

WaveSurfer 10 Oscilloscopes 1 GHz, 10 GS/s



Key Features

- **1 GHz, 10 GS/s, 10 Mpts/ch**
- **MAUI - Advanced User Interface**
 - Designed for Touch
 - Built for Simplicity
 - Made to Solve
- **WaveScan - Advanced Search and Find**
- **LabNotebook Documentation and Report Generation**
- **10.4" Touch Screen Display**
- **Spectrum Analyzer Mode**
- **Power Analysis Software**
- **Serial Trigger and Decode**
 - I²C, SPI, UART
 - CAN, LIN, FlexRay, SENT
 - Ethernet 10/100BaseT, USB 1.0/1.1/2.0, USB2.0-HSIC
 - Audio (I²S, LJ, RJ, TDM)
 - MIL-STD-1553, ARINC 429
 - MIPI D-PHY, DigRF 3G, DigRF v4
 - Manchester, NRZ
- **Advanced Debug Toolkit adds:**
 - 10 GS/s on all 4 channels
 - 16 Mpts/ch memory (32 Intlv'd)
 - Sequence Mode Segmented Memory
 - History Mode Waveform Playback
 - 13 Additional Math Operators
 - 2 Math Functions

The WaveSurfer 10 combines the MAUI advanced user interface with powerful waveform processing, in addition to advanced math, measurement and debug tools, to quickly analyze and find the root cause of problems. With a 10.4" touch screen display, high performance hardware, and compact form factor the WaveSurfer 10 is unique among 1 GHz oscilloscopes.

MAUI - A New Wave of Thinking

MAUI is the most advanced oscilloscope user interface. MAUI is designed for touch; all important oscilloscope controls are accessed through the intuitive touch screen. MAUI is built for simplicity; time saving shortcuts and intuitive dialogs simplify setup. MAUI is made to solve; deep set of debug and analysis tools help identify problems and find solutions quickly.

Uncompromised Performance

Many 1 GHz oscilloscopes are available at attractive entry-point prices, however, they are often limited in sample rate, memory or features. The WaveSurfer 10 provides uncompromised 1 GHz performance with up to 10 GS/s per channel and 32 Mpts of memory.

Advanced Debug Toolkit

With the addition of the Advanced Debug Toolkit, the WaveSurfer 10 becomes an unparalleled debug and analysis machine adding 10 GS/s sample rate on 4 channels, 32 Mpts of memory, sequence mode, history mode, 13 additional math functions, and 2 simultaneous math traces.

Capture Debug, Analyze, Document

Easily accessible measurement, math and debug tools, plus a wide variety of serial data protocol decoders, and active probes ensure the WaveSurfer 10 can capture and analyze any type of waveform and simplify the debug process. The LabNotebook tool provides a fast way to save waveforms, save setups and screen images, report results, and view offline.

MAUI – A NEW WAVE OF THINKING



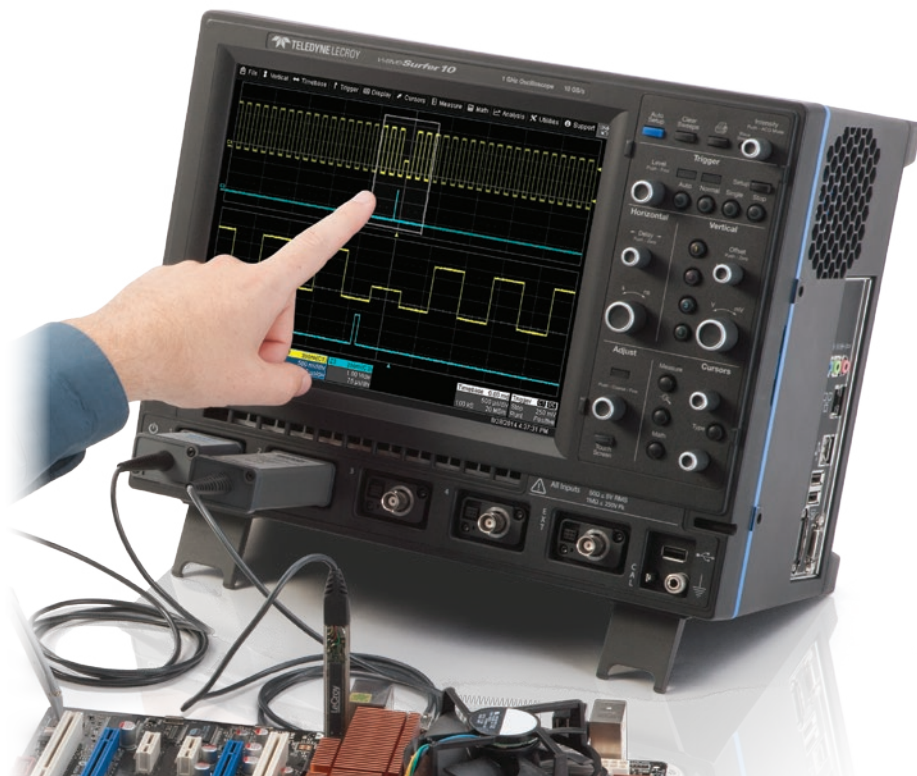
MAUI is the most advanced oscilloscope user interface developed to put all the power and capabilities of the modern oscilloscope right at your fingertips. Designed for touch; all important oscilloscope controls are accessed through the intuitive touch screen. Built for simplicity; time saving shortcuts and intuitive dialogs simplify setup. Made to solve; a deep set of debug and analysis tools helps identify problems and find solutions quickly.

Oscilloscopes are constantly evolving to meet the rapidly changing test and measurement needs of today's cutting edge designs. Additional complexity and capabilities are introduced with each new feature, and in some cases when capabilities of other instruments like a protocol analyzer, function generator or logic analyzer are added. With all this added capability the oscilloscope becomes complex and cumbersome to use. The traditional user interface consisting of knobs, buttons, soft keys and nested menus is unmanageable and more buttons are typically added to access the new functionality.

MAUI solves the complexity problem. MAUI eliminates the overwhelming number of buttons and knobs providing an intuitive user interface that is designed for touch, built for simplicity and made to solve without sacrificing any features or cutting edge test capabilities.

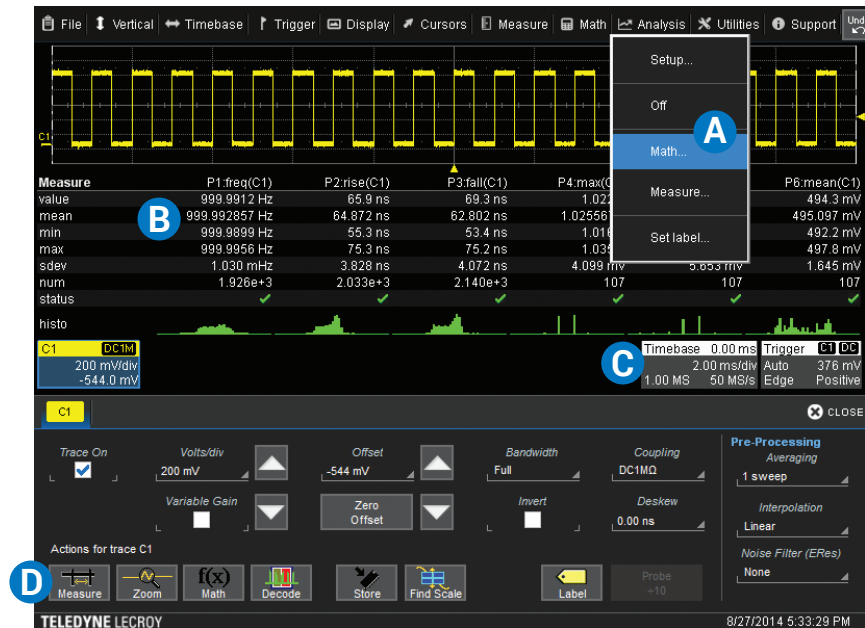
Designed for Touch

MAUI is designed for touch. All important controls for vertical, horizontal and trigger are always one touch away. Touch the waveform to position and drag a box around it to zoom in for more details. Position cursors, configure measurements and interact with tables all through simple touch operation.



Built for Simplicity

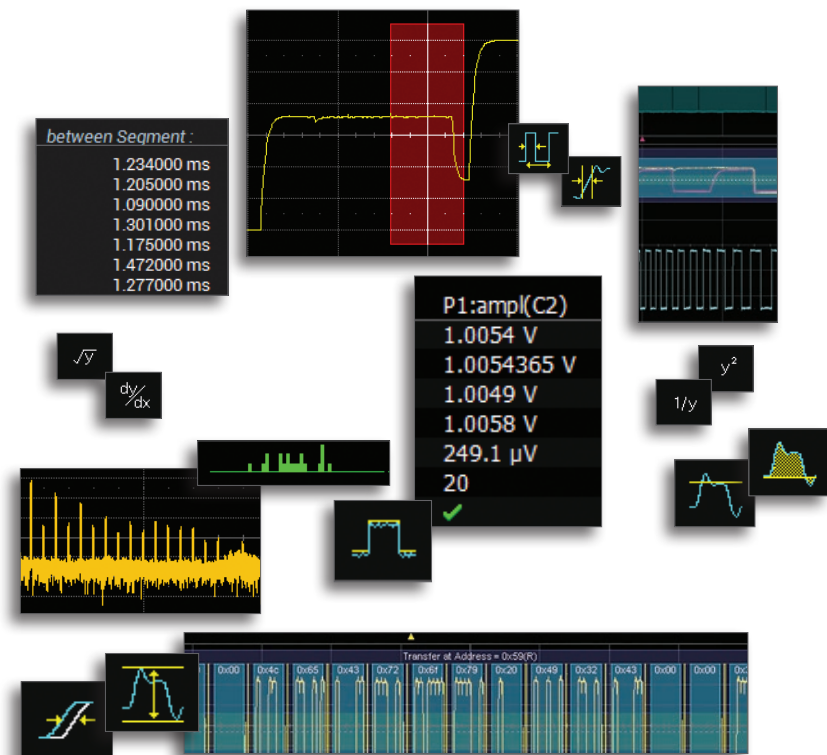
MAUI is built for simplicity. Basic waveform viewing and measurement tools as well as advanced math and analysis capabilities are seamlessly integrated in a single user interface. Time saving shortcuts and intuitive dialogs simplify setup and shorten debug time.

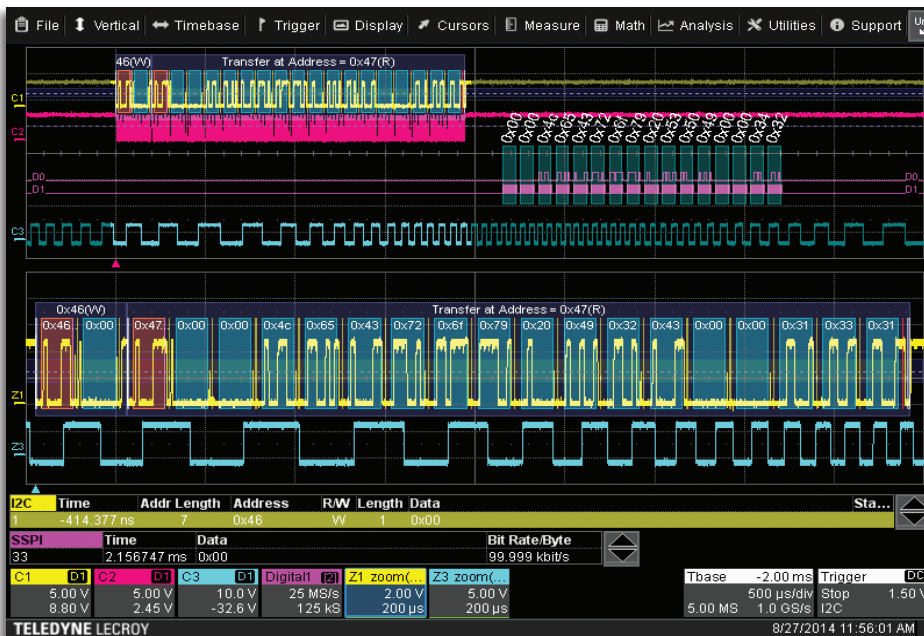


- A** Access shortcuts to analysis tools by touching the waveform.
- B** Configure parameters by touching measurement results.
- C** Channel, timebase and trigger descriptors provide easy access to controls without navigating menus.
- D** Shortcuts to commonly used functions are displayed at the bottom of the channel, math and memory menus.

Made to Solve

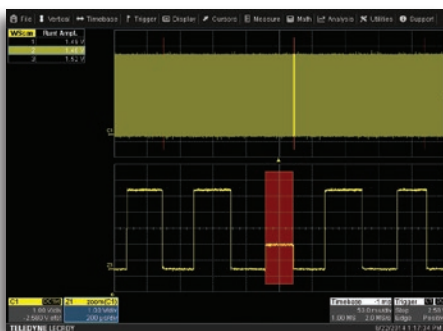
MAUI is made to solve. Measure all aspects of a waveform to identify problems. Debug with a large set of time saving tools to find the cause of problems. Solve problems fast with powerful analysis tools.





Embedded Controller Design and Debug

Save time when working with embedded controllers by adding high-performance mixed signal capability with the WaveSurfer 10. Capture digital signals up to 250 MHz with up to 10 Mpts/Ch memory, 1 GS/s and 18 channels. Quickly and easily isolate specific serial data events with I²C, SPI, UART, RS-232, USB 1.0/1.1/2.0, USB2-HSIC, 10/100Base T ENET, Audio (I2S, LJ, RJ, TDM), MIL-STD-1553, ARINC 429, MIPI D-PHY, DigRF, CAN, CAN FD, LIN, FlexRay, SENT, Manchester, and NRZ trigger and decode options.



WaveScan Advanced Search and Find Tool

Quickly search waveforms for runs, glitches or other anomalies with WaveScan.



LabNotebook Documentation and Report Generation Tool

Save all results and data with a single button press and create custom reports with LabNotebook.



Pass/Fail Mask Testing

Built-in masking testing quickly identifies problems and marks the location. A history of the pass/fail results can be displayed on the screen.

Enhanced Resolution

The enhanced resolution (ERES) feature improves vertical resolution of the oscilloscope resulting in cleaner traces and the ability to see more signal details. Up to 3 bits of ERES can be applied.

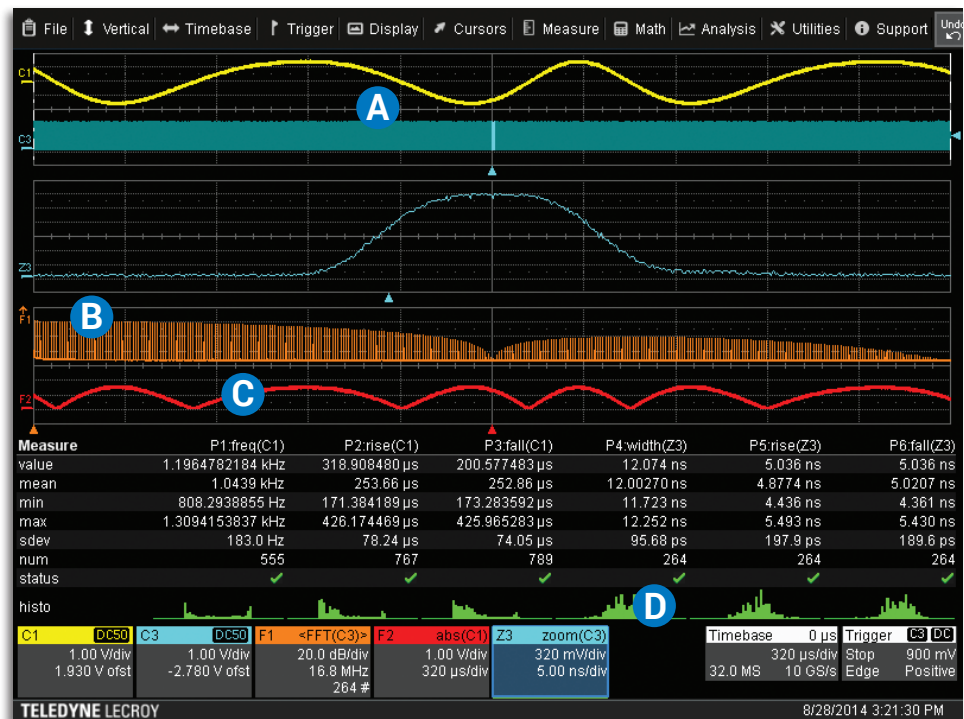
Advanced Math and Measure

Use automatic measurement parameters with statistics and histograms as well as math functions to understand every waveform detail.

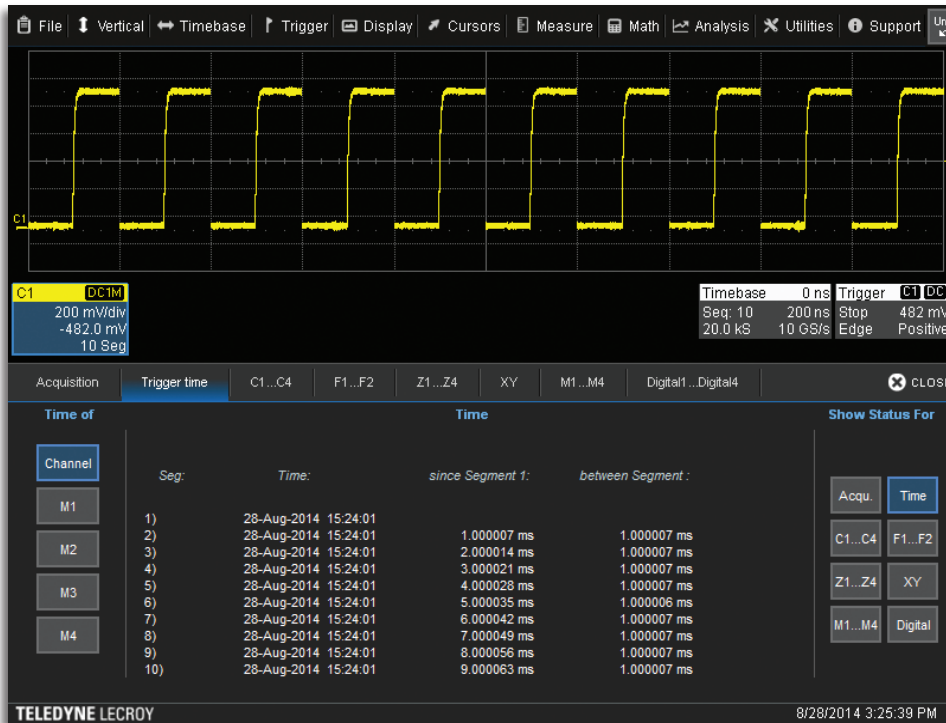
WaveStream Fast Viewing Mode

WaveStream provides a vibrant, intensity graded (256 levels) display with a fast update to closely simulate the look and feel of an analog oscilloscope.

With the addition of the Advanced Debug Toolkit software, the WaveSurfer 10 becomes an unparalleled debug and analysis machine. The high sample rate of 10 GS/s on all 4 channels, 32 Mpts of memory, sequence mode segmented memory, history mode waveform playback, 13 additional math functions, and 2 simultaneous math traces, all included in this powerful debug package, enable the WaveSurfer 10 to perform advanced analysis on long captures with 10x oversampling to find the root cause of problems.



- A** With 10 GS/s and 16 Mpts per channel every detail of a signal will be captured and displayed. In 4 channel operation 1.6ms of data can be captured at full sample rate, in 2 channel mode, 3.2ms, to ensure no detail or anomaly is missed.
- B** Configure and view 2 simultaneous math traces, each math trace can perform dual math operation enabling complex analysis and faster troubleshooting.
- C** 13 additional math operators are added to the already wide variety of math functions to allow deeper analysis. Included additional functions are absolute value, average (summed or continuous), envelope, enhanced resolution, exp (base e), exp (base 10), floor, invert, log (base e), log (base 10), reciprocal, roof, and trend.
- D** Histicons display the statistical distribution of each measurement parameter. Anomalies in measurement data can quickly be seen and then analyzed to find the root cause of problems faster. Histicons are auto-scaled so outliers can never be missed.



Advanced Waveform Capture with Sequence Mode

Use Sequence mode to store up to 5,000 triggered events as “segments” into memory. This can be ideal when capturing many fast pulses in quick succession or when capturing events separated by long time periods.

Sequence mode provides timestamps for each acquisition and minimizes dead-time between triggers to less than 1 μ s. Combine Sequence mode with advanced triggers to isolate rare events over time and analyze afterwards.

History Mode Waveform Playback

Scroll back in time using History Mode to view previous waveforms and isolate anomalies. Use cursors and measurement parameters to quickly find the source of problems. History mode is always available with a single button press, no need to enable this mode and never miss a waveform.

Go Back in Time to Identify the Source of a Problem



Teledyne LeCroy's versatile WaveSurfer 10 mixed signal oscilloscope combines the powerful WaveSurfer 10 with the flexibility of digital inputs using the MS-250. In addition, the many triggering and decoding options turn the WaveSurfer 10 into an all-in-one analog, digital, and serial data trigger, acquisition, and debug machine.

High-performance Mixed Signal Capabilities

Embedded controller design and debug involves capturing and viewing a number of different types of signals. These signals are typically a mix of analog, digital, and serial data waveforms from a combination of analog sensors, microcontrollers and peripheral devices. With the ability to capture digital signals with speeds up to 250 MHz and long memory of 10 Mpts/Ch the WaveSurfer 10 provides unmatched mixed signal performance. The WaveSurfer 10 is the ideal tool for testing embedded systems with 8-bit microcontrollers or slower digital signals. With 18 digital inputs each with 250 MHz maximum input frequency and 10 Mpts/Ch memory, the WaveSurfer 10 is an outstanding value and provides a complete set of tools for embedded system testing.

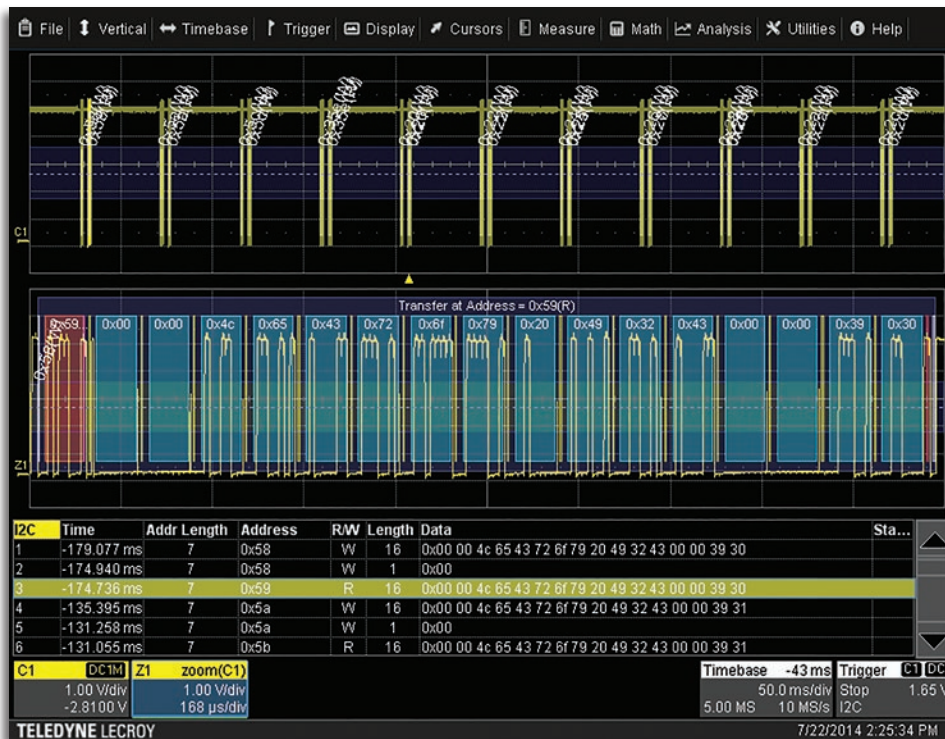
Extensive Triggering

The WaveSurfer 10 has extensive digital trigger capabilities. Normal oscilloscope triggers will operate on digital inputs. Cross-pattern triggering allows for simple or complex trigger patterns to be setup with any combination of analog and digital channels. Event triggering can be configured to arm on an analog signal and trigger on a digital pattern.

Quick Mixed Signal Setup, Easy-to-use

Unlike a traditional Logic Analyzer, the WaveSurfer 10 is easy to use. A simple connection links the oscilloscope with the digital inputs so users can start viewing signals and begin debugging quickly. In addition, all standard oscilloscope tools are readily accessible. Signal debug is simple, using standard oscilloscope tools, such as cursors, measurement parameters, and zooming.





View decoded protocol information on top of physical layer waveforms and trigger on protocol specific messages.

Supported Serial Data Protocols

- I²C, SPI, UART
- CAN, CAN FD, LIN, FlexRay™, SENT
- Ethernet 10/100BaseT, USB 1.0/1.1/2.0, USB 2.0-HSIC
- Audio (I²S, LJ, RJ, TDM)
- MIL-STD-1553, ARINC 429
- MIPI D-PHY, DigRF 3G, DigRF v4
- Manchester, NRZ

Debugging serial data busses can be confusing and time consuming. The serial data and decode options for WaveSurfer 10 provide time saving tools for serial bus debug and validation.

Powerful Serial Data Triggers

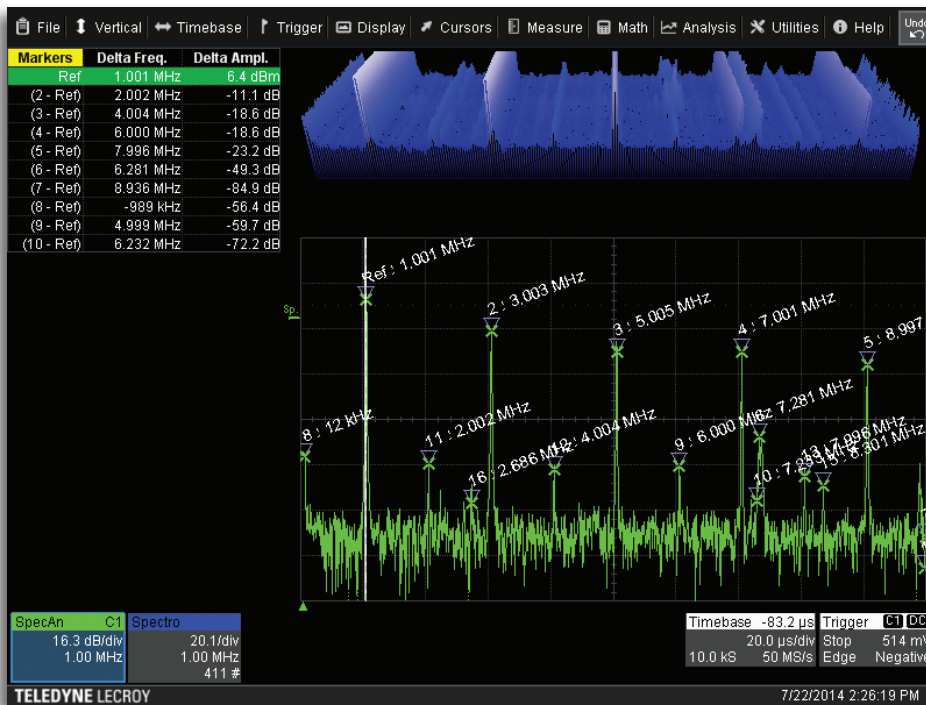
The serial data trigger will quickly isolate events on a bus eliminating the need to set manual triggers and hoping to catch the right information. Trigger conditions can be entered in binary or hexadecimal formats and conditional trigger capabilities even allow triggering on a range of different events.

Intuitive, Color-Coded Decode Overlay

Protocol decoding is shown directly on the waveform with an intuitive, color-coded overlay and presented in binary, hex or ASCII. Decoding on the WaveSurfer 10 is fast even with long memory and zooming in to the waveform shows precise byte by byte decoding.

Table Summary and Search/Zoom

To further simplify the debug process all decoded data can be displayed in a table below the waveform grid. Selecting an entry in the table with the touch screen will display just that event. Additionally, built-in search functionality will find specific decoded values.



Simple Frequency Domain Analysis

Get better insight to the frequency content of any signal with use of the Spectrum Analyzer mode on the WaveSurfer 10. This mode provides a spectrum analyzer style user interface with controls for start/stop frequency or center frequency and span. The unique peak search automatically labels spectral components and presents frequency and level in an interactive table. Utilize up to 20 markers to automatically identify harmonics and monitor how the spectrum changes over time using the spectrogram which can display a 2D or 3D history of the frequency content.

Power Analyzer Automates Switching Device Loss Measurements

Quickly measure and analyze the operating characteristics of power conversion devices and circuits with the Power Analyzer option. Critical power switching device measurements, control loop modulation analysis, and line power harmonic testing are all simplified with a dedicated user interface and automatic measurements. Areas of turn-on, turn-off, and conduction loss are all identified with color-coded waveform overlays for faster analysis.

Power Analyzer provides quick and easy setup of voltage and current inputs and makes measurements as simple as the push of a

button. Tools are provided to help reduce sources of measurement errors and the measurement parameters provide details of single cycle or average device power losses.

Beyond the advanced power loss measurement capabilities, the Power Analyzer modulation analysis capa-

bilities provide insight to understand control loop response to critical events such as a power supply's soft start performance or step response to line and load changes. The Line Power Analysis tool allows simple and quick pre-compliance testing to EN 61000-3-2.



WAVESURFER 10 SPECIFICATIONS



Analog - Vertical

Bandwidth (@ 50Ω)	1 GHz
Rise time	350 ps
Input Channels	4
Resolution	8 bits
Sensitivity	2 mV/div–10 V/div (1 MΩ); 2 mV/div–1 V/div (50 Ω)
DC Gain Accuracy	±1.0% of full scale (typical); ±1.5% of full scale ≥ 10 mV/div (warranted)
BW Limit	20 MHz, 200 MHz
Maximum Input Voltage	50 Ω: 5 Vrms, 1 MΩ: 250 V max. (DC + Peak AC ≤10 kHz)
Input Coupling	AC, DC, GND (DC and GND for 50 Ω)
Input Impedance	1 MΩ 16 pF, or 50 Ω

Analog - Acquisition

Sample Rate (Single-shot)	5 GS/s (10 GS/s Interleaved)
Sample Rate (Repetitive)	50 GS/s
Record Length	10 Mpts/Ch (all channels), 20 Mpts (interleaved)
Capture Time	Up to 2.0 ms at full sample rate on all four channels
Acquisition Modes	Real Time, Roll, RIS (Random Interleaved Sampling), WaveStream (Fast Viewing Mode).
Timebase Range	200 ps/div–1000 s/div (roll mode from 500 ms/div–1000 s/div)
Timebase Accuracy	≤ 5 ppm @ 25 °C (typical) (≤ 10 ppm @ 5–40 °C)

Digital - Vertical and Acquisition (with MS-250 Mixed Signal Option)

Input Channels	18 (D0-D17)
Input Impedance	100 kΩ 5.0 pF
Maximum Input Voltage	±30 V non-destruct
Threshold Groupings	D0–D8, D9–D17
Threshold Selections	TTL, ECL, CMOS, PECL, LVDS, User Defined
Sample Rate	1 GS/s
Record Length	10 Mpts/Ch
Minimum Detectable Pulse Width	2 ns
Maximum Input Frequency	250 MHz

Trigger System

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)
Coupling	DC, AC, HFRej, LFRej
Pre-trigger Delay	0-100% of full scale
Post-trigger Delay	0-10,000 Divisions
Hold-off	1 ns to 20 s or 1 to 1,000,000,000 events
Internal Trigger Level Range	±4.1 div from center
External Trigger Level Range	EXT/10 ±4V; EXT ±400 mV
Trigger Types	Edge, Glitch, Width, Logic (Pattern), TV (NTSC, PAL, SECAM, HDTV–720p, 1080i, 1080p), Runt, Slew Rate, Interval (signal or Pattern), Dropout, Qualified (State or Edge)

Probes

Standard Probes	One PP011 (5 mm) per channel
Probing System	BNC and Teledyne LeCroy ProBus for Active voltage, current and differential probes

Display System

Display Size	Color, 10.4" TFT-LCD Touch Screen
Display Resolution	SVGA: 800 x 600 pixels

Measure, Zoom and Math Tools

Measurement Parameters	Up to 6 of the following parameters can be calculated at one time on any waveform: Amplitude, Area, Base (Low), Delay, Parameters Duty, Fall Time (90%–10%), Fall Time (80%– 20%), Frequency, Maximum, Mean, Minimum, Overshoot+, Overshoot–, Period, Peak-Peak, Phase, Rise Time (10%–90%), Rise Time (20%–80%), RMS, Skew, Standard Deviation, Top (High), Width+, Width–. Measurements can be gated.
Zooming	Use front panel QuickZoom button, or use touch screen or mouse to draw a box around the zoom area.
Math Functions	Functions include Sum, Difference, Product, Ratio, Derivative, Integral, Res- cale (change scale and units), Square, Square Root, Zoom and FFT (up to 1 Mpts with power spectrum output and rectangular, VonHann, and FlatTop windows). 1 math function may be defined at a time, 2 functions may be chained together.

Advanced Debug Toolkit (Optional)

Sample Rate (Single-shot)	10 GS/s on all 4 channels
Record Length	16 Mpts/ch (32 Interleaved)
Additional Acquisition Mode	Sequence (Segmented Memory up to 5,000 segments with 1μs intersegment time)
Additional Math Functions	Absolute value, Average (summed or continuous), Envelope, Enhanced Resolution, Exp (base e), Exp (base 10), Floor, Invert, Log (base e), Log (base 10), Reciprocal, Roof and Trend. 2 dual operator math functions may be defined at a time.
Additional Measurement Capabilities	Histograms for measurement distribution analysis
Additional Debug Tools	History mode waveform playback

Connectivity

Ethernet Port	10/100/1000Base-T Ethernet interface (RJ-45 connector)
USB Host Ports	(5) USB Ports
GPIO Port (Optional)	Supports IEEE – 488.2 (Optional External Adapter)
External Monitor Port	Standard 15-pin D-Type SVGA- compatible DB-15 connector
Remote Control	Via Windows Automation, or via Teledyne LeCroy Remote Command Set
Network Communication Standard	VXI-11 or VICP, LXI Class C Compliant

Physical

Dimensions (HWD)	260 mm x 340 mm x 152 mm Exclud- ing accessories and projections (10.25" x 13.4" x 6")
Net Weight	7.26 kg. (16.0 lbs.)

ORDERING INFORMATION

Product Description

WaveSurfer 10 Oscilloscopes

1 GHz, 5 GS/s, 4 Ch, 10 Mpts/Ch DSO with 10.4" Touch Screen Display, 10 GS/s, 20 Mpts Interleaved

Product Code

WaveSurfer 10

Included with Standard Configurations

÷10 Passive Probe (Total of 1 Per Channel), Protective Front Cover, Getting Started Guide, Commercial NIST Traceable Calibration with Certificate, Power Cable for the Destination Country, 3-year Warranty

General Accessories

Soft Carrying Case	WS10-SOFTCASE
Hard Carrying Case	WS10-HARDCASE
Rack Mount Accessory	WS10-RACK

Software Options

Advanced Debug Toolkit Option	WS10-ADT
Power Analyzer Option	WS10-PWR
Spectrum Analyzer Option	WS10-SPECTRUM

Local Language Overlays

German Front Panel Overlay	WS10-FP-GERMAN
French Front Panel Overlay	WS10-FP-FRENCH
Italian Front Panel Overlay	WS10-FP-ITALIAN
Spanish Front Panel Overlay	WS10-FP-SPANISH
Japanese Front Panel Overlay	WS10-FP-JAPANESE
Korean Front Panel Overlay	WS10-FP-KOREAN
Chinese (Tr) Front Panel Overlay	WS10-FP-CHN-ES-TR
Chinese (Simp) Front Panel Overlay	WS10-FP-CHN-ES-SI
Russian Front Panel Overlay	WS10-FP-RUSSIAN

Mixed Signal Solutions

500 MHz, 18 Channels, 2 GS/s, 50 Mpts/ch	MS-500
Mixed Signal Oscilloscope Option	
250 MHz, 36 Ch, 1 GS/s, 25 Mpts/ch	MS-500-36
(500 MHz, 18 Ch, 2 GS/s, 50 Mpts/ch Interleaved)	
Mixed Signal Option	
250 MHz, 18 Channels, 1 GS/s, 10 Mpts/ch	MS-250
Mixed Signal Oscilloscope Option	

Mixed Signal Accessories

Extra Large Gripper Probe Set, Includes 22 probes	PK400-0
Large Gripper Probe Set for 0.10 Inch (2.54 mm)	PK400-1
Pin Pitch. Includes 10 Probes with Color-coded Leads	
Medium Gripper Probe Set for 0.04 Inch (1.0 mm)	PK400-2
Pin Pitch. Includes 10 Probes with Color-coded Leads	
Small Gripper Probe Set for 0.008 Inch (0.2 mm)	PK400-3
Pin Pitch. Includes 10 Probes with Color-coded Leads	
18-pin 3M Interface Cable MSO-3M	MSO-3M
(Mates with 3M Part Number 2520-6002)	
36 Channel Mictor Connector	MSO-Mictor
(Includes 1 MSO-MICTOR-SHROUD)	

Product Description

Serial Data Options

ARINC 429 Symbolic Decode Option	WS10-ARINC429bus DSymbolic
Audiobus Trigger and Decode Option for I ² S, LJ, RJ, and TDM	WS10-Audiobus TD
CAN Trigger and Decode Option	WS10-CANbus TD
CAN FD Trigger and Decode Option	WS10-CAN FDbus TD
D-PHY Decode Option	WS10-DPHYbus D
DigRF 3G Decode Option	WS10-DigRF3Gbus D
DigRF v4 Decode Option	WS10-DigRFv4bus D
ENET Decode Option	WS10-ENETbus D
FlexRay Trigger and Decode Option	WS10-FlexRaybus TD
I ² C, SPI and UART Trigger and Decode Option	WS10-EMB
I ² C Bus Trigger and Decode Option	WS10-I2Cbus TD
LIN Trigger and Decode Option	WS10-LINbus TD
Manchester Decode Option	WS10-Manchesterbus D
MIL-STD-1553 Trigger and Decode Option	WS10-1553 TD
NRZ Decode Option	WS10-NRZbus D
SENT Decode Option	WS10-SENTbus D
SPI Bus Trigger and Decode Option	WS10-SPIbus TD
UART and RS-232 Trigger and Decode Option	WS10-UART-RS232bus TD
USB 2.0 Decode Option	WS10-USB2bus D
USB2-HSIC Decode Option	WS10-USB2-HSICbus D

Probes

500 MHz Passive Probe 10:1, 10 M Ω	PP011
700 V, 15 MHz High-Voltage Differential Probe	AP031
200 MHz, 3.5 pF, 1 M Ω Active Differential Probe	ZD200
1 GHz, 1.0 pF, 1 M Ω Active Differential Probe	ZD1000
Deskew Calibration Source for CP031 and CP030	DCS015
30 A; 50 MHz Current Probe – AC/DC; 30 A _{rms} ; 50 A _{peak} Pulse	CP030
30 A; 100 MHz Current Probe – AC/DC; 30 A _{rms} ; 50 A _{peak} Pulse	CP031
150 A; 10 MHz Current Probe – AC/DC; 150 A _{rms} ; 500 A _{peak} Pulse	CP150
500 A; 2 MHz Current Probe – AC/DC; 500 A _{rms} ; 700 A _{peak} Pulse	CP500
1,400 V, 100 MHz High-Voltage Differential Probe	ADP305
1,400 V, 20 MHz High-Voltage Differential Probe	ADP300
1 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A
1.5 GHz, 0.9 pF, 1 M Ω	ZS1500
High Impedance Active Probe	
Set of 4 ZS1500, 1.5 GHz, 0.9 pF, 1 M Ω	ZS1500-QUADPAK
High Impedance Active Probe	
1 GHz, 0.9 pF, 1 M Ω	ZS1000
High Impedance Active Probe	
Set of 4 ZS1000, 1 GHz, 0.9 pF, 1 M Ω	ZS1000-QUADPAK
High Impedance Active Probe	
25 MHz High Voltage Differential Probe	HVD3102
120 MHz High Voltage Differential Probe	HVD3106

Customer Service

Teledyne LeCroy oscilloscopes and probes are designed, built, and tested to ensure high reliability. In the unlikely event you experience difficulties, our digital oscilloscopes are fully warranted for three years and our probes are warranted for one year. This warranty includes:

- No charge for return shipping
- Long-term 7-year support
- Upgrade to latest software at no charge



1-800-5-LeCroy
teledynelecroy.com

Local sales offices are located throughout the world.
Visit our website to find the most convenient location.

© 2014 Teledyne LeCroy, Inc. All rights reserved. Specifications, prices, availability, and delivery subject to change without notice.
Product or brand names are trademarks or registered trademarks of their respective holders.

wavesurfer10-ds-19sept14

1.888.610.7664

 www.calcert.com

sales@calcert.com