WaveSurfer
Digital Storage Oscilloscopes

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Designed for the way you really work—you'll never go back to your old oscilloscope again.

LEADING FEATURES

- ***500 MHz, 350 MHz, and 200 MHz bandwidths***
- ***2 or 4 channels***
- ***10.4" color LCD touch screen***
- ***Only 6" deep***
- ***High sample rate and long capture time***
- ***Front Panel Mounted USB port***
- ***Extensive built-in tools for network connectivity, printing, document storage, and communication***
- ***Local language user interface***
- ***Analog Persistence™ for color-rendered view of signal variations***
- ***Dedicated front panel cursor knobs***
- ***Measurements, Math incl. FFT***
- ***Pass/Fail Testing***
- ***Battery Pack Option available***

WaveSurfer is simple to use, affordable, and contains the perfect balance between simplicity and capability.

Perfect For Your Eyes and Your Bench

WaveSurfer's large 10.4" high resolution color LCD display is unique—use it to view signals like never before. And you don't have to sacrifice small size for a large display— WaveSurfer's small footprint makes bench location easy. Or take advantage of WaveSurfer's ergonomic mounting systems to lift the oscilloscope off the bench and reduce the footprint to zero.

Long Capture Time

WaveSurfer not only provides a large viewing area, but also more than 100X the capture time at full sample rate compared to other oscilloscopes in this class. Trigger, capture, and view your data with all the signal detail that you need by maintaining a high sample rate for long records. This is especially important when capturing a mix of signals that are spaced widely apart in time, or when you require a long post-trigger time.

Communication and Documentation

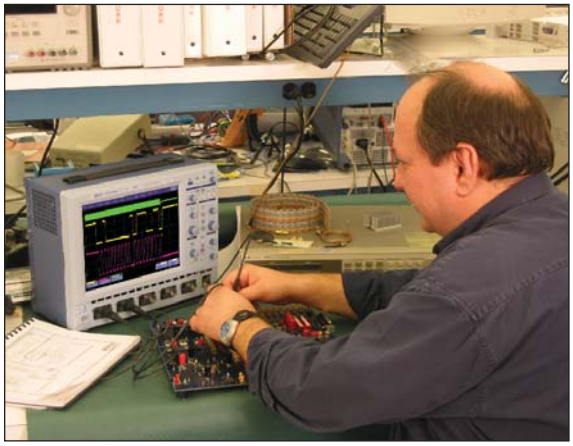
Communicate with others efficiently and productively. Document your work quickly and easily. WaveSurfer makes it all so easy you'll wonder why you accepted less. Connect the oscilloscope to your network with the standard Ethernet port. Email images (and comments) directly from the oscilloscope. Save data or images to your oscilloscope hard drive or to a USB memory stick (using the front-mounted USB port). Connect to any printer to print your images. Control the oscilloscope from your desktop PC using off-the-shelf programs included on most PCs.

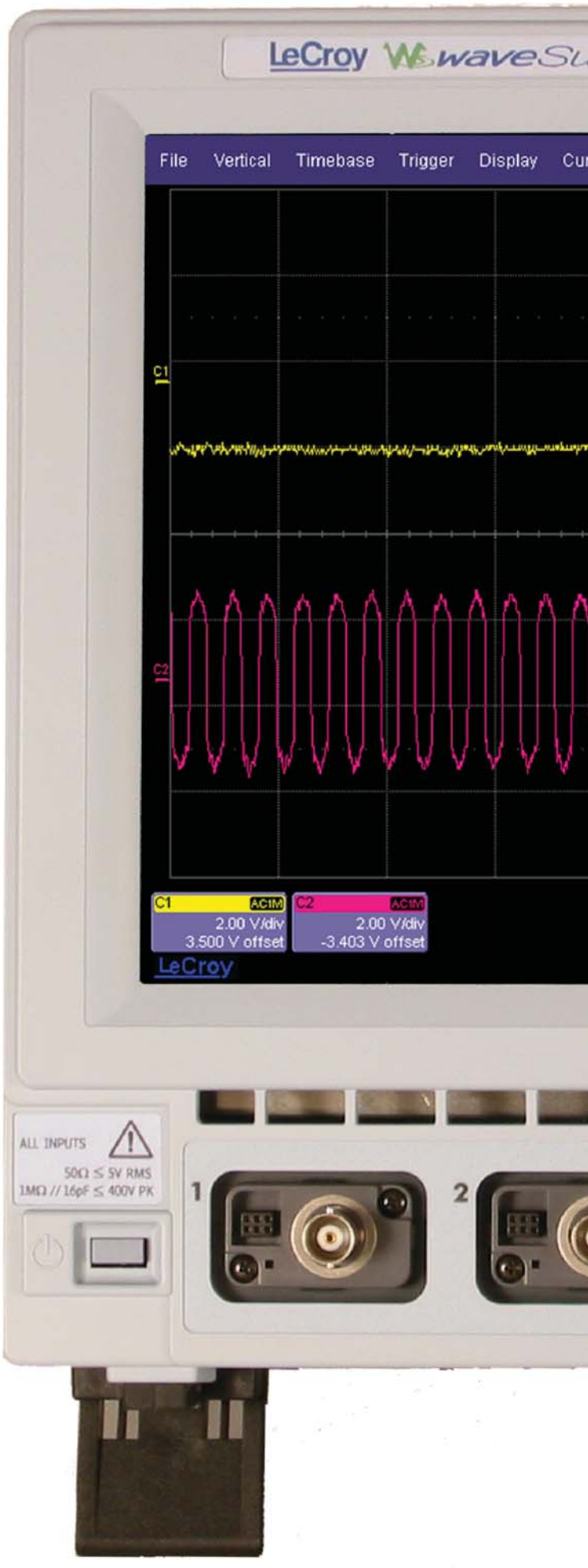
LeCroy

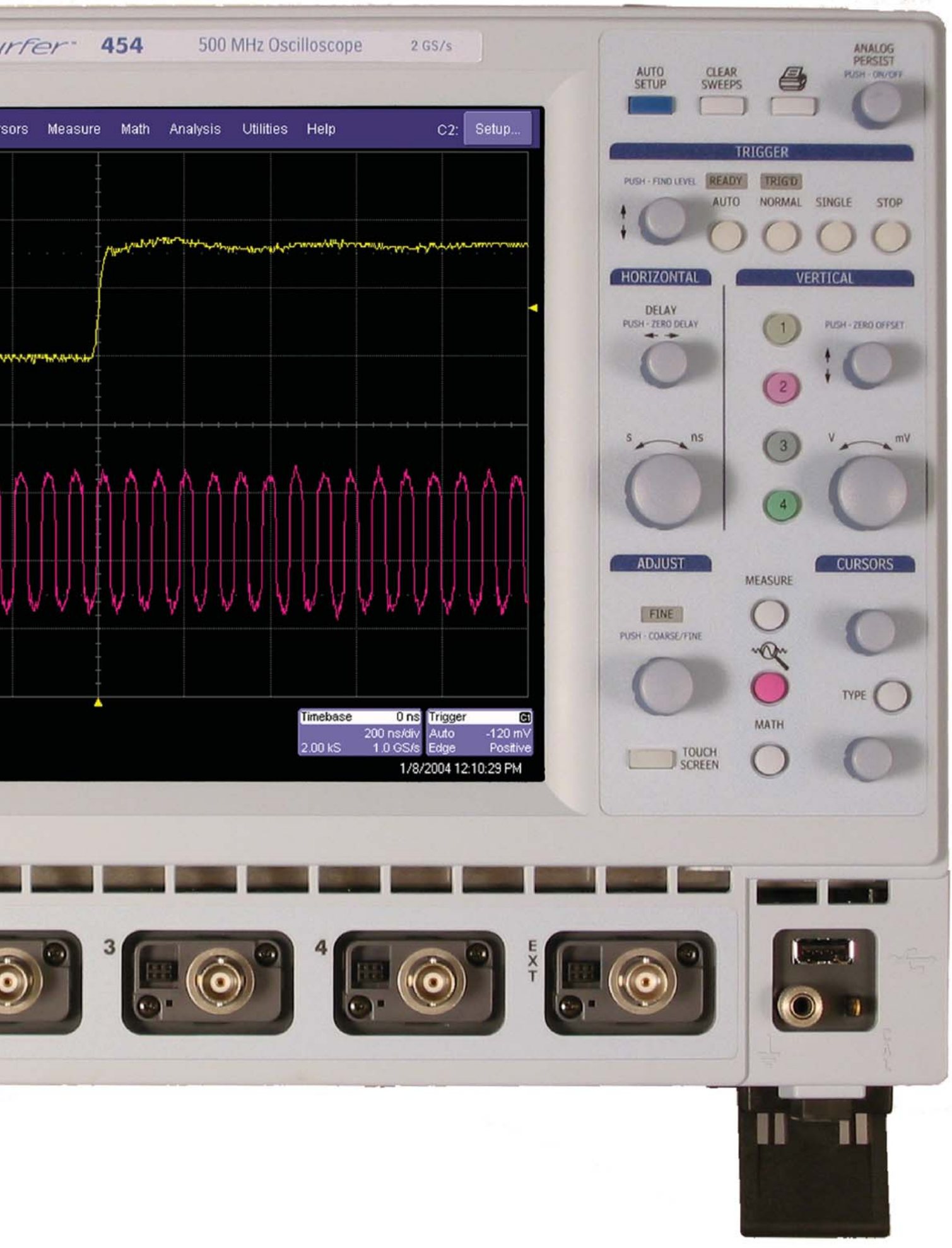
BECAUSE THERE IS SO MUCH TO SEE

10.4" – You'll never go back once you've seen a WaveSurfer

Every oscilloscope user is a decision maker, and the size and clarity of the oscilloscope screen helps to improve the decisions that are made. WaveSurfer's display area is 250% larger than the 6.4" displays found on competitive oscilloscopes, yet the footprint of the oscilloscope is no larger, and the 6" deep WaveSurfer fits on even the smallest bench. In addition, the 800x600 SVGA display boasts exceptional brightness and a wide viewing angle. Signal details will leap out at you like never before. Operation is made even easier via the simple, intuitive touch screen operator interface that even inexperienced operators will be able to learn quickly. Help is always easily accessible right on the oscilloscope display – no need to waste valuable time looking for a misplaced manual.





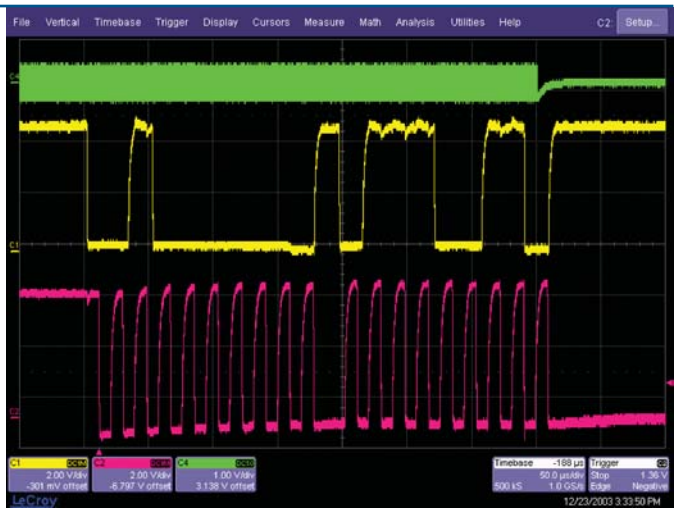

454
500 MHz Oscilloscope
2 GS/s
Measure
Math
Analysis
Utilities
Help
C2:
Setup...
Timebase
0 ns
200 ns/div
2.00 kS
1.0 GS/s
Trigger
Auto
-120 mV
Edge
Positive
1/8/2004 12:10:29 PM
AUTO SETUP
CLEAR SWEEPS
ANALOG PERSIST
TRIGGER
READY
TRIG'D
AUTO
NORMAL
SINGLE
STOP
HORIZONTAL
VERTICAL
DELAY
PUSH - ZERO DELAY
PUSH - ZERO OFFSET
ADJUST
CURSORS
MEASURE
FINE
PUSH - COARSE/FINE
TYPE
MATH
TOUCH SCREEN
3
4
EXT

Designed to Work the Way You Do

Because the Details Make the Difference

The Long Record Captures You Need

Don't accept a tradeoff between high sample rate and long capture time. WaveSurfer provides you with standard 250 µs capture time at full sample rate, with options to allow up to 1 ms. Longer captures at less than maximum sample rate are easily made. Long capture is especially important during debug when you need to capture signals that may be spaced widely apart. It also provides longer post-trigger time, and better sampling resolution on sporadic trigger events. This makes the WaveSurfer uniquely able to debug many common circuit problems, such as clock/data issues, timing errors, etc. that would be difficult or impossible to find with a short memory oscilloscope.

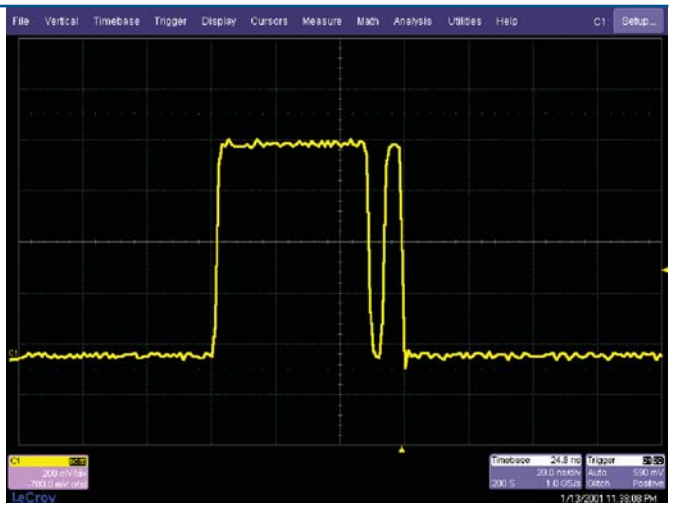


Persistence the Way You Want It

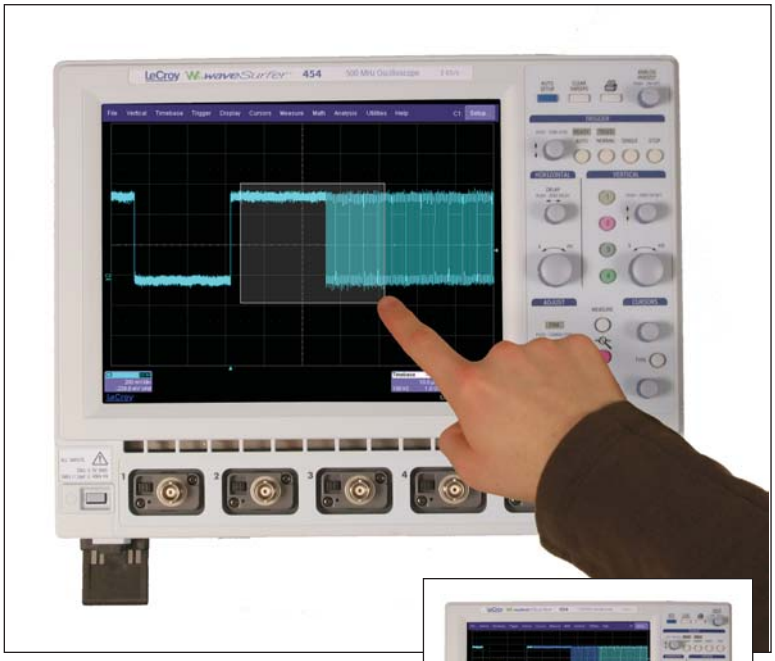
WaveSurfer's patented Analog Persistence™ provides a color-graded view of waveform activity. Analog Persistence is commonly used in a wide variety of applications, such as quickly viewing signal variation, creating X-Y plots, measuring serial data signal jitter, etc. Turn it ON or OFF from the front panel. Use the front panel knob to adjust the persistence saturation to maximize understanding. Use it the way you want to, or choose not to use it at all—you're in control.

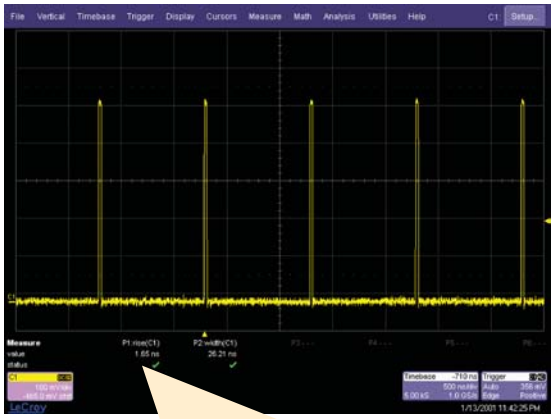
Find the Source of the Problem

A comprehensive trigger set helps you capture the signals that interest you the most. To help you capture the exact event of interest, the Edge trigger can be coupled in DC, AC, HF, HFREJ, and LFREJ modes. Glitch, Width, Logic (Pattern), and TV triggers are also standard. Runt, Slew Rate, Qualified Edge, Qualified State, Interval, and a Dropout trigger may also be optionally purchased.



Measure/Characterize



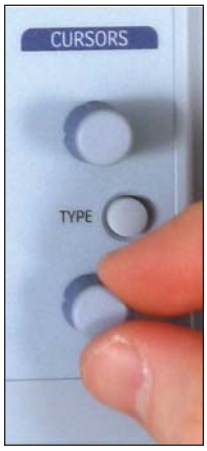


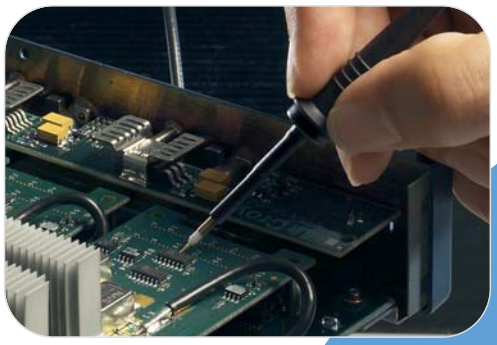
Once you've captured your signals, the WaveSurfer makes it simple to characterize them. Use a variety of cursors or measurements to understand your signal. Zoom in or out, or apply waveform math. It's all easily accessed, and easy to use—just the way you'd expect it.

Use dedicated front panel cursor knobs to position your cursors at any time without having to invoke special menus. Or, select one of the 23 built-in measurements and apply it to your signal.

Waveform math is built-in and easily applied. In addition, a power spectrum FFT is also standard. The FFT included in WaveSurfer can be quickly invoked and is easily set up, even by someone not experienced in using an FFT. It aids in troubleshooting of problems by providing detailed information on the frequency content of your signals.

MathSurfer (optional) provides additional math capability. Chain math functions together, or create custom calculations using math, measurements, or rescaling. MathSurfer also adds more than 10 additional functions, such as integral and derivative. This capability can be especially helpful to the design engineer who desires more understanding of his circuit.





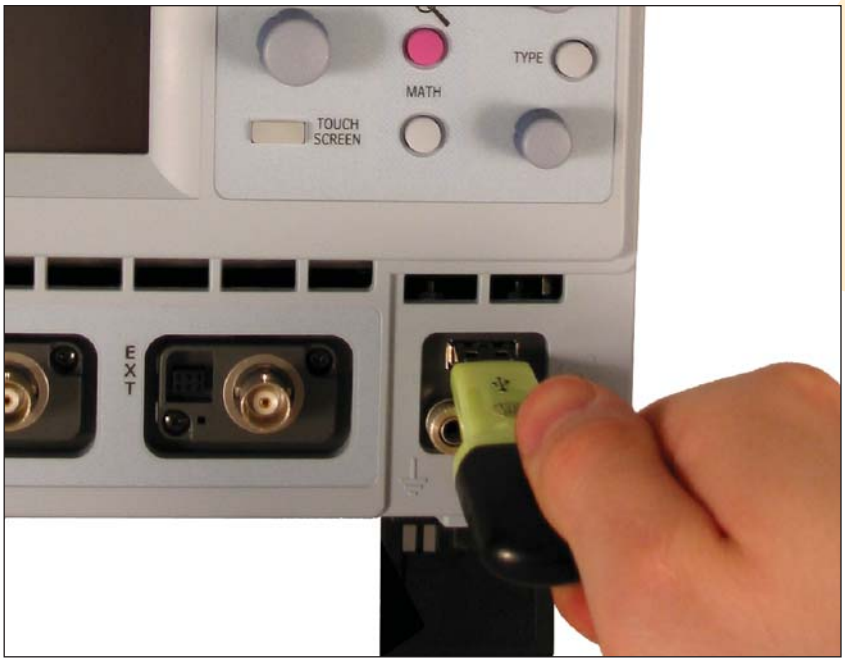
An Outstanding New Passive Probe

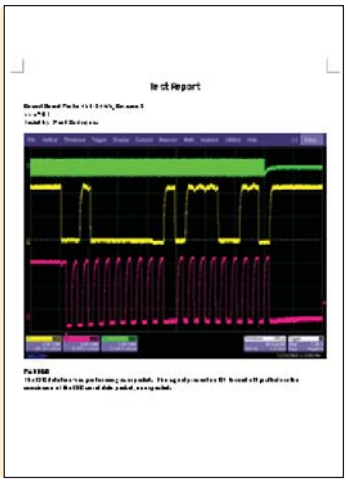
The new PP007 500 MHz passive probe comes standard with the WaveSurfer series. Just 2.5 mm, the PP007 lets you take measurements in small spaces without touching another device. The low capacitance (< 9.5 pF) and flat impulse response ensure your signal is perfectly transmitted to the high-fidelity WaveSurfer front-end amplifier.

The probe is compatible with over 30 accessories, including clips, leads, hooks, tips, ground leads, and BNC adapters. This makes it practical in a variety of applications. The PP007 is just one of over 25 LeCroy passive, active, current and differential probes that are compatible with the WaveSurfer—one is sure to be perfect for your application.

Connect, Communicate, Document

Capability that will save hours every day, and improve your product quality.





WaveSurfer is designed to make you more productive by connecting you to the tools you already use.

In this era of rapid response to customer problems and shortening design times, you need the capability to communicate rapidly and effectively across your organization. WaveSurfer helps you do this. WaveSurfer is the only oscilloscope in this class that will allow you to:

- Email engineers or customers images of signals directly from the oscilloscope
- Allow annotation of image files directly on the oscilloscope
- Save images and data files to the oscilloscope hard drive
- Download images and files quickly to a USB memory stick
- Create an archive of "perfect" signals to compare to during board validation
- Print to any printer
- Be controlled or viewed from a remote location using off-the-shelf software tools.

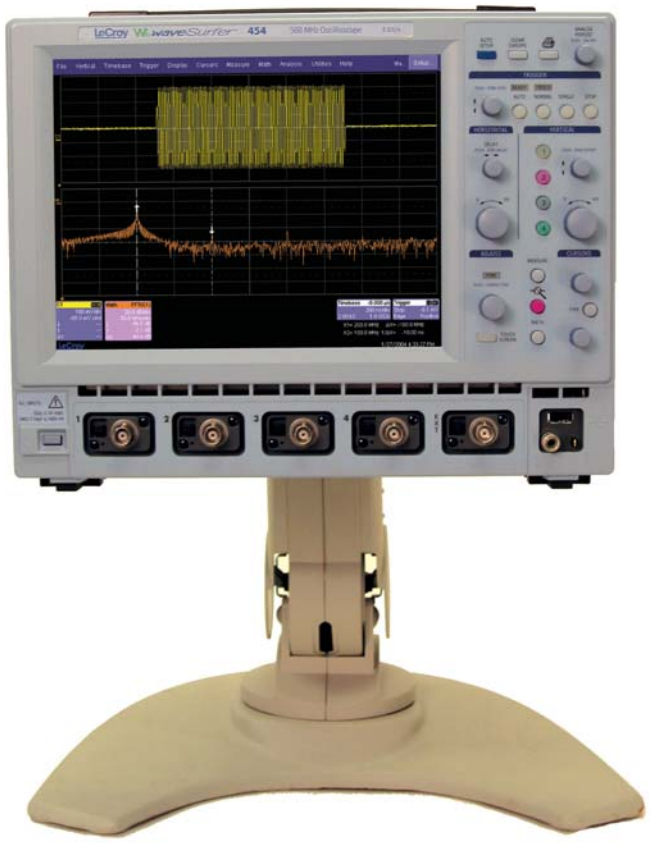
WaveSurfer comes standard with a 10/100Base-T Ethernet port to allow quick and easy connection to a network. When connected, WaveSurfer will, in most cases, self-assign its network address so that you can begin communicating quickly. Or you can assign your own using familiar Windows setup routines.

Use Windows NetMeeting, VNC, pcAnywhere, or a similar program to control the oscilloscope remotely or share screen information in real-time with others located anywhere in the world, or just down the hallway.

New users can access on-line help to get up to speed quickly, and avoid the hassles associated with trying to find a missing paper manual.

In addition to the front-mounted USB port, WaveSurfer also comes standard with two side-mounted USB ports, 9-pin serial port, 25-pin parallel (Centronics) port, and SVGA output. IEEE 488 GPIB port is optional.

Options and Accessories



Ergonomic Mounting Brackets – Frees up valuable bench space. Several options are offered. All are specially designed to provide precise adjustment and stability for the WaveSurfer.

- Desk Stand – This freestanding unit can swing, lift, tilt and turn your WaveSurfer for maximum efficiency and ergonomic comfort. The base is heavy with a high friction, non-marring bottom.
- Telescoping Mount – Clamps to a bench, creating a "zero footprint" oscilloscope. Easily move your WaveSurfer across a worksurface with an extension range of 23" (58 cm).

Bracket Only – A factory-installed 100 mm square mounting bracket on the back of the WaveSurfer. Choose whichever solution is best for you.

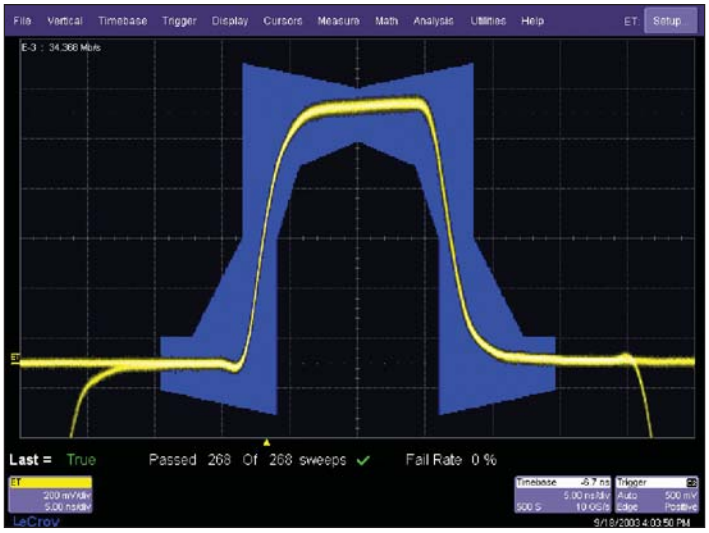
Memory Options – For technicians who need to increase capture time, or engineers who design longer records for more advanced debugging, WaveSurfer has memory options up to 2 Mpts/Ch (interleaved) for a 1ms capture time at full sample rate.

MathSurfer – For engineers who need to add additional math capability, or desire a graphical setup of math and measurements with rescale capability.

Advanced Trigger Package – For those desiring more triggering flexibility, you can optionally add Runt, Slew Rate, Qualified Edge, Qualified State, Interval, and Dropout triggers to the standard triggering package.

ET-PMT Electrical Testing

LeCroy's powerful Electrical Test software program instantly transforms your digital oscilloscope into a dedicated mask-testing device, specifically designed for manufacturing, type approval and field testing. The Tester's 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. Included with the software package are hardware connectors and cables you'll need for quality cable termination and exact amplitude scaling. Tests the following standards: E1 (2 Mb/s), E2 (8 Mb/s), E3 (34 Mb/s), E4 (140 Mb/s "0" and "1"), and STM-1e (156 Mb/s "0" and "1"), and most ANSI T1.102 standards.



WaveSurfer Specifications

Main Specifications

	424	422	434	432	454	452
Bandwidth (at probe tip)	200 MHz		350 MHz		500 MHz	
Rise Time	2 ns		1.15 ns		800 ps	
Input Channels	4	2	4	2	4	2
Display	10.4" Color flat-panel TFT-LCD, 800x600 SVGA, touch screen					
Sample Rate (single-shot)	2 GS/s max (interleaved mode), 1 GS/s (all channels)					
Sample Rate (RIS mode)	50 GS/s					
Standard Record Length	500 kpts/Ch (interleaved mode), 250 kpts/Ch (all channels)					
Maximum Record Length (Optional)	2 Mpts/Ch (interleaved mode), 1 Mpts/Ch (all channels)					
Standard Capture Time	up to 250 µs at full sample rate					
Maximum Capture Time (Optional)	up to 1 ms at full sample rate					
Vertical Resolution	8 bits					
Vertical Sensitivity	1 mV/div - 10 V/div (1 MΩ); 1 mV/div - 2 V/div (50 Ω)					
Vertical (DC Gain) Accuracy	±(1.5% + 0.5% of full scale)					
BW Limit	20 MHz		20 MHz, 200 MHz			
Maximum Input Voltage	±400 V_{pk} (CAT I), ±300 V_{pk} (CAT II)					
Input Coupling	AC, DC, GND (AC for 1 MΩ only)					
Input Impedance	1 MΩ//16 pF, or 50 Ω +/-1%,					
Probing System	BNC or ProBus®					
Probes	One PP007 per channel (standard)					
Time Base Range	1 ns/div - 1000 s/div (roll mode from 500 ms/div to 1000 s/div)					
Time Base Accuracy	10 ppm					

Additional Specifications

Triggering System

Trigger Modes	Normal, Auto, Single, and Stop
Sources	Any input channel, External, Ext/10, or line; slope and level unique to each source (except for line trigger)
Trigger Coupling	AC, DC, HF, HFRej, LFRej
Pre-trigger Delay	0 – 100% of full scale
Post-trigger Delay	0 – 10,000 divisions
Hold-off	2 ns to 20 s or 1 to 99,999,999 events
Internal Trigger Level Range	±5 div from center
External Trigger Range	EXT/10 ±5 V; EXT ±500 mV
External Trigger Input Impedance	50 Ω, 1MΩ

Standard Triggers

Edge	Triggers when signal meets slope (positive, negative, or Window) and level condition
Glitch	Triggers on positive or negative glitches with widths selectable from 2 ns to 20 s or on intermittent faults. Includes exclusion mode (trigger on intermittent faults by specifying the normal width period).
Width	Triggers on positive or negative glitches with widths selectable from 2 ns to 20 s or on intermittent faults. Includes exclusion mode (trigger on intermittent faults by specifying the normal width period).
Logic (Pattern)	Logic combination (AND, NAND, OR, NOR) of 5 inputs (4 channels and external trigger input). Each source can be high, low, or don't care. The High and Low level can be selected independently.
TV-Composite Video	Triggers selectable fields (1, 2, 4, or 8), Positive or Negative slope, for NTSC, PAL, SECAM, or non-standard video (up to 1500 lines)

Optional SMART Triggers®

Runt	Trigger on positive or negative runts defined by two voltage limits and two time limits. Select between 2 ns and 20 ns. Includes exclusion mode (trigger on intermittent faults by specifying the normal width period).
Slew Rate	Trigger on edge rates. Select limits for dV, dt, and slope. Select edge limits between 2 ns and 20 ns. Includes exclusion mode (trigger on intermittent faults by specifying the normal width period).
Interval (Signal or Pattern)	Triggers on a source if a given state (or transition edge) has occurred on another source. Delay between sources is 2 ns to 20 s, or 1 to 99,999,999 events. Includes exclusion mode (trigger on intermittent faults by specifying the normal width period).
Dropout	Triggers if signal drops out for longer than selected time between 2 ns and 20 s. Includes exclusion mode (trigger on intermittent faults by specifying the normal width period).
Qualified (State or Edge)	Triggers on any input source only if a defined state or edge occurred on another input source. Delay between sources is 2 ns to 20 s, or 1 to 99,999,999 events. Includes exclusion mode (trigger on intermittent faults by specifying the normal width period).

Documentation and Connectivity

Printing	Connect to any WindowsXP-compatible printer. Load any standard WindowsXP printer driver onto the unit as future needs require.
Email	Configure the unit to send an email of a screen image in a variety of formats using MAPI (i.e. through a default email program) or SMTP (no additional program needed).

WaveSurfer Specifications

Waveform Memories	Save waveform data as a reference trace to be compared to channels, zooms, or math functions.
Waveform File Data	Save waveform data in the following formats: Binary, ASCII, Excel, Mathcad, MATLAB.
Screen Image	Save a screen image to the internal hard drive, a user-supplied USB memory stick, or any other peripheral connected to one of the three USB 2.0 ports. Image can be saved in a variety of formats, and with white or black background.
Waveform Labeling (Annotation)	Attach up to 10 labels to any combination of waveforms. Labels appear on screen images.
Hardcopy Front Panel Button	Configure the front panel Hardcopy button to send an email, save a screen image, save waveform file data, and save to the clipboard.
Networking	Standard 10/100Base-T Ethernet interface (RJ-45 connector). Connect to any network using DHCP with automatically assigned IP address.
Remote Control	Via LeCroy Remote Command Set (via Ethernet)
USB Ports	3 USB ports (one on front of instrument) support Windows compatible devices
External Monitor Port Standard	15-pin D-Type female SVGA-compatible connector for external color
Parallel Port	25-pin D-type female (Centronics)
Serial Port	9-pin D-type male (not for remote oscilloscope control)
Audio Port	Mic Input, Line Input, Line Output

Measure, Zoom, and Math Tools

Standard Parameter Measurement	Up to 6 of the following parameters can be calculated at one time on any waveform: Amplitude, Area, Base (Low), Delay, Duty, Fall Time (90%-10%), Fall Time (80%-20%), Frequency, Maximum, Mean, Minimum, Overshoot+, Overshoot-, Period, Peak-Peak, Rise Time (10%-90%), Rise Time (20%-80%), RMS, Skew, Standard Deviation, Top (High), Width. Measurements may be gated.
Zooming	Use front panel QuickZoom button, or use touch screen or mouse to draw a box around the zoom area.
Standard Math	Operators include Sum, Difference, Product, Ratio, and FFT (up to 25 kpts with power spectrum output and rectangular, VonHann, and FlatTop windows). 1 math function may be defined at a time.
Extended Math (MathSurfer Options)	Adds the following additional math functions: Absolute Value, Averaging (summed and continuous), Derivative, Envelope, Enhanced Resolution (to 11 bits), Floor, Integral, Invert, Reciprocal, Roof, Square, and Square Root. Also adds chaining of two math functions, and rescaling to different units.

Automatic Setup

Auto Setup	Automatically sets timebase, trigger, and sensitivity to display a wide range of repetitive signals. Vertical Find Scale automatically sets the vertical sensitivity and offset for the selected channel.
Analog Persistence	When ON, persistence applied to all waveforms. Select analog or color-graded. Variable saturation level, with aging time selectable from 500 ms to infinity.

Setup and Waveform Storage

Front Panel and Instrument Status	Save to the internal hard drive, over the network, or to a USB connected peripheral device.
Waveform Traces	Save to one of four internal memories with 16 bit resolution for recall/comparison.
Waveform Data	Save to the internal hard drive, over the network, or to a USB connected peripheral device.

Outputs

Calibrator	500 Hz - 1 MHz square wave or DC level; Select from -1.0 to +1.0 into 1 MW, output on front panel test point and ground lug
Control Signals	Rear Panel: TTL level, BNC output; Choice of trigger ready, trigger out, pass/fail status. (output resistance 300 W ±10%)

Environmental and Safety

Temperature (Operating)	+5 °C to +40 °C
Temperature (Non-Operating)	–20 °C to +60 °C
Humidity (Operating)	5% to 80% relative humidity (non-condensing) at <= 30 °C. Upper limit derates to 55% relative humidity (non-condensing) at +40 °C.
Humidity (Non-Operating)	5% to 95% relative humidity (non-condensing) as tested per MIL–PRF–28800F.
Altitude (Operating)	up to 3048 m (10,000 ft) at up to 25 °C
Altitude (Non-Operating)	up to 12,190 m (40,000 ft)
Vibration (Operating)	Random vibration, 0.31 grms 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Vibration (Non-Operating)	Random vibration, 2.4 grms 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Functional Shock	20 g peak, half sine, 11 ms pulse, 3 shocks (positive and negative) in each of three orthogonal axes, 18 shocks total
Certification	CE Approved, UL (Std. UL 3111-1) and cUL (Std. CSA C22.2 No. 1010-1) listed. EMC Directive 89/336/EEC; EN61326-1:1997+A1:1998+A2:2001. Low Voltage Directive 73/23/EEC; EN 61010-1:2001 Product Safety (Installation Category II, Pollution Degree 2, Protection Class 1)

Physical Dimensions

Dimensions (HxWxD)	260 mm x 340 mm x 152mm (10.25" x 13.4" x 6"). Excluding accessories and projections.
Net Weight	6.8 kg (15 lbs). Excluding accessories.

General

Power (AC)	100–120 Vrms at 50/60/400 Hz; 200–240 Vrms at 50/60 Hz; Max. Power Consumption: 150 VA
Warranty and Calibration	Three year warranty. Calibration recommended yearly.

Ordering Information	Product Code
WaveSurfer Four Channel Digital Oscilloscopes	
500 MHz, 1 GS/s, 250 kpts/Ch Color DSO with 10.4" Display 2 GS/s, 500 kpts/Ch in interleaved mode	WaveSurfer 454
350 MHz, 1 GS/s, 250 kpts/Ch Color DSO with 10.4" Display 2 GS/s, 500 kpts/Ch in interleaved mode	WaveSurfer 434
200 MHz, 1 GS/s, 250 kpts/Ch Color DSO with 10.4" Display 2 GS/s, 500 kpts/Ch in interleaved mode	WaveSurfer 424
WaveSurfer Two Channel Digital Oscilloscopes	
500 MHz, 1 GS/s, 250 kpts/Ch Color DSO with 10.4" Display 2 GS/s, 500 kpts/Ch in interleaved mode	WaveSurfer 452
350 MHz, 1 GS/s, 250 kpts/Ch Color DSO with 10.4" Display 2 GS/s, 500 kpts/Ch in interleaved mode	WaveSurfer 432
200 MHz, 1 GS/s, 250 kpts/Ch Color DSO with 10.4" Display 2 GS/s, 500 kpts/Ch in interleaved mode	WaveSurfer 422
Included with Standard Configuration	
PP007 10:1 Passive Probe (1 per Channel)	
Operator's Getting Started Manual, Quick Reference Guide, Remote Control Manual	
CD-ROM with Operator's Getting Started Manual, QRG, and Remote Control Manual	
CD-ROMs with Utility and Recovery Software	
10/100Base-T Ethernet Port, 3 USB2.0 Ports, SVGA Video Output Port, RS232-C Serial Port, Centronics Parallel Port, Protective Front Cover	
Standard Commercial Calibration and Performance Certificate	
3-Year Warranty	
Memory Options for Four Channel WaveSurfers	
2 Mpts/2 Ch, 1 Mpts/4 Ch	WS-L-4CH
Memory Options for Two Channel WaveSurfers	
2 Mpts/1 Ch, 1 Mpts/2 Ch	WS-L-2CH
Mounting/Ergonomic Accessories	
Mounting Stand - Pedestal Style (includes WS-MB Mounting Bracket)	WS-MS-PED
Mounting Stand - Desktop Clamp Style (includes WS-MB Mounting Bracket)	WS-MS-CLAMP
Mounting Brackets - 100 mm Square	WS-MB
Hardware and Software Accessories	
Advanced Trigger Package	WS-ADVTRIG
MathSurfer Extended Math and Graphical Setup Display	WS-MATHSURF
Electrical Telecom Mask Test Package	WS-ET-PMT
Warranty & Calibration	
NIST Traceable Calibration Certificate for WaveSurfer Series DSOs	WS-CCNIST
METAS Traceable Calibration Certificate for WaveSurfer Series DSOs	WS-CCMETAS
MIL Std. Traceable Calibration Certificate for WaveSurfer Series DSOs	WS-CCMIL
5-Year Warranty on any WaveSurfer Series DSO	WS-W5
5-Year Warranty and NIST Calibration on any WaveSurfer Series DSO	WS-T5
5 Annual NIST Calibrations for WaveSurfer Series DSOs	WS-C5
1-Year Extended Warranty on any WaveSurfer Series DSO	WS-EW
2-Year Extended Warranty on any WaveSurfer Series DSO	WS-EW2

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