



## WavePro 954

### LEADING FEATURES

- 1 GHz bandwidth
- 2 GS/s sample rate
- 8 GS/s single channel mode
- 250 kpoints memory/ch
- Wavepilot toolbar
- 10.4" TFT LCD color display
- GPIB, RS232 standard ethernet (optional)



WavePro 954 scopes are feature-laden with attractive price/performance ratios.

### Great Value

The WavePro 954 scope incorporates the same industry-leading 'digitizer on a chip' technology that made the WavePro series scopes a big hit with design engineers.

WavePro scopes offer faster sampling rates and longer memory in the 500 MHz to 2 GHz range, at lower prices, than other digital oscilloscopes.

Now, the model 954 at 1 GHz and with useful features like Wavepilot, Quick Zoom, and analog persistence, underscores the unique price/performance appeal of WavePro scopes.

### Easy to Use & Powerful Too

The WavePro 954 is designed to get you up and running quickly. Its color-coded front panel, simple menu system, common tasks toolbar (Wavepilot) and

rich analysis feature-sets, all help you easily master the scope *and* your measurements. Take shortcuts to obtain data with one button access to 26 different parameter measurements, another button links to cursor measurements, and more. Save time with dedicated keys for time/date stamping, stored custom routines and persistence mapping. Two new high frequency probes (the HFP series models 1500 & 2500) preserve the full 1 GHz bandwidth of the scope at the probe tip. Physically small and with low mass, they are perfect for working in tight spaces. Today's leading edge designs require the capture, viewing and analysis of long, complex signals. The WavePro series is ideally suited to this critical function. And the 954 is an outstanding value when your budget is limited but your measurement challenges are abundant.

**LeCroy**

# WavePro 954

## Specifications

<b>Vertical System</b>		<b>WavePro 954</b>
Analog Bandwidth @ 50 $\Omega$ (-3 dB)		1 GHz
Input Channels		4
Bandwidth Limiters		20 MHz, 200 MHz
Input Impedance		50 $\Omega$ $\pm$ 1.5%; 10 M $\Omega$ // 11 pF typical (using PP005 probe)
Input Coupling		1 M $\Omega$ : AC, DC, GND; 50 $\Omega$ : DC, GND
Maximum Input		50 $\Omega$ : 5 Vrms; 1 M $\Omega$ : 100 Vmax (peak AC $\leq$ 5 kHz + DC)
Vertical Resolution		8 bits; up to 11 bits with enhanced resolution (ERES)
Sensitivity		50 $\Omega$ : 1 mV – 1 V/div fully variable ; 1 M $\Omega$ : 1 mV – 2 V/div fully variable
Offset Range		50 $\Omega$ or 1 M $\Omega$ : 1 mV – 4.99 mV/div; $\pm$ 400 mV, 50 $\Omega$ : 5 mV – 99 mV/div; $\pm$ 1 V; 0.1 V – 1 V/div; $\pm$ 10 V 1 M $\Omega$ : 5 mV – 100 mV/div; $\pm$ 1 V; 101 mV – 2 V/div; $\pm$ 20 V
<b>Timebase System</b>		
Timebases		Main and up to four independent zoom traces simultaneously
Clock Accuracy		$\leq$ 10 ppm
Interpolator Resolution		5 ps
External Clock Frequency		500 MHz maximum, 50 $\Omega$ , or 1 M $\Omega$ impedance
Roll Mode – Operating Range		time/div 500 ms – 1000 s/div or sample rate < 100 kS/s max
<b>Acquisition System</b>		
Single-Shot Sample Rate		8 GS
2 Channels Max.		4 GS/s
3 – 4 Channels Max.		2 GS/s
Maximum Acquisition Points/Ch		( 1 Ch ) / ( 2 Ch ) / ( 3 – 4 Ch )
Standard		1M / 500k / 250k
M – Memory Option		4M / 2M / 1M
<b>Acquisition Modes</b>		
Random Interleaved Sampling (RIS)		50 GS/s for repetitive signals: 200 ps/div – 1 $\mu$ s/div
Single-Shot		For transient and repetitive signals: 200 ps/div – 1000 s/div
Sequence		2 – 1000 segments
Intersegment Time		Typically 30 $\mu$ s
<b>Acquisition Processing</b>		
Averaging		Summed averaging to 10 <sup>3</sup> sweeps (standard). Continuous averaging up to 10 <sup>6</sup> sweeps with weighting range from 1:1 to 1:1023 (option).
Enhanced Resolution (ERES)		From 8.5 to 11 bits vertical resolution
Envelope (Extrema)		Envelope, floor, roof for up to 10 <sup>6</sup> sweeps
<b>Triggering System</b>		
Modes		Normal, Auto, Single, and Stop
Sources		Any input channel, external, Ext/5 or line; slope, level, and coupling unique to each source (except line trigger)
Coupling modes		DC, AC, HF, HFREJ, LFREJ
Pre-trigger delay		0 – 100% of horizontal time scale
Post-trigger delay		0 – 10000 divisions
Hold-off by time or events		Up to 20s or from 1 to 99 999 999 events
Internal trigger range		$\pm$ 5 div
Max trigger frequency		1 GHz (DC, AC), > 1 GHz (HF)
External trigger input range		$\pm$ 0.5 ( $\pm$ 2.5 V with Ext/5 selected )
<b>Automatic setup</b>		
Auto Setup		Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals
Vertical Find		Automatically sets the vertical sensitivity and offset for the selected channels to display a waveform with maximum dynamic range

# WavePro 954

## Specifications (continued)

### Probes

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

### Color Waveform Display

Type	Color 10.4" flat-panel TFT-LCD
Resolution	VGA 640 x 480 pixels
Real Time Clock	Date, hours, minutes, and seconds displayed with waveform
Number of Traces	Display a maximum of eight traces. Simultaneously display channel, zoom, memory, and math traces.
Grid Styles	Single, Dual, Quad, Octal, XY, Single + XY, Dual + XY; Full Screen gives enlarged view of each style.
Intensity Controls	Separate intensity control for grids and waveforms
Waveform Styles	Sample dots joined or dots only — regular or bold sample point highlighting.
Trace Overlap Display	Select opaque or transparent mode with automatic waveform overlap management.

### Analog Persistence Display

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

### Zoom Expansion Traces

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

### Rapid Signal Processing

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

### Internal Waveform Memory

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

### Setup Storage

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

### Interface

Remote Control	Full control of all front panel controls and internal functions via RS-232-C, GPIB, or Ethernet
RS-232-C	Asynchronous transfer rate of up to 115.2 kbaud
GPIB Port	Full control via IEEE - 4888.2; configurable as talker/listener for computer control and data transfer
Ethernet (optional)	10 BaseT Ethernet interface
Floppy Drive	Internal, DOS-format, 3.5" high-density
PC Card Slot (optional)	Supports memory and hard drive cards
External Monitor Port Standard	15-pin D-Type VGA-compatible
Centronics Port	Parallel printer interface
Internal Graphics Printer (optional)	Hard copy output in <10 seconds or strip chart mode up to 200 cm/div
Pass/Fail and Trigger Output	Front panel Cal BNC output provides choice of Cal Signal, Pass/Fail Condition, Trigger Ready, or Trigger Out signals

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## Specifications (continued)

### Outputs

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

### General

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

### Physical Dimensions

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

### Service

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

### Math Tools (Standard)

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

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

$\Delta$ delay	<i>fall @ level; % and volts</i>
$\Delta$ time @ level; % and volts	<i>first point</i>
$\Delta$ time @ level from trigger	<i>last point</i>
$\Delta$ time from clock to data + (setup time)	<i>median</i>
$\Delta$ time from clock to data - (hold time)	<i>number of points</i>
cycle median	<i>phase</i>
data	<i>rise @ level; % and volts</i>
duration	<i>time @ minimum (min)</i>
duty cycle	<i>time @ maximum (max)</i>

### Measure Tools (Standard)

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

#### Automated Measure Tools

<b>amplitude</b>	<b>fall 80-20%</b>	<b>rise 10-90%</b>
<b>area</b>	<b>frequency</b>	<b>rise 20-80%</b>
<b>base</b>	<b>maximum</b>	<b>rms</b>
<b>cycle std. deviation</b>	<b>mean</b>	<b>std. deviation</b>
<b>cycle mean</b>	<b>minimum</b>	<b>top</b>
<b>cycle rms</b>	<b>+overshoot</b>	<b>width</b>
<b>cycles</b>	<b>-overshoot</b>	<b>xamn</b>
<b>delay</b>	<b>peak-to-peak</b>	<b>xamx</b>
<b>fall 90-10%</b>	<b>period</b>	

### Pass/Fail

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

### WAVEANALYZER PRO (WAVAPRO)

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

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

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## Specifications (continued)

### Other Application Solutions Available

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

### Software Utilities

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

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

**MaskMaker**  
Create your tolerance mask offline with this graphic tool.

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

### Basic Triggers

Edge/Slope/Window/Line	Triggers when signal meets slope and level condition
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### SMART Triggers

State or Edge Qualified	Triggers on any input source only if a defined state or edge occurred on another input source. Delay between sources is selectable by time or events.
Dropout	Triggers if signal drops out for longer than selected time between 2 ns and 20 s
Pattern	Logic combination of 5 inputs (4 channels and external trigger input); Each source can be high, low, or don't care. Trigger at start or end of the pattern.

### SMART Triggers with Exclusion Technology

Signal or Pattern Width	Triggers on glitches or on pulse widths selectable from 600 ps to 20 s or on intermittent faults.
Signal or Pattern Interval	Triggers on intervals selectable between 2 ns and 20 s
Slew Rate	Triggers on edge rates; select limits for dV, dt, and slope
Runt	Positive or negative runts defined by two voltage limits and two time limits selectable between 600 ps and 20 ns

## Ordering Information

### WavePro 954 Digital Oscilloscope

1 GHz, 4 GS/s, 250 kpts/ch, 4 Channel Color DSO

### Product Code

WAVEPRO 954

### Included with Standard Configuration:

10:1 10 M $\Omega$ Passive Probe (1 per channel)	PP005
Operator's Manual, Quick Reference Guide, CD-ROM with OM/RCM PDF manuals, and utility software	WAVEPRO-OPDOCS
Remote Control Manual	WP-RCM
Floppy Disk Drive	
GPIB, RS-232-C, Centronics Parallel Port, VGA Video Output Port	
Protective Front Cover	
Performance Certificate	
Three-Year Warranty	

### Memory Option

M 4 Mpts max, 1 Mpts/ch	Option-M
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### Hardware Options

Internal Graphics Printer	WAVEPRO-GP02
10 BaseT Ethernet LAN option	WAVEPRO-LAN10BT
PC Card Slot	PCSLOT
PC Card Slot including 1 hard drive card and 1 memory card	PCMEDIA

### Software Options

WaveAnalyzer Pro Analysis Package (includes WAVA, JTA, and DFP)	WAVAPRO
WaveAnalyzer Analysis Package	WAVA
ITU G.703 Fully Automated Mask Tester	MT01
ANSI T1.102 Fully Automated Mask Tester	MT02
ITU G.957 STM-1 and STM-4 Fully Automated Mask Tester with O/E converter and reference receiver	MT03
Jitter and Timing Analysis Package	JTA
JitterPro	JPRO
Digital Filter Package	DFP
Disk Drive Measurements	DDM
Supplementary Disk Drive Measurements	PRML
Advanced Optical Recording Measurements	AORM
PowerMeasure Analysis Software	PMA1

### Selected Accessories

Graphic Printer Paper/10 Rolls	GPR10
Oscilloscope Carts	OC-1021 & OC-1024
1 GHz Active Voltage Probe	HFP 1000
1.5 GHz Active Voltage Probe	HFP 1500
2.5 GHz Active Voltage Probe	HFP 2500

### Warranty & Calibration

NIST Calibration Certificate	CCNIST
MIL STD Calibration	CCMIL
Swiss OFMET Standard	CCOFMET
5-Year Repair Warranty	W5
5-Year NIST Calibration Contract	C5
5-Year Warranty & NIST Calibration	T5

## Sales and Service Throughout the World

### Corporate Headquarters

700 Chestnut Ridge Road  
Chestnut Ridge, NY 10977  
USA

<http://www.lecroy.com>

### LeCroy Sales Offices:

Asia: Hong Kong  
Phone (852) 2834 5630  
Fax (852) 2834 9893

Austria: Markersdorf  
Phone (43) 2749 30050  
Fax (43) 2749 30051

Benelux: The Netherlands  
Phone (31) 40 211 6998  
Fax (31) 40 211 6999

France: Les Ulis  
Phone (33) 1 69 18 83 20  
Fax (33) 1 69 07 40 42

Germany: Heidelberg  
Phone (49) 6221 827 00  
Fax (49) 6221 834 655

Italy: Venice  
Phone (39) 041 456 97 00  
Fax (39) 041 456 95 42

Japan: Osaka  
Phone (81) 6 6396 0961  
Fax (81) 6 6396 0962

Japan: Tokyo  
Phone (81) 3 3376 9400  
Fax (81) 3 3376 9587

Japan: Tsukuba  
Phone (81) 298 56 0961  
Fax (81) 298 56 0962

Korea: Seoul  
Phone (82) 2 3452 0400  
Fax (82) 2 3452 0490

Spain: Madrid  
Phone: (34) 91 640 11 34  
Fax: (34) 91 640 06 40

Switzerland: Geneva  
Phone (41) 22 719 2111  
Fax (41) 22 719 2230

U.K.: Abingdon  
Phone (44) 1 235 536 973  
Fax (44) 1 235 528 796

U.S.A.: Chestnut Ridge  
Phone (1) 845 578 6020  
Fax (1) 845 578 5985

