Fast Fourier Transforms (FFT) are a set of algorithms used to reduce the computation time (by better than a factor of 100 for a 1000 point FFT) needed to evaluate a DFT.

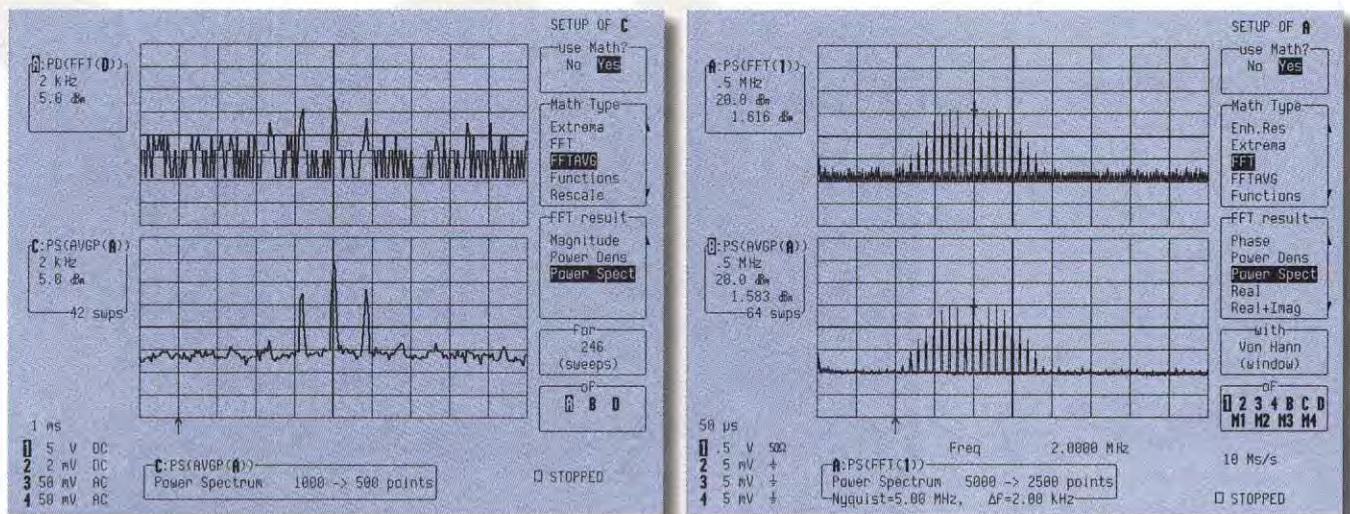
data points can be handled in scopes equipped with the 930X-64 RAM option of 64 MBytes of RAM.

Min. number data points: Data points can be reduced down to 50 in the processing function to improve update rate.

Vertical Zoom: x50 maximum.

Horizontal Zoom: maximum zooming to a point where 20 - 25 samples of the source trace occupy the full screen.

Maximum Sensitivity: 50 $\mu\text{V}/\text{div}$ after vertical expansion.



An FFT (top trace) with spectral components buried in noise. By applying the power averaging function (lower trace), all the base-line noise is removed, and the spectral components of an AM signal are clearly visible.

Frequency modulated signal, 2 MHz carrier with 99 kHz modulation frequency, 4:1 frequency deviation. FFT shows modulation sidebands. FFT power average used to improve s/n ratio.

Frequency Range:

Repetitive signals: DC to instrument bandwidth.
Transient signals: DC to 1/2 maximum single-shot sampling frequency.

Frequency Scale Factors: 0.05 Hz/div to 0.2 GHz/div in a 1-2-5 sequence.

Frequency Accuracy: 0.01%

AMPLITUDE AND PHASE

Amplitude Accuracy: Better than 2%. Amplitude accuracy can be modified by the window function (see the window functions table).

Signal Overflow: A warning is provided at the top of the display when the input signal exceeds the ADC range.

NUMBER OF TRACES:

Time domain and frequency domain data can be displayed simultaneously (up to 4 waveforms).

Phase Range: -180° to +180°

Phase Accuracy: ±5° (for amplitudes > 1.4 div).

Phase Scale Factor: 50°/division.

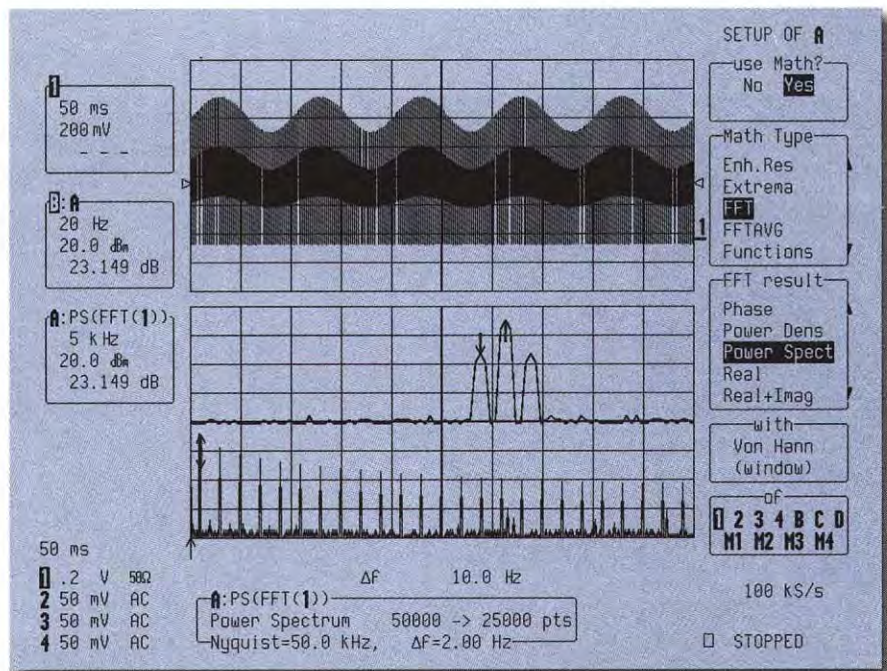
SPECTRUM SCALING

FORMATS

Horizontal Scale: Linear, in Hz.

Vertical Scales: Power Spectrum in dBm (1 mW into 50 W).

Power Spectral Density (PSD) in dBm.



FFT analysis of a 1 kHz square wave with 25% pulse amplitude modulation at 10 Hz. Long memory and 50 kpoint FFT show up to 51st harmonic, while expansion shows 10 Hz modulation sidebands.

Magnitude, Real, Imaginary: Linear, in V/div.

Phase Display: Linear, in degrees.

WINDOW FUNCTIONS

Rectangular, von Hann (Hanning), Hamming, Flattop and Blackman-Harris (see table below).

FFT EXECUTION TIMES*

100 points in less than 0.03 s.
 1000 points in less than 0.3 s.
 10000 points in less than 3 s.

* Valid for 9300C series or for 9350, 9360, 9370, 9384 and 9304/10/14 with MWP option. Other 9300 models, add 50%.

FFT execution in LC series scopes is typically a factor of 15 faster.

Filter Pass Band and Resolution				
Window Type:	Filter Bandwidth at 6 dB [freq. bins]	Highest Side Lobe [dB]	Scallop Loss [dB]	Noise Bandwidth [freq. bins]
Rectangular	1.21	-13	3.92	1
von Hann	2	-32	1.42	1.5
Hamming	1.81	-43	1.78	1.36
Flattop	1.78	-44	0.01	2.96
Blackman-Harris	1.81	-67	1.13	1.71

Filter Bandwidth at -6 dB characterizes the frequency resolution of the filter. Highest Side Lobe indicates the reduction in leakage of signal components into neighboring frequency bins. Scallop Loss is the loss associated with picket fence effect.



FREQUENCY DOMAIN**POWER AVERAGING**

Summation averaging of power, PSD or magnitude for up to 50,000 sweeps.

FUNCTION AVERAGING

Up to four functions can be automatically chained using traces A, B, C and D. Using memories M1 to M4 for intermediate results, any number of operations can be chained manually or via remote control.

REMOTE CONTROL

All controls and waveform processing functions are fully programmable using simple commands over the oscilloscope's GPIB or RS-232-C interfaces. Adding the WP02 Spectrum Analysis Package to the 9300 family of digital oscilloscopes provides a fast and economical solution to frequency domain applications.

ORDERING INFORMATION

SOFTWARE OPTIONS:
Spectrum Analysis

PRODUCT CODE
WP02

PRICE
\$ 1,250

Included as standard in LC Series Oscilloscopes, 9384CTM, 9374CTM and 9354CTM.



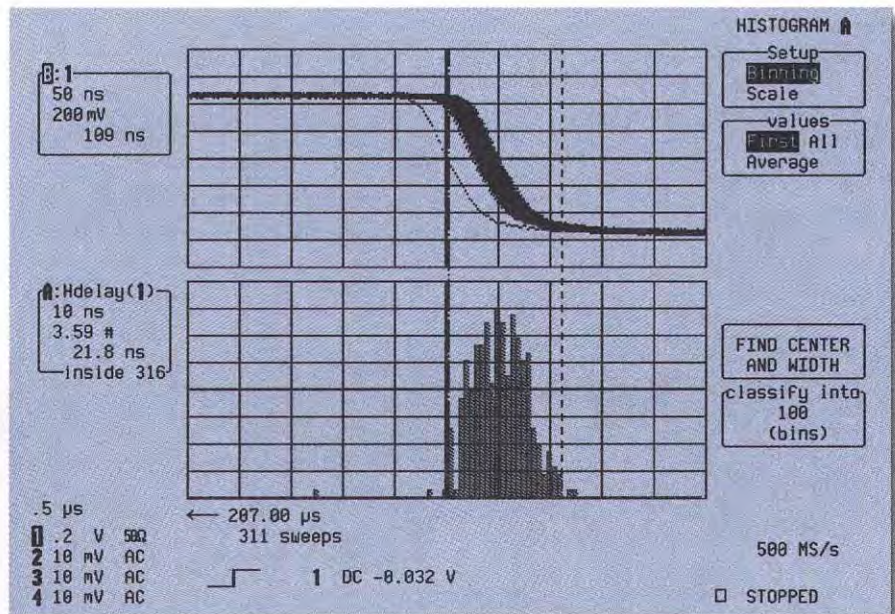
Parameter Analysis Package - WP03

MAIN FEATURES

- Histogram or Trend Functions for Over 40 Different Parameters
- Up to 2000 Bins
- Population of Up to 2,000,000,000
- 18 Histogram Parameters
- Autoscale on Histogram
- Histograms of All or Individual Segments in Sequence Waveforms

The LeCroy Parameter Analysis package extends the measurement capability of the 9300 or LC series oscilloscope by providing new processing functions – built into the oscilloscope – to perform in-depth analysis on waveform parameters, a task that was formerly carried out either manually, with a notepad, or by means of an external computer, in a spreadsheet program.

The new functions provide **bistogramming** or **rending** of any waveform parameter measurement. A histogram is a barchart showing how often each value of a parameter occurred. It can be conveniently **autoscaled** to display the center and width of the distribution. In addition, an already wide range of automated measurements are extended to provide a new category of statistical measurements specifically designed to analyze histogram distributions.



The package is fully programmable over GPIB and RS-232-C interfaces, and hard copies can be made directly to a wide range of printers (including the optional internal printer), plotters or graphic formats.

WAVEFORM PARAMETER ANALYSIS

WP03 adds a powerful dimension to waveform analysis by recording and analyzing the properties of a series of waveform parameter measurements. This is accomplished by a function that records the parameter values and presents the data in a statistical form – the Histogram – or shows the values in time order – the Trend.

The Histogram function produces a bar chart where each bar represents a range of parameter measurement values consisting of one bin. The height of each bar is equal to the number of parameter values which fall into the corresponding bar. Analysis of histogram distributions is supported by a wide range of automated statistical parameters which provide insight into and quantitative analysis for difficult-to-measure phenomena such as jitter and amplitude fluctuation. This function is also invaluable in establishing production test limits.

The Trend function displays the time-sequenced values of selected parameters. Key performance parameters can be tracked during changes in temperature or variation of supply voltage to plot amplitude modulation or other time-ordered dependencies.

A DATABASE IN THE OSCILLOSCOPE

The Histogram function performs calculations on a stored history database of waveform parameters. This allows detailed analysis to be performed on parameter data without the need to reacquire the source waveforms. Having the parameter database available also allows automatic scaling of histogram and graph displays.

WAVEFORM PARAMETER MEASUREMENTS

LeCroy DSOs have the capability to perform a wide range of automated waveform parameter measurements which make interpretation of waveform data easy, accurate and repeatable. The distribution of these parameter measurements can be analyzed by bistogramming their values.



Some of the waveform parameters available include:

amplitude	duration
minimum	area
duty cycle	overshoot +
base	falltime
overshoot -	cmean
frequency	peak to peak
cmedian	first
period	crms
f80-20%	phase
csdev	f@level (abs)
points	cycles
f@level (%)	rissetime
delay	last
r20-80%	Δ delay
maximum	r@level (abs)
Δ t@level(abs)	mean
r@level (%)	Δ t@level (%)
median	RMS
t@level (t=0,abs)	std dev
t@level (t=0,%)	top
Δ C2D+(hold)	width
Δ C2D-(setup)	

HISTOGRAM FEATURES

Provided below are just some of the histogramming capabilities.

Vertical:

Autoscaling, choice of "Linear," "Log" or "Constant maximum" (linear) scales. Up to 50x expansion.

Horizontal:

20 to 2000 bins in a 1-2-5 sequence. User-specified center and width or Autosetup of center and width.

Population:

20 to 2,000,000,000 selectable in a 1-2-5 sequence.

Data Source:

Any waveform parameter.

Value Displayed:

The bin event count/div, the number of events contained within the histogram, and the percent of the captured events lower and greater than the histogram scale are automatically displayed.

Measurements:

18 Statistical parameters operate directly on the histogram. Cursor measurements can also be made directly on histograms.

HISTOGRAM PARAMETERS

The standard 9300 and LC series offer basic parameter statistics (maximum, minimum, average and standard deviation). WP03 adds 18 parameters for use directly on the histogram displays.

These additional measurements allow detailed analysis of the parameter distributions and can be monitored by the Pass/Fail system to provide go/no-go testing based on parameter statistics.

TREND FEATURES

Up to four graphs of successive values of any waveform parameters can be generated through the Trend function. Output of the function is a line graph whose vertical axis is the value of the parameter and whose horizontal axis is the order in which the values were acquired.



HISTOGRAM PARAMETERS

Parameter	Abbreviation	Explanation
histogram base	hbase	Horizontal position of left-most statistically significant bin.
histogram top	htop	Horizontal position of right-most statistically significant bin.
histogram amplitude	hampl	Horizontal difference between the htop and hbase values.
histogram rms value	hrms	Root Mean Square value of histogram distribution.
sigma	sigma	Standard Deviation of histogram distribution.
low	low	Horizontal position of left-most non-zero bin.
high	high	Horizontal position of right-most non-zero bin.
range	range	Horizontal difference between the high and low values.
total population	totp	Total population in the histogram.
maximum population	maxp	Maximum population in any histogram bin (i.e. vertical value at the mode).
peaks	pks	Number of peaks in the distribution.
mode	mode	Horizontal position of the bin with maximum population.
average	avg	Horizontal mean of the distribution.
median	median	Horizontal median of distribution. The value of the mid-point of the distribution.
full width at half max	fwhm	The width of the distribution around the maximum population bin, including bins which contain at least one half of the maximum population.
full width at x% of max	fwxx	The width of the distribution around the maximum population bin, including bins which are at least x% of the maximum population.
x position at peak	xapk	Horizontal position of the nth largest peak by area.
percentile	ptl	Value in histograms for which % of population is smaller.

SOFTWARE OPTIONS - ORDERING INFORMATION

SOFTWARE OPTIONS:
Parameter Analysis Package

PRODUCT CODE
WP03

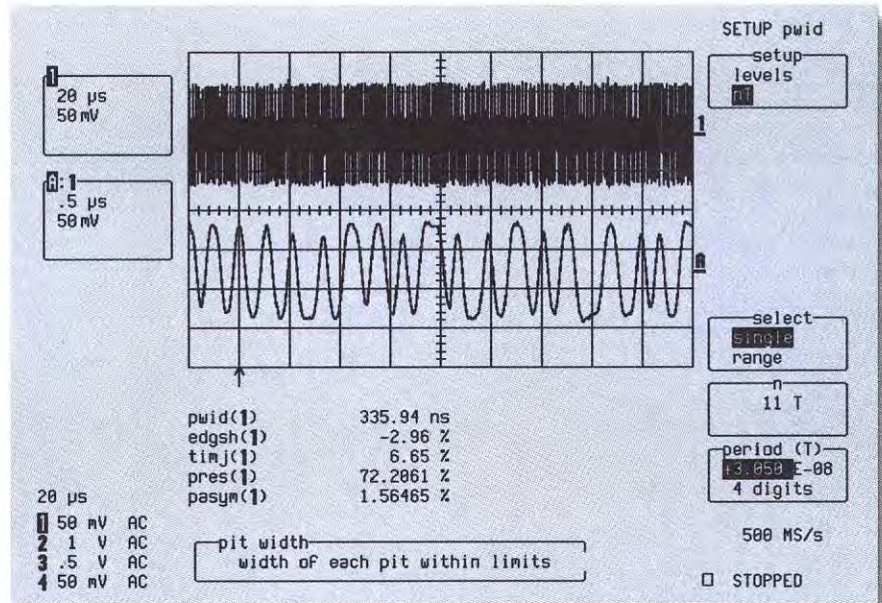
PRICE
\$ 1,250



Optical-Recording Measurement Package

MAIN FEATURES

- **Optical Recording Applications**
 - CD-ROM - PD - DVD
 - Magnetic-Optical
- **Optical Recording Parameters**
 - 14 Optical-Recording Specific Measurements,
 - 6 Timing Parameters and
 - 8 Amplitude Parameters, Including Pit Width, Time from Pit Edge to Clock, Resolution...
- **List by nT Display Mode**
 - Display a List of Optical-Recording Measurement Values Indexed by Each (nT) Pulse Width.
- **Histograms of Measurements**
 - Generate Histogram Bar Charts for Analysis of Parameter Value Distributions.
- **Trend Analysis of Measurements**
 - Generate Trend Lines of Parameter Measurement Values to Study Sector Variations, Modulation and Other Time-Ordered Dependencies



Trace 1 is a captured CD waveform. Trace A is a zoom expansion of Trace 1. Measurements performed on Trace 1 are Pit Width (pwid), Edge Shift (edgsh), Timing Jitter (timj), Resolution (pres) and Pit Asymmetry (pasym).

OPTICAL-RECORDING MEASUREMENT PACKAGE

LeCroy's Optical-Recording Measurement package provides the ability to perform automated measurements of optically recorded data waveforms. The combination of automated optical-recording measurements, long DSO memory, advanced triggering features and a large-screen waveform display provides previously unavailable optical recording analysis capabilities.

Fourteen optical-recording waveform specific parameter measurements are provided.

Up to five different parameter values can be displayed simultaneously with statistics such as average, maximum, minimum and sigma.

Also provided is a unique List by nT display mode, which simultaneously provides, for each group of 'nT' width pits/spaces, the values of measurements such as edge shift, timing jitter, etc.

Histogram graphs of parameter measurements can be selected to observe statistical anomalies not normally identifiable by calculating, for example, a parameter's average or sigma.

Trend graphs of parameter measurements can also be selected to observe the variation of successive parameter measurements within a sector or even around a track.

These measurements can be made by adding the optical-recording measurements package to either a 9300 or LC series DSO.



OPTICAL-RECORDING PARAMETERS

Optical-recording measurement package parameters directly support the pit/space width-based, data-encoding mechanism used in optical recording, by pre-screening waveform pits and spaces into width ranges from 1T to 25T, where T is the clock period.

User options include the ability to:

- calculate parameter values for pits, spaces or both.
- calculate parameter values for pits and/or spaces of a specific 'nT' value or range of 'nT' values.
- set the voltage threshold level at which to measure pits/spaces widths.

and much more....

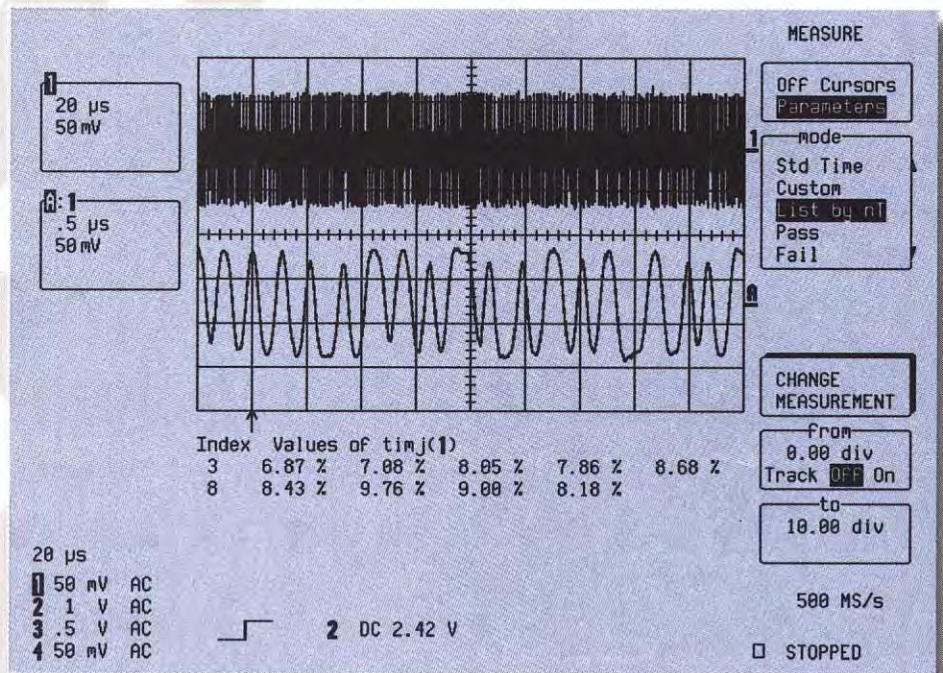
OPTICAL-RECORDING 'LIST BY nT' DISPLAY MODE

Often, it is desirable to view a measurement value for each 'n' value for all possible 'nT' width ranges simultaneously. The List by nT display is provided to accommodate this need. Up to 25 nT values can be displayed simultaneously in this mode. Measurements that can be displayed in the List by nT mode are:

- Time from Pit to Clock
- Pit Width
- Edge Shift
- Timing Jitter
- Pit Top
- Pit Base
- Pit Maximum
- Pit Minimum
- Pit Number
- Pit Average Amplitude

OPTICAL PARAMETER DESCRIPTION

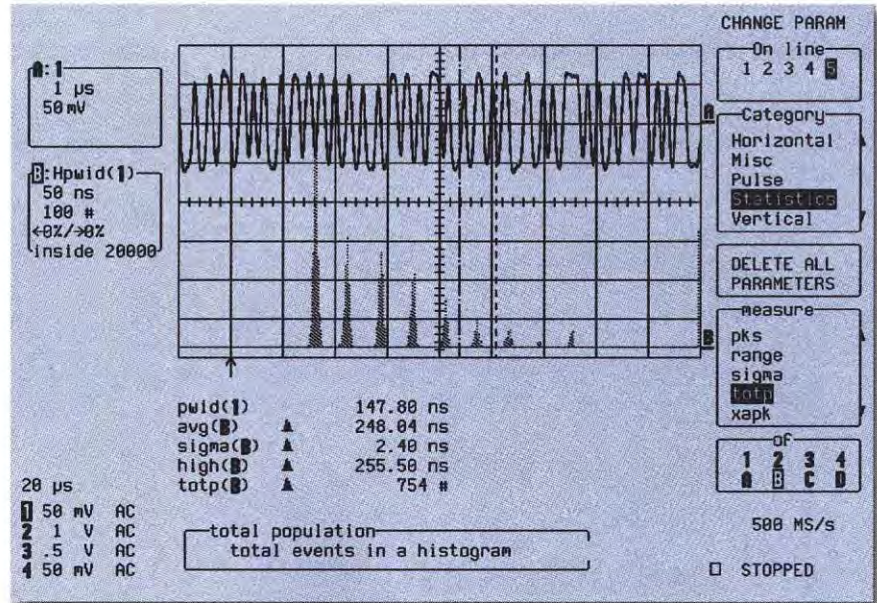
dp2clk	Delta Pit to Clock - time between the pit or space edges and the next clock edge. The measurement is normalized by the period of the clock signal.
edgsh	Edge Shift - the mean value of the difference between pits or space widths and their ideal widths.
paa	Pit Average Amplitude - average amplitude of pits in a waveform.
pasym	Pit Asymmetry - ratio of the difference between the amplitude of the largest 'nT' width pits and the smallest 'nT' width pits to the amplitude of the largest 'nT' width pits.
pbase	Pit Base - the value for the base level of a space.
pmidl	Pit Middle - the midpoint between the top and base of pits.
pmax	Pit Max - the maximum value of a pit.
pmin	Pit Min - the minimum value of a space.
pmoda	Pit Modulation Amplitude - ratio of the amplitude of pits of the smallest 'nT' width to the top of pits of the largest 'nT' width.
pnum	Pit Number - the total number of pits and/or spaces in a waveform.
pres	Pit Resolution - ratio of the amplitude of pits of the smallest 'nT' width to pits of the largest 'nT' width.
ptop	Pit Top - the value for the top level of a pit space.
pwid	Pit Width - the width of pits and/or spaces measured at a user-defined threshold.
timj	Timing Jitter - the standard deviation of the difference between pit and/or space widths and their ideal widths.



List by nT display of Timing Jitter (timj) measurement of CD-ROM Data Waveform with separate values displayed for each 'nT' mark/space width (3T-11T).

HISTOGRAM FUNCTION

A histogram of any waveform parameter measurement can be displayed. The histogram function produces a bar graph with the vertical axis in units of 'Events' and the horizontal axis in the unit of the parameter being histogrammed (i.e. volts, nanoseconds, etc.). Histograms graphically represent the distribution of parameter measurements, providing insights often not available through standard statistical measurements such as the average and standard deviation.



CD-ROM Data Waveform with Histogram of Pit Width (pwid) parameter. Notice the distinct peaks resulting from pits/spaces all being an integral number of clock periods in width. Statistical analysis of histograms is performed using histogram parameters. For the above figure, the histogram peak representing 8T pits and spaces is selected, and the average (avg) sigma, the highest value (high) and population of the peak (totp) are displayed.

HISTOGRAM PARAMETERS

Histogram parameters provide the ability to obtain numeric values for the statistics or other features of a histogram distribution. When combined with the 9300 or LC series parameter cursors, the statistics or other characteristics of a selected section of interest in a histogram, such as a specific histogram peak, can be directly measured.

HISTOGRAM PARAMETER DESCRIPTION

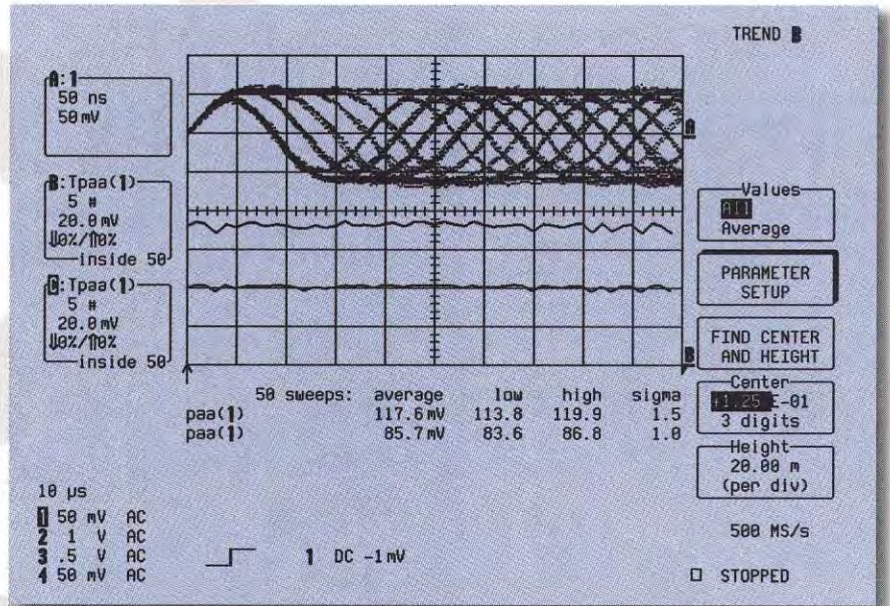
low	Minimum horizontal axis value in a histogram.
high	Maximum horizontal axis value in a histogram.
range	High - Low.
fwhm	The width of the largest peak in a histogram at half the peak's amplitude.
maxp	Population of the highest bin in a histogram.
average	The mean value of a histogram.
sigma	The standard deviation of the values in a histogram.
totp	The total number of parameter measurement values displayed in a histogram.
xapk	The horizontal axis value of the selected histogram peak.
Ppks	The number of distinct peaks (modes) in a histogram.
median	The horizontal axis value which divides the histogram population into two equal populations.
mode	The horizontal axis value of the most populated histogram bin.
pctl (percentile)	Horizontal position separating a histogram population such that the population on the left is equal to the selected percentile of the total population.



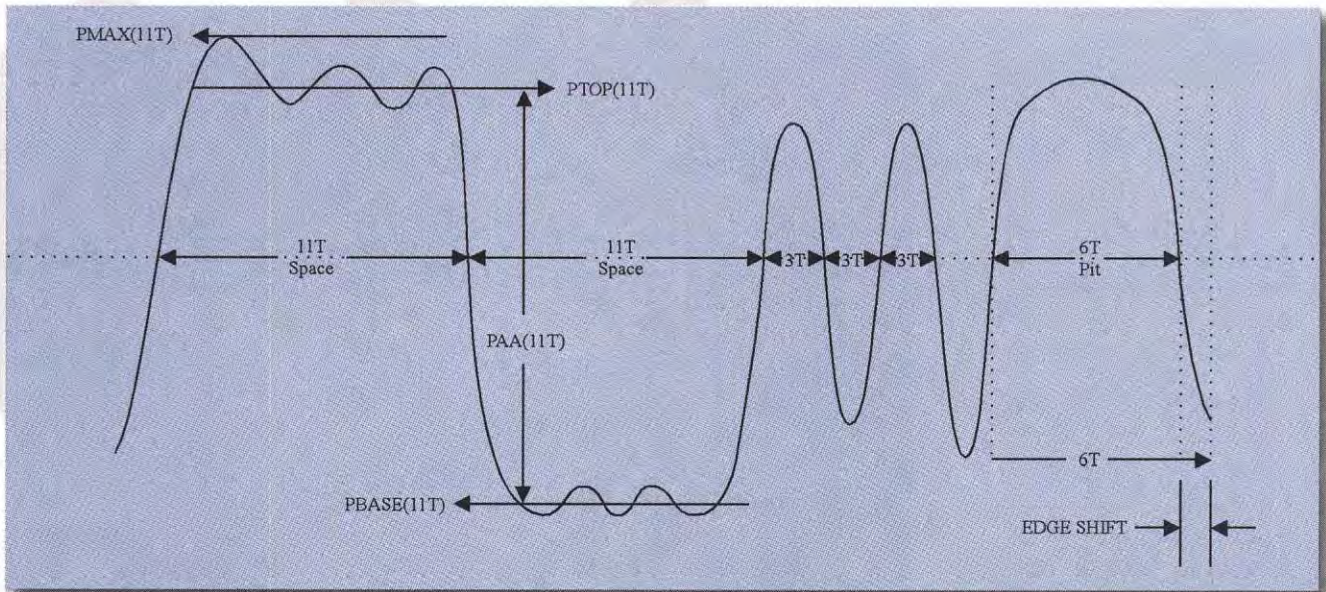
TREND FUNCTION

A graph of successive values of any waveform parameter measurement can be generated through the Trend function. The Trend function produces a line graph with the vertical axis representing the values of parameter measurements and the horizontal axis the rank order number (i.e. first parameter measurement calculated, second parameter...) in which each parameter value displayed was calculated.

The trend function provides instant insight into the variation of a selected waveform attribute for successive parameter measurements calculations. This is particularly useful when trying to determine the modulation of a track or other time- or position-based variations of interest.



Trace A shows an eye diagram of a CD signal. Trace B is a trend of the Pit Amplitude of 11T pits, and Trace C is a trend of the Pit Amplitude of 3T pits. Notice the similarity of the variation in the two trend lines.



SOFTWARE OPTIONS - ORDERING INFORMATION

SOFTWARE OPTIONS:
Optical Recording Measurements Package

PRODUCT CODE
ORM

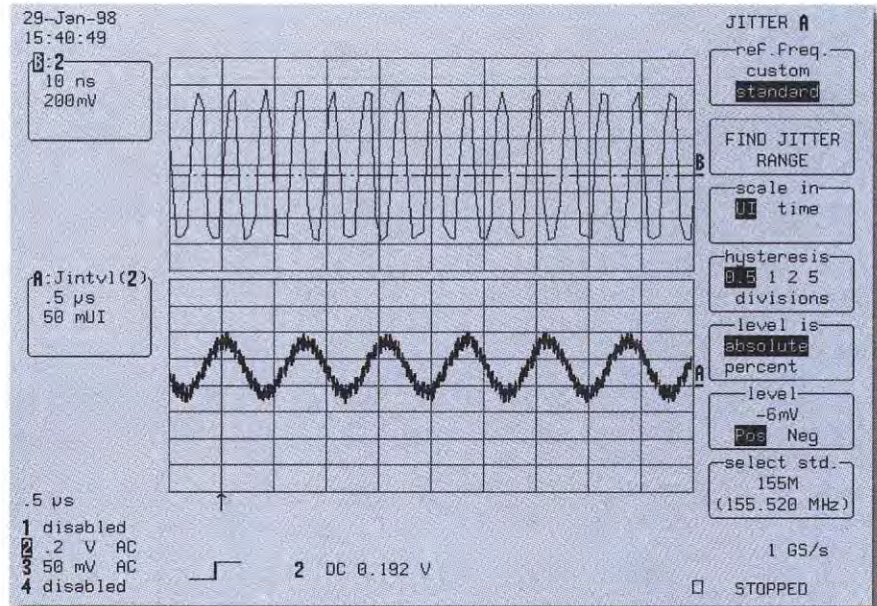
PRICE
\$ 3,000



Jitter and Timing Analysis Package

MAIN FEATURES

- *Jitter Measurements*
- *Cycle-to-Cycle Timing Measurements*
- *Histograms on Persistence Waveforms**
- *Full Statistical Analysis*
- *Enhanced Timing Accuracy*
- *Persistence-to-Waveform Tracing**



Cumulative jitter on a 155 Mb/s clock. Note the sine-shaped jitter.

The Jitter and Timing Analysis Package (JTA) augments the long memory and highly accurate clock of LeCroy oscilloscopes to provide dedicated, precise timing measurements. JTA addresses the growing need to precisely characterize waveform timing stability — essential to applications such as synchronous networks or digital systems. Timing measurements can be represented in standard formats such as UI (Unit Intervals).

JTA offers three basic types of tools: Timing Parameters, Timing functions and Statistical Tools.

JTA can:

- Display the Jitter function of a signal
 - Measure Cycle-to-Cycle Jitter
 - Measure Duty Cycle or Width (either polarity)
 - Show detail in the shape of an edge
 - Measure Jitter and Noise on Eye Diagrams
 - Measure an unlimited number of cycles on long records
 - Count an unlimited number of edges
- * On LC series oscilloscopes only



TIMING PARAMETERS

Offering maximum flexibility, each timing parameter operates on a **selectable level** of the acquired waveform — in either Volts or percent of signal amplitude.

In addition, each parameter calculation is performed over **all cycles or edges** present in the input signal, without limitation. The acquired set can then be analyzed using **Histograms** or **Trends** (see Statistical Tools).

To optimize measurement **accuracy, repeatability and speed**, advanced interpolation filtering is applied to the signal edges in the vicinity of the measurement points.

The Parameters:

P@LV (period at level) calculates the period of each cycle in an acquired waveform.

WID@LV (Width at level) returns the width — positive or negative — of each period in the source trace.

ΔP@LV (Delta period at level) calculates the adjacent cycle deviation

(Cycle-to-Cycle Jitter) of each cycle in an acquired record.

EDGE@LV (Edge at Level) counts the number of edges — positive or negative — in the source trace.

DUTY@LV (Duty Cycle at Level) calculates the duty cycle of each period in the source trace.

TIE@LV (Time Interval Error at level) calculates the cumulative time interval error in the signal compared to an “ideal” position defined by a user-defined reference.

TIMING FUNCTIONS

The **Jitter** function plots the amplitude of the following waveform attributes, as a function of time:

- Cycle-Cycle variation
- Duty Cycle
- Interval Error
- Period
- Width

The **Interval Error** jitter function, as defined in Bellcore TR-499, plots “the

short-term variations of a digital signal’s significant instants, from their ideal positions in time”.

Persistence Histogram* (Per.Hist) is the ideal “quantitative” companion to persistence display. The function histograms a horizontal or vertical “slice” of the persistence waveform. A pertinent application is jitter and noise analysis on an eye diagram, where the information resides in the persistence map and not the waveform itself. And the Persistence Histogram can in turn be characterized using statistical measurements such as range, sigma, or full width at half max.

Persistence Trace* (Per.Trace) is a totally new concept that involves computing a vector trace from a bit map. Several settings are available:

- **Average:** for each vertical time slice on the persistence map, calculates and plots a trace corresponding to the mean value. Single-shot signals sampled at or above 2 GS/s and accumulated in the persistence map can be traced at a resolution of 10 ps (100 GS/s equivalent sampling).
- **Sigma:** for each vertical time slice on the persistence map, calculates and plots an envelope corresponding to the standard deviation. Multiples of sigma are also supported.
- **Range:** for each vertical time slice on the persistence map, calculates and plots an envelope corresponding to the range. Artifact rejection is also supported.

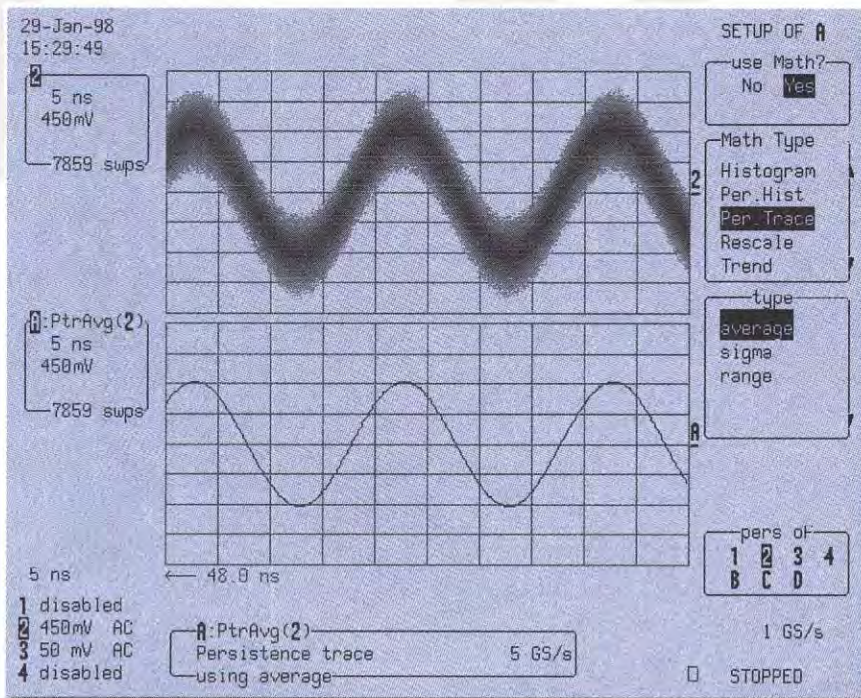
STATISTICAL TOOLS

The **Histogram** presents the statistical distribution of any timing parameter’s set of values. The most important Histogram capabilities are described here.

Vertical: Autoscaling, choice of “Linear”, “Log” or “Constant maximum” scales.

Horizontal: 20 to 2000 bins. User-specified or automatic center-and-width adjustments.

Population: 20 to 2x10⁹.



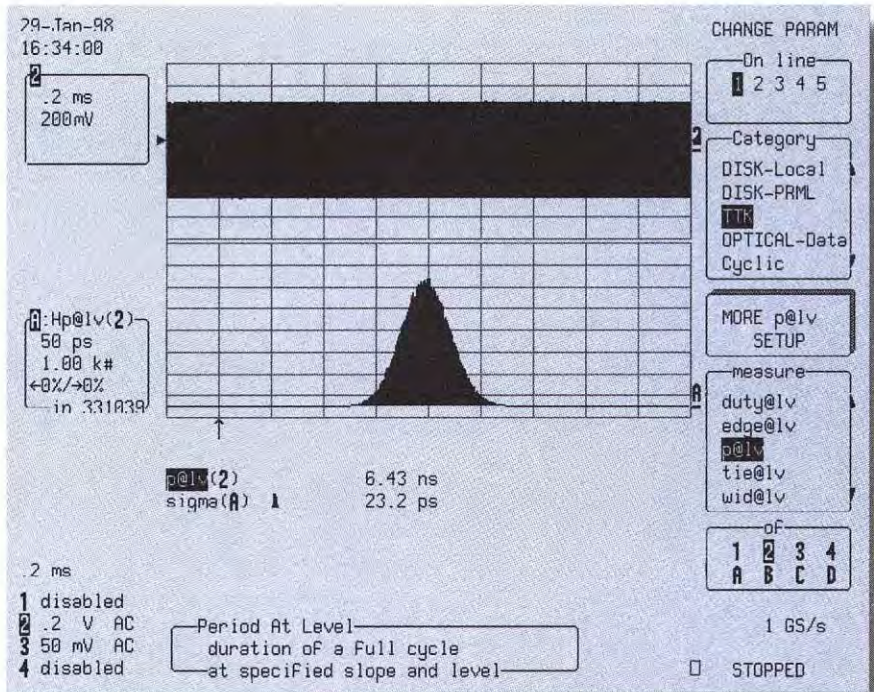
Persistence trace (Per.Trace) set to “average”

Value Displayed: Automatically displayed are the bin event count/div, the number of events contained within the histogram, and the percentage of the captured events lower and greater than the histogram scale.

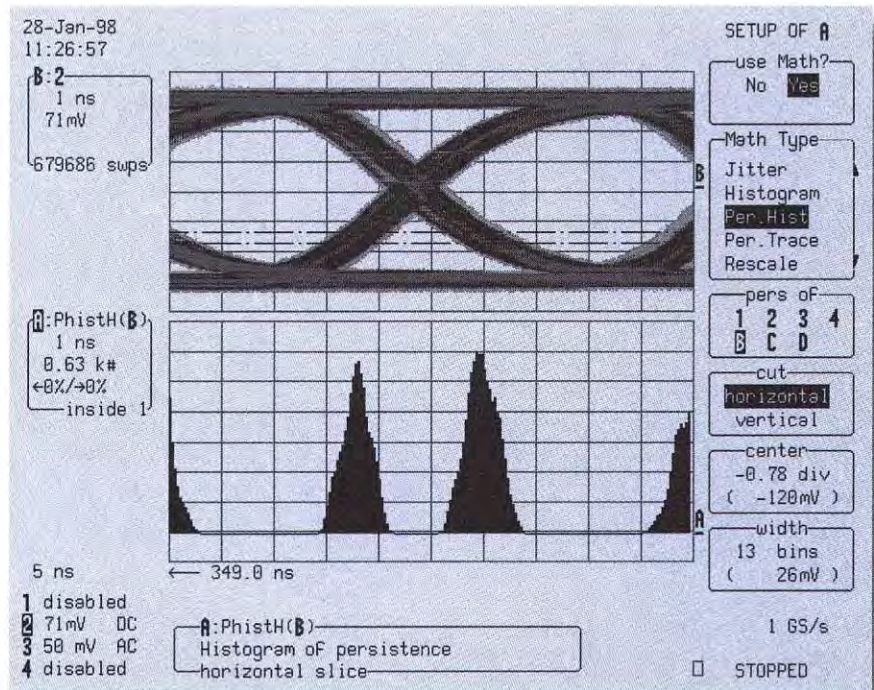
Histogram Measurements: 18 statistical parameters operate directly on the histogram. Cursor measurements can also be made directly on histograms.

The **Trend** function graphically represents the evolution of any given timing parameter. This function outputs a line graph whose vertical axis is the value of the parameter and horizontal axis is the order in which the values were acquired, as in XY or scatter diagrams.

* On LC series oscilloscopes only



Histogram of period at level (p@lv) showing 331039 calculations in one acquisition.



Persistence Histogram (Per.Hist) of a SONET OC-3 eye diagram.



JITTER AND TIMING ANALYSIS PACKAGE - ORDERING INFORMATION

SOFTWARE OPTIONS

Jitter and Timing Analysis Package (includes WP03 statistical analysis)
JTA Field Retrofit (includes WP03 statistical analysis)
JTA Upgrade for WP03 Owners

PRODUCT CODE

JTA
RK-JTA
RK-UPG-JTA

PRICE

\$ 1,875
Contact Service Office
Contact Service Office

