The WaveSurfer 510 combines a superior oscilloscope experience with an extensive toolbox to deliver faster time to insight.
HIGH PERFORMANCE.
POWERFUL TOOLBOX.

WaveSurfer 510

MAUI®
with OneTouch

Deep Toolbox

OneTouch delivers a superior user experience by providing gesture control of common operations.

Designed for Touch
Built for Simplicity
Made to Solve

OBSESSED WITH TOOLS

WaveSurfer 510 has the greatest breadth and depth of tools, ensuring quick resolution of the most complicated debug tasks.

Drag and Drop
All Instance
User Spectrum
WaveScan
The WaveSurfer 510 combines a superior oscilloscope experience with an extensive toolbox to deliver faster time to insight.

Faster Time to Insight

Insight alone is not enough. Markets and technologies change too rapidly.

The timing of critical design decisions is significant.

Time to insight is what matters.
MAUI – SUPERIOR USER EXPERIENCE

MAUI – Most Advanced User Interface was 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.

Designed for Touch
MAUI is designed for touch. Operate the oscilloscope just like a phone or tablet with the most unique touch screen features on any oscilloscope. All important controls are always one touch away. Touch the waveform to position or zoom in for more details using intuitive actions.

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.

Made to Solve
MAUI is made to solve. A deep set of integrated debug and analysis tools help identify problems and find solutions quickly. Unsurpassed integration provides critical flexibility when debugging. Solve problems fast with powerful analysis tools.

MAUI with OneTouch
MAUI with OneTouch introduces a new paradigm for oscilloscope user experience. Dramatically reduce setup time with revolutionary drag and drop actions to copy and setup channels, math functions, and measurement parameters without lifting a finger. Use common gestures like drag, drop, and flick to instinctively interact with the oscilloscope. Quickly enable a new channel, math or measurement using the “Add New” button and simply turn off any trace with a flick of the finger. These OneTouch innovations provide unsurpassed efficiency in oscilloscope operation.

- Channel, timebase, and trigger descriptors provide easy access to controls without navigating menus.
- Configure parameters by touching measurement results.
- Shortcuts to commonly used functions are displayed at the bottom of the channel, math and memory menus.
- Use the “Add New” button for one-touch trace creation.
- Drag to change source, copy setup, or turn on new trace.
- Drag to copy measurement parameters to streamline setup process.
- Drag to quickly position cursors on a trace.
Our Heritage

Teledyne LeCroy’s 50+ year heritage has its origins in the high-speed collection of data in the field of high-energy physics, and the processing of long records to extract meaningful insight. We didn’t invent the oscilloscope, but we did invent the digital oscilloscope, which can take full advantage of advanced digital signal processing and waveshape analysis tools to provide unparalleled insight.

Our Obsession

Our developers are true to our heritage – they are more obsessed with making better and smarter tools than anybody else. Our tools and operating philosophy are standardized across much of our product line for a consistent user experience. Our mission is to help you use these tools to understand problems, including the ones you don’t even know you have. Our deep toolbox inspires insight; and your moment of insight is our reward.

Our Invitation

Our Periodic Table of Oscilloscope Tools provides a framework to understand the toolsets that Teledyne LeCroy has created and deployed in our oscilloscopes. Visit our interactive website to learn more about what we offer and how we can help you develop and debug more efficiently.

teledynelecroy.com/tools
The WaveSurfer 510 combines the MAUI with OneTouch 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. The 12.1” touch-screen display of the WaveSurfer 510 is the largest in its class and makes viewing waveform abnormalities fast and easy.

Key Features

1 GHz, 10 GS/s, up to 16 Mpts/ch

MAUI with OneTouch
- Designed for touch
- Built for simplicity
- Made to solve

WaveScan - Advanced Search and Find

LabNotebook Documentation and Report Generation

History Mode - Waveform Playback

Sequence Mode Segmented Memory

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

Superior User Experience

The WaveSurfer 510 with MAUI OneTouch sets the standard for oscilloscope user experience by providing the most unique touch features on any oscilloscope. Common gestures are used to instinctively interact with the oscilloscope and dramatically reduce setup time. Convenience and efficiency are optimized - all common operations can be performed with one touch and do not require opening and closing of pop-up dialogs or menus.

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 510 provides uncompromised 1 GHz performance with up to 10 GS/s per channel and 32 Mpts of memory.

Advanced Debug Tools

Advanced debug tools make the WaveSurfer 510 an unparalleled debug and analysis machine providing 10 GS/s sample rate on 4 channels, 32 Mpts of memory, sequence mode, history mode, advanced 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 510 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.
Key Attributes

1. 12.1" Widescreen (16 x 9) high resolution WXGA color touch screen display
2. MAUI with OneTouch optimized for convenience and efficiency
3. "Add New" button for fast waveform creation
4. "Push" Knobs – All knobs have push functionality that provide shortcuts to common actions such as Set to Variable, Find Trigger Level, Zero Offset, and Zero Delay
5. Waveform Control Knobs – Control channel, zoom, math and memory traces with the multiplexed vertical and horizontal knobs
6. Dedicated Cursor Knob – Select type of cursor, position them on your signal, and read values without ever opening a menu
7. Dedicated buttons to quickly access popular debug tools.
8. L-Bus connectivity allow for the addition of the MS-250 or MS-500 mixed signal options.
9. Easy connectivity with four USB 3.1 ports and three USB 2.0 ports
Embedded Controller Design and Debug
Save time when working with embedded controllers by adding high-performance mixed signal capability with the WaveSurfer 510. 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 \( \text{i}^2\text{C}, \text{SPI}, \text{UART}, \text{RS}-232, \text{USB 1.0/1.1/2.0}, \text{USB2-HSIC}, 10/100\text{Base T ENET}, \text{Audio (I}^2\text{S, LJ, RJ, TDM)}, \text{MIL-STD-1553, ARINC 429, MIPI D-PHY, DigRF, CAN, CAN FD, LIN, FlexRay, SENT, Manchester, and NRZ trigger and decode options.}

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**WaveScan Advanced Search and Find Tool**
Quickly search waveforms for runts, 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.

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**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 histicons 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.
LabNotebook Documentation Tool
LabNotebook is a one-button tool to save and restore waveforms, measurements and settings without navigating multiple menus. Custom reports can be created and easily shared; saved waveforms can be measured and analyzed later both on the oscilloscope or offline using the WaveStudio PC Utility.

WaveStudio Offline Analysis Tool
WaveStudio is a fast and easy way to analyze acquired waveforms offline. Offline tools include x and y axis cursors for quick measurements and 21 built-in automatic measurements for more precise and accurate results. WaveStudio can also connect to the oscilloscope for direct data transfer to the PC. Data saved with LabNotebook can be shared with others using WaveStudio for easy collaboration.

Advanced Probe Interface
The advanced active probe interface gives tremendous flexibility for measuring high voltages, high frequencies, currents, or differential signals.

- High Impedance Active Probes
- High Bandwidth Differential Probes
- High Voltage Differential Probes
- High Voltage Passive Probes
- Current Probes
The WaveSurfer 510 includes the advanced debug tools which makes it 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 510 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** Advanced math and measurements capabilities allow deeper analysis. Included functions are absolute value, average (summed or continuous), derivative, difference, envelope, enhanced resolution, exp (base e), exp (base 10), FFT, floor, integral, invert, log (base e), log (base 10), product, ratio, reciprocal, rescale, roof, square, square root, sum, trend and zoom.

**D** Display up to 6 measurement parameters together with statistics, including mean, minimum, maximum, standard deviation, and total number. Each occurrence of each parameter is measured and added to the statistics table. Histicons provide a fast, dynamic view of parameters and waveshape characteristics. Parameter gates define the location for measurement on the source waveform.
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 μs. 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
The WaveSurfer 510 features the widest range and most complete serial data debug and validation solutions.

- Triggering
- Decoding

### Trigger

Powerful, flexible triggers designed by people who know the standards, with the unique capabilities you want to isolate unusual events. Conditional data triggering permits maximum flexibility and highly adaptable error frame triggering is available to isolate error conditions. Efficiently acquire bursted data using Sequence Mode to maximize the oscilloscope’s memory usage. Sequence Mode enables the oscilloscope to ignore idle time and acquire only data of interest.

### Decode

Decoded protocol information is color-coded to specific portions of the serial data waveform and transparently overlaid for an intuitive, easy-to-understand visual record. All decoded protocols are displayed in a single time-interleaved table. Touch a row in the interactive table to quickly zoom to a packet of interest and select a column header to create filter criteria, as is commonly done in spreadsheets. Easily search through long records for specific protocol events using the built-in search feature.
Teledyne LeCroy’s versatile WaveSurfer 510 mixed signal oscilloscope combines the powerful WaveSurfer 510 with the flexibility of digital inputs using the MS-250. In addition, the many triggering and decoding options turn the WaveSurfer 510 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 510 provides unmatched mixed signal performance. The WaveSurfer 510 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 510 is an outstanding value and provides a complete set of tools for embedded system testing.

**Extensive Triggering**

The WaveSurfer 510 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 510 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.
Simple Frequency Domain Analysis

Get better insight to the frequency content of any signal with use of the Spectrum Analyzer mode on the WaveSurfer 510. 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 capabilities 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 510**

### Vertical System
- **Analog Bandwidth @ 50 Ω (3 dB)**: 1 GHz (≥ 2 mV/div)
- **Analog Bandwidth @ 1 MΩ (3 dB)**: 500 MHz (≥ 2 mV/div)
- **Rise Time (10–90%, 50 Ω)**: 415 ps (typical)
- **Input Channels**: 4
- **Vertical Resolution**: 8-bits; up to 11-bits with enhanced resolution (ERES)
- **Sensitivity**:
  - **50 Ω**: 1 mV/div–1 V/div, fully variable
  - **1 MΩ**: 1 mV/div–10 V/div, fully variable
- **DC Vertical Gain Accuracy**
  - Gain Component of DC Accuracy
    - ±1% F.S. (typical), offset at 0 V
- **Channel-Channel Isolation DC**
  - up to rated BW: 40 dB (>100:1), (For any two ProBus input channels, same v/div settings, typical)
- **Offset Range**
  - **50 Ω**:
    - ±1.6 V @ 1 mV–4.95 mV/div, ±4 V @ 5 mV–9.9 mV/div, ±8 V @ 10 mV–19.8 mV/div, ±10 V @ 20 mV–1 V/div
  - **1 MΩ**:
    - ±1.6 V @ 1 mV–4.95 mV/div, ±4 V @ 5 mV–9.9 mV/div, ±8 V @ 10 mV–19.8 mV/div, ±16 V @ 20 mV–100 mV/div, ±80 V @ 102 mV–1.0 V/div, ±160 V @ 1.02 V–10 V/div
- **DC Vertical Offset Accuracy**
  - ±(1.5% of offset setting + 1% of full scale + 1 mV) (test limit)
- **Maximum Input Voltage**
  - **50 Ω**: 5 V<sub>rms</sub> ±10 V peak;
  - **1 MΩ**: 400 V max. (DC + peak AC < 10 kHz)
- **Input Impedance**
  - **50 Ω**: ±2% or 1 MΩ || 17 pF, 10 MΩ || 9.5 pF with supplied Probe
- **Timebases**
  - Internal timebase common to 4 input channels; an external clock may be applied at the EXT input
- **Clock Accuracy**
  - ≤ 1.5 ppm +(aging of 0.5 ppm/yr from last calibration)
- **Sample Clock Jitter**
  - Up to 10 μs
- **Delta Time Measurement Accuracy**
  - \[ \sqrt{2} \times \left( \frac{\text{Noise}}{\text{SlewRate}} \right)^2 + \text{(Sample Clock Jitter)}^2 \quad \text{(RMS, seconds, TIE)} \]
- **Jitter Measurement Floor**
  - \[ \sqrt{\left( \frac{\text{Noise}}{\text{SlewRate}} \right)^2 + \text{(Sample Clock Jitter)}^2} \quad \text{(RMS, seconds, TIE)} \]
- **Channel-Channel Deskew Range**
  - ±9 x time/div. setting, 100 ms max., each channel

### Horizontal System
- **Sample Rate (Single-Shot)**: 10 GS/s on 4 Ch
- **Sample Rate (Repetitive)**: 50 GS/s for repetitive signals (20 ps/div to 10 ns/div)
- **Memory Length**
  - (# of Segments in Sequence Mode)
  - 16 Mpts/ch for all channels, 32 Mpts (interleaved) (5,000 segments)
- **Intersegment Time**
  - 1 μs
- **Averaging**
  - Summed averaging to 1 million sweeps; continuous averaging to 1 million sweeps
- **Enhanced Resolution (ERES)**
  - From 8.5 to 11 bits vertical resolution
- **Interpolation**
  - Linear or Sin x/x
WaveSurfer 510

**Triggering System**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Modes</strong></td>
<td>Normal, Auto, Single, and Stop</td>
</tr>
<tr>
<td><strong>Sources</strong></td>
<td>Any input channel, Ext, Ext/10, or line; slope and level unique to each source (except line trigger)</td>
</tr>
<tr>
<td><strong>Coupling Mode</strong></td>
<td>DC, AC, HFRej, LFRej</td>
</tr>
<tr>
<td><strong>Pre-trigger Delay</strong></td>
<td>0 - 100% of memory size (adjustable in 1% increments or 100 ns)</td>
</tr>
<tr>
<td><strong>Post-trigger Delay</strong></td>
<td>0 - 10,000 divisions in real time mode, limited at slower time/div settings or in roll mode</td>
</tr>
<tr>
<td><strong>Hold-off</strong></td>
<td>From 2 ns up to 20 s or from 1 to 99,999,999 events</td>
</tr>
<tr>
<td><strong>Trigger and Interpolator Jitter</strong></td>
<td>≤ 3.5 ps RMS (typical)</td>
</tr>
<tr>
<td><strong>Internal Trigger Level Range</strong></td>
<td>±4.1 div from center (typical)</td>
</tr>
<tr>
<td><strong>External Trigger Level Range</strong></td>
<td>Ext (±0.4 V), Ext/10 (±4 V)</td>
</tr>
<tr>
<td><strong>Maximum Trigger Rate</strong></td>
<td>1,000,000 waveforms/second (in Sequence Mode, up to 4 channels)</td>
</tr>
</tbody>
</table>
| **Trigger Sensitivity with Edge Trigger (Ch 1–4)** | 2 div @ <1 GHz  
1.5 div @ < 500 MHz  
1 div @ < 200 MHz  
0.9 div @ < 10 MHz  
(DC, AC, and LFRej coupling, ≥ 10 mV/div, 50 Ω) |
| **Trigger Sensitivity with Edge Trigger (External Input)** | 2 div @ <1 GHz  
1.5 div @ < 500 MHz  
1 div @ < 200 MHz  
0.9 div @ < 10 MHz  
(DC, AC, and LFRej coupling) |
| **Max. Trigger Frequency, SMART Trigger** | 1.0 GHz @ ≥ 10 mV/div (minimum triggerable width 750 ps) |

**Basic Triggers**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Edge</strong></td>
<td>Triggers when signal meets slope (positive, negative, or either) and level condition</td>
</tr>
<tr>
<td><strong>Width</strong></td>
<td>Triggers on positive or negative glitches with selectable widths</td>
</tr>
<tr>
<td><strong>Glitch</strong></td>
<td>Triggers on positive or negative glitches with selectable widths. Minimum width 200 ps, maximum width: 20 s</td>
</tr>
<tr>
<td><strong>Window</strong></td>
<td>Triggers when signal exits a window defined by adjustable thresholds</td>
</tr>
<tr>
<td><strong>Pattern</strong></td>
<td>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. Triggers at start or end of the pattern.</td>
</tr>
<tr>
<td><strong>TV-Composite Video</strong></td>
<td>Triggers NTSC or PAL with selectable line and field; HDTV (720p, 1080i, 1080p) with selectable frame rate (50 or 60 Hz) and Line; or CUSTOM with selectable Fields (1–8), Lines (up to 2000), Frame Rates (25, 30, 50, or 60 Hz), Interlacing (1.1, 2.1, 4.1, 8.1); or Synch Pulse Slope (Positive or Negative)</td>
</tr>
<tr>
<td><strong>Runt</strong></td>
<td>Trigger on positive or negative runts defined by two voltage limits and two time limits. Select between 1 ns and 20 ns.</td>
</tr>
<tr>
<td><strong>Slew Rate</strong></td>
<td>Trigger on edge rates. Select limits for dV, dt, and slope. Select edge limits between 1 ns and 20 ns.</td>
</tr>
<tr>
<td><strong>Interval</strong></td>
<td>Triggers on intervals selectable between 1 ns and 20 s.</td>
</tr>
<tr>
<td><strong>Dropout</strong></td>
<td>Triggers if signal drops out for longer than selected time between 1 ns and 20 s.</td>
</tr>
<tr>
<td><strong>Triggers with Exclusion Technology</strong></td>
<td>Trigger on intermittent faults by specifying the expected behavior and triggering when that condition is not met</td>
</tr>
<tr>
<td><strong>Qualified (Timeout or State/Edge Qualified)</strong></td>
<td>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.</td>
</tr>
<tr>
<td><strong>Low Speed Serial Protocol Trigger (Optional)</strong></td>
<td>I2C, SPI (SPI, SSPI, SIOP), UART-RS232, CAN1.1, CAN2.0, CAN FD, LIN, FlexRay, MIL-STD-1553, AudioBus (I2S, LJ, RJ, TDM), USB1.x/2.0, SATA</td>
</tr>
</tbody>
</table>

**Measurement Tools**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Measurement Functionality</strong></td>
<td>Display up to 6 measurement parameters together with statistics, including mean, minimum, maximum, standard deviation, and total number. Each occurrence of each parameter is measured and added to the statistics table. Parameter gates define the location for measurement on the source waveform.</td>
</tr>
<tr>
<td><strong>Measurement Parameters - Horizontal + Jitter</strong></td>
<td>Delay (from trigger, 50%), Duty Cycle, Fall Time (90-10, 80-20), Frequency, Period, Phase, Rise Time (10-90, 20-80), Skew, Width +, Width -</td>
</tr>
<tr>
<td><strong>Measurement Parameters - Vertical</strong></td>
<td>Amplitude, Base, Maximum, Mean, Minimum, Peak-to-Peak, RMS, Std. Deviation, Top</td>
</tr>
<tr>
<td><strong>Measurement Parameters - Pulse</strong></td>
<td>Area, Base, Fall Time (90-10, 80-20), Overshoot (positive, negative), Rise Time (10-90, 80-20), Top, Width +, Width -</td>
</tr>
</tbody>
</table>

**Math Tools**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Math Functionality</strong></td>
<td>Display up to 2 math functions traces (F1-F2). The easy-to-use graphical interface simplifies setup of up to two operations on each function trace, and function traces can be chained together to perform math-on-math.</td>
</tr>
<tr>
<td><strong>Math Operators - Basic Math</strong></td>
<td>Average (summed), Average (continuous), Difference (−), Envelope, Exp (base e, base 10), Floor, Invert (negative), Log (base e, base 10), Product (×), Ratio (⁄), Reciprocal, Rescale (with units), Root, Sum (+)</td>
</tr>
<tr>
<td><strong>Math Operators - Filters</strong></td>
<td>Enhanced resolution (to 11 bits vertical)</td>
</tr>
<tr>
<td><strong>Math Operators - Frequency Analysis</strong></td>
<td>FFT (power spectrum, magnitude), up to full record length. Select from Rectangular, Von-Hann, Hamming, FlatTop and Blackman Harris windows</td>
</tr>
<tr>
<td><strong>Math Operators - Functions</strong></td>
<td>Absolute value, Derivative, Integral, Invert (negative), Reciprocal, Rescale (with units), Square, Square root, Zoom (identity)</td>
</tr>
</tbody>
</table>

**Measurement and Math Integration**

<table>
<thead>
<tr>
<th>Feature</th>
<th>Specification</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Trend (datalog)</strong></td>
<td>Trend (datalog) of up to 1 million measurement parameters</td>
</tr>
</tbody>
</table>
**SPECIFICATIONS**

### WaveSurfer 510

**Pass/Fail Testing**
- Mask Test (pre-defined or user-defined mask, waveform All In, All Out, Any In, or Any Out conditions) with following THEN Save (waveforms), Stop, Alarm, (send) Pulse, Hardcopy (send email, save screen image, save to clipboard, send to printer), or (save) LabNotebook.

**Display System**
- **Display Size**: Color 12.1" widescreen flat panel TFT-Active Matrix with high resolution touch screen
- **Display Resolution**: WXGA; 1280 x 800 pixels
- **Number of Traces**: Display a maximum of 8 traces. Simultaneously display channel, zoom, memory and math traces.
- **Grid Styles**: Auto, Single,X-Y, Single+X-Y
- **Waveform Representation**: Sample dots joined, or sample dots only

**Processor/CPU**
- **Type**: Intel® Core™ i3-6100 Dual, 3.7 GHz (or better)
- **Processor Memory**: 8 GB standard
- **Operating System**: Microsoft Windows® 7 For Embedded Systems 64Bits
- **Oscilloscope Operating Software**: Teledyne LeCroy MAUI™
- **Real Time Clock**: Date and time displayed with waveform in hardcopy files. SNTP support to synchronize to precision internal clocks

**Connectivity**
- **Ethernet Port**: Supports 2 10/100/1000BaseT Ethernet interface (RJ45 ports)
- **USB**: 4 side USB 3.1 Gen1 ports, and 1 front USB 3.1 port support Windows compatible devices
- **GPIB Port (optional)**: Supports IEEE = 488.2 (External)
- **External Monitor Port**: DisplayPort 1.1 and HDMI to support customer-supplied external monitor. Includes support for extended desktop operation with UHD (3840 x 2160) pixel resolution and split-grid capability on external monitor. Supports touch screen integration of external monitor (Note: external display can not use a Fujitsu touch-screen driver).
- **Remote Control**: Via Windows Automation, or via Teledyne LeCroy Remote Command Set
- **Network Communication Standard**: VXI-11 or VICP, LXI Class C (v1.2) Compliant

**Probes**
- **Standard Probes**: Qty. (4) ÷10 Passive Probes
- **Probing System**: ProBus. Automatically detects and supports a variety of compatible probes

**Power Requirements**
- **Voltage**: 100-240 VAC ±10% at 50/60 Hz ±5%; 110-120 VAC ±10% at 400 Hz ±5%; Automatic AC Voltage Selection
- **Power Consumption (Nominal)**: 285 W / 285 VA
- **Max Power Consumption**: 375 W / 375 VA (with all PC peripherals and active probes connected to 4 channels)

**Environmental**
- **Temperature (Operating)**: +5 °C to +40 °C
- **Temperature (Non-Operating)**: -20 °C to +60 °C
- **Humidity (Operating)**: 5% to 90% relative humidity (non-condensing) up to +31 °C.
- **Humidity (Non-Operating)**: 5% to 95% relative humidity (non-condensing) as tested per MIL-PRF-28800F
- **Altitude (Operating)**: Up to 10,000 ft. (3048 m) at or below +30 °C
- **Altitude (Non-Operating)**: Up to 40,000 ft. (12,192 m)
- **Random Vibration (Operating)**: 0.31 grms 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
- **Random Vibration (Non-Operating)**: 2.4 grms 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
- **Functional Shock**: 30 g peak, half sine, 11 ms pulse, 3 shocks (positive and negative) in each of three orthogonal axes, 18 shocks total

**Physical Dimensions**
- **Dimensions (HWD)**: 12.44”H x 16.42”W x 9.37”D (316 x 417 x 238 mm)
- **Weight**: 22.8 lbs. (10.3 kg)

**Certifications**
- CE Compliant, UL and cUL listed, conforms to UL 61010-1 (3rd Edition), UL 61010-2-030 (1st Edition)
- CAN/CSA C22.2 No. 61010-1-12

**Warranty and Service**
- 3-year warranty; calibration recommended annually. Optional service programs include extended warranty, upgrades, and calibration services.
### Product Description | Product Code
---|---
**WaveSurfer 510 Oscilloscopes**  
1 GHz, 10 GS/s, 4 Ch, 16 Mpts/Ch DSO with 12.1" Touch Screen Display. 10 GS/s, 32 Mpts Interleaved  | WaveSurfer 510

#### 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
- External GPIB Accessory  | USB2-GPIB
- Instrument Cart  | DC1021-A
- Hard Carrying Case  | WS510-HARDCASE
- Rack Mount Accessory  | WS510-RACK

#### Local Language Overlays
- German (Tri) Front Panel Overlay  | WS510-FP-GERMAN
- French Front Panel Overlay  | WS510-FP-FRENCH
- Italian Front Panel Overlay  | WS510-FP-ITALIAN
- Spanish Front Panel Overlay  | WS510-FP-SPANISH
- Japanese Front Panel Overlay  | WS510-FP-JAPANESE
- Korean Front Panel Overlay  | WS510-FP-KOREAN
- Chinese (Tri) Front Panel Overlay  | WS510-FP-CHINES-TR
- Chinese (Simp) Front Panel Overlay  | WS510-FP-CHINES-SI
- Russian Front Panel Overlay  | WS510-FP-RUSSIAN

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

#### Mixed Signal Accessories
- Extra Large Gripper Probe Set, Includes 22 probes  | PK400-0
- Large Gripper Probe Set for 0.10 Inch (2.54 mm) Pin Pitch. Includes 10 Probes with Color-coded Leads  | PK400-1
- Medium Gripper Probe Set for 0.04 Inch (1.0 mm) Pin Pitch. Includes 10 Probes with Color-coded Leads  | PK400-2
- Small Gripper Probe Set for 0.008 Inch (0.2 mm) Pin Pitch. Includes 10 Probes with Color-coded Leads  | PK400-3
- 18-pin 3M Interface Cable MSO-3M  | MSO-3M  
  (Mates with 3M Part Number 2520-6002)
- 36 Channel Mictor Connector (Includes 1 MSO-MICTOR-SHROUD)  | MSO-Mictor
- 16" Digital Lead Set, D0-D17  | MSO-DLS-18
- 16" Digital Lead Set, D18-D35  | MSO-DLS-36

#### Serial Data Options
- ARINC 429 Symbolic Decode Option  | WS510-ARINC429bus-DSymbolic
- AudioBus Trigger and Decode Option for I²S, LI, RJ, and TDM  | WS510-AudioBus TD
- CAN Trigger and Decode Option  | WS510-CANbus TD
- CAN FD Trigger and Decode Option  | WS510-CANFDbus TD
- D-PHY Decode Option  | WS510-DPHYbus D
- DigRF 3G Decode Option  | WS510-DigRF3Gbus D
- DigRF 4V Decode Option  | WS510-DigRF4Vbus D
- ENET Decode Option  | WS510-ENETbus D
- FlexRay Trigger and Decode Option  | WS510-FlexRaybus TD
- I²C, SPI and UART Trigger and Decode Option  | WS510-EMB
- I²C Bus Trigger and Decode Option  | WS510-I²Cbus TD
- LIN Trigger and Decode Option  | WS510-LINbus TD
- Manchester Decode Option  | WS510-Manchesterbus D
- MIO Decode Option  | WS510-MIObus D
- MIL-STD-1553 Trigger and Decode Option  | WS510-1553 TD
- NRZ Decode Option  | WS510-NRZbus D
- SENT Decode Option  | WS510-SENTbus D
- SpaceWire Decode Option  | WS510-SENTbus D
- Spectrum Analysis Option for WaveSurfer 610  | WS510-SPECTRUM
- SPI Bus Trigger and Decode Option  | WS510-SPIBus TD
- SPMI Decode Option  | WS510-SPMIbus D
- UART and RS-232 Trigger and Decode Option  | WS510-UART-RS232bus TD
- USB 2.0 Decode Option  | WS510-USB2bus D
- USB2-HSIC Decode Option  | WS510-USB2-HSICbus D
<table>
<thead>
<tr>
<th>Product Description</th>
<th>Product Code</th>
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<tbody>
<tr>
<td><strong>Probes</strong></td>
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<tr>
<td>500 MHz Passive Probe, 5mm, 10:1, 10 MΩ</td>
<td>PP024</td>
</tr>
<tr>
<td>700 V, 15 MHz High-Voltage Differential Probe</td>
<td>AP031</td>
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<tr>
<td>200 MHz, 3.5 pF, 1 MΩ Active Differential Probe</td>
<td>ZD200</td>
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<tr>
<td>500 MHz, 1.0 pF Active Differential Probe, ±8 V</td>
<td>ZD500</td>
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<tr>
<td>1 GHz, 1.0 pF, 1 MΩ Active Differential Probe</td>
<td>ZD1000</td>
</tr>
<tr>
<td>1.5 GHz, 1.0 pF Active Differential Probe, ±8 V</td>
<td>ZD1500</td>
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<tr>
<td>Deskew Calibration Source for CP031 and CP030</td>
<td>DCS015</td>
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<tr>
<td>30 A; 50 MHz Current Probe – AC/DC; 30 A rms, 50 A peak Pulse</td>
<td>CP030</td>
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<tr>
<td>30 A; 100 MHz Current Probe – AC/DC; 30 A rms, 50 A peak Pulse</td>
<td>CP031A</td>
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<tr>
<td>150 A; 10 MHz Current Probe – AC/DC; 150 A rms, 500 A peak Pulse</td>
<td>CP150</td>
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<td>500 A; 2 MHz Current Probe – AC/DC; 500 A rms, 700 A peak Pulse</td>
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<tr>
<td>1,400 V, 100 MHz High-Voltage Differential Probe</td>
<td>ADP305</td>
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<tr>
<td>1,400 V, 20 MHz High-Voltage Differential Probe</td>
<td>ADP300</td>
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<tr>
<td>1 Ch, 100 MHz Differential Amplifier with Precision Voltage Source</td>
<td>DA1855A</td>
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<tr>
<td>1.5 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe</td>
<td>ZS1500</td>
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<tr>
<td>Set of 4 ZS1500, 1.5 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe</td>
<td>ZS1500-QUADPAK</td>
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<tr>
<td>1 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe</td>
<td>ZS1000</td>
</tr>
<tr>
<td>Set of 4 ZS1000, 1 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe</td>
<td>ZS1000-QUADPAK</td>
</tr>
<tr>
<td>25 MHz High Voltage Differential Probe</td>
<td>HVD3102</td>
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<tr>
<td>1kV, 25 MHz High Voltage Differential Probe without tip Accessories</td>
<td>HVD3102-NOACC</td>
</tr>
<tr>
<td>80 MHz High Voltage Differential Probe with 6m cable</td>
<td>HVD3106-6M</td>
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<tr>
<td>120 MHz High Voltage Differential Probe</td>
<td>HVD3106</td>
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<tr>
<td>1kV, 120 MHz High Voltage Differential Probe without tip Accessories</td>
<td>HVD3106-NOACC</td>
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<tr>
<td>2kV, 120 MHz High Voltage Differential Probe</td>
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<td>2kV, 80 MHz High Voltage Differential Probe with 6m cable</td>
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<td>6kV, 100 MHz High Voltage Differential Probe</td>
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<td>1001 400 MHz 50 MΩ 4 kV High-voltage Probe</td>
<td>PPE4KV</td>
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<td>10001 400 MHz 50 MΩ 5 kV High-voltage Probe</td>
<td>PPE5KV</td>
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<tr>
<td>10001 400 MHz 50 MΩ 6 kV High-voltage Probe</td>
<td>PPE6KV</td>
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<tr>
<td>TekProbe to ProBus Probe Adapter</td>
<td>TPA10</td>
</tr>
<tr>
<td>Set of 4 TPA10 TekProbe to ProBus Probe Adapters. Includes soft carrying case.</td>
<td>TPA10-QUADPAK</td>
</tr>
</tbody>
</table>
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