TELEDYNE LECROY
Everywhereyoulook™

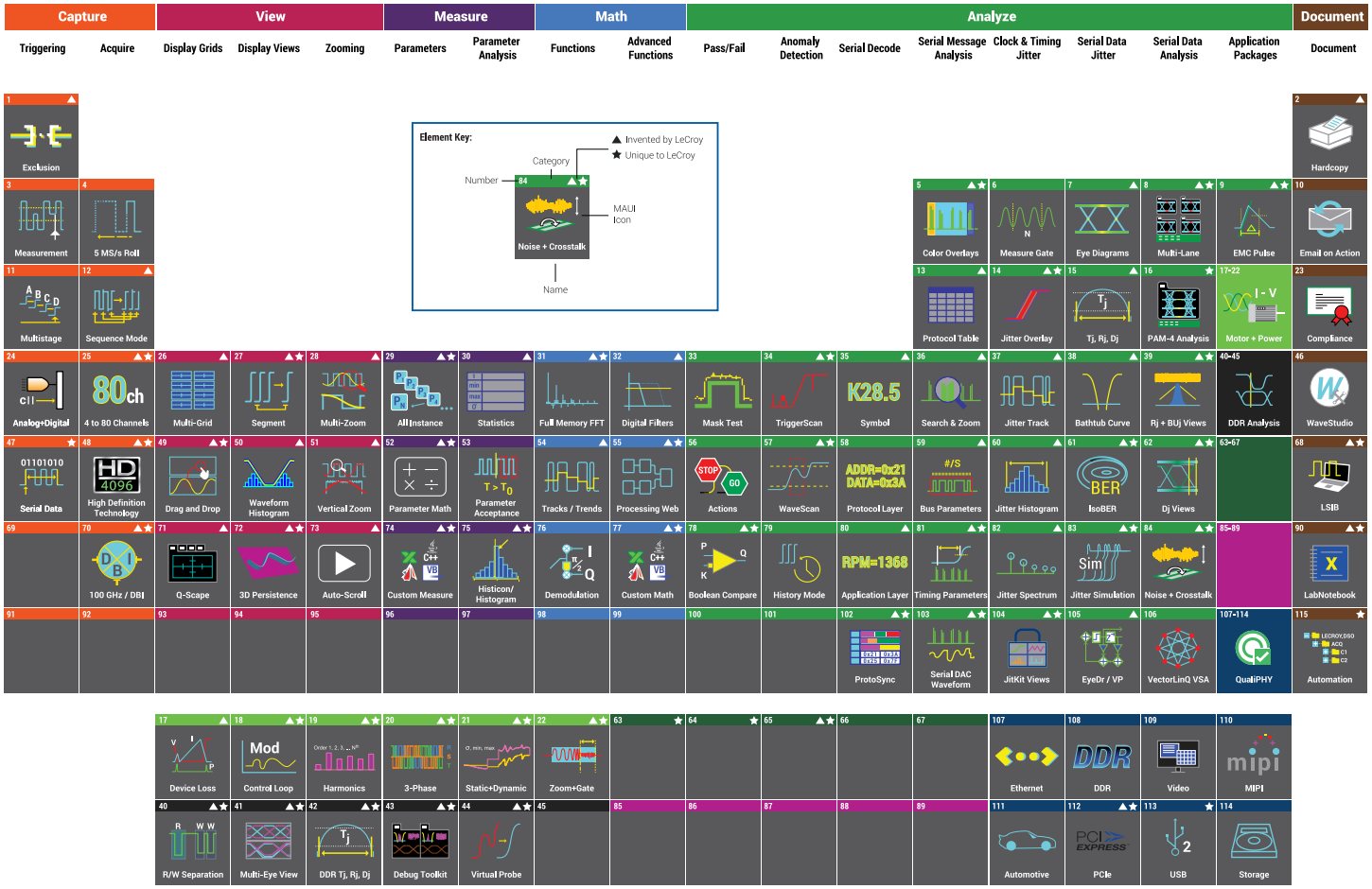
Oscilloscope Features, Options, and Accessories

WaveSurfer 3000z
WaveSurfer 510
HDO4000A

POWERFUL, DEEP TOOLBOX

Our “powerful, deep toolbox” starts with all the standard tools listed on the following pages. These standard tools provide exceptional capabilities for Measure & Math, Statistical Analysis, Anomaly Detection, basic Jitter Analysis, Spectrum Analysis—nearly any type of waveform analysis you can name.

Software options integrate seamlessly with the standard tools to extend your capabilities into a wide variety of applications. Our MAUI with OneTouch user interface and deep toolbox is consistently applied across product lines ranging in bandwidth from 350 MHz to 100 GHz, providing a unified user-experience and set of debug, validation and analysis capabilities that is unique in the industry.



Our heritage

Teledyne LeCroy’s 50+ year heritage is in processing long records to extract meaningful insight. We invented the digital oscilloscope and many of the additional waveshape analysis tools.

Our obsession

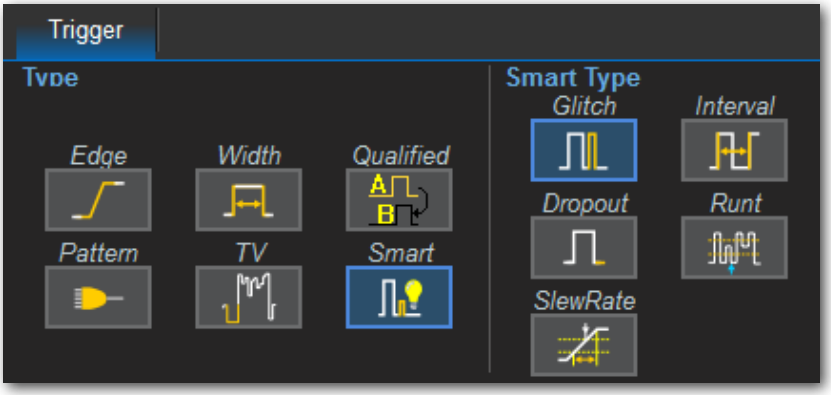
Our tools and operating philosophy are standardized across much of our product line. This deep toolbox inspires insight; and your moment of insight is our reward.

Our invitation

Our Periodic Table of Oscilloscope Tools explains the toolsets that Teledyne LeCroy has deployed in our oscilloscopes. Visit our interactive website to learn more about them. **teledynelecroy.com/tools**

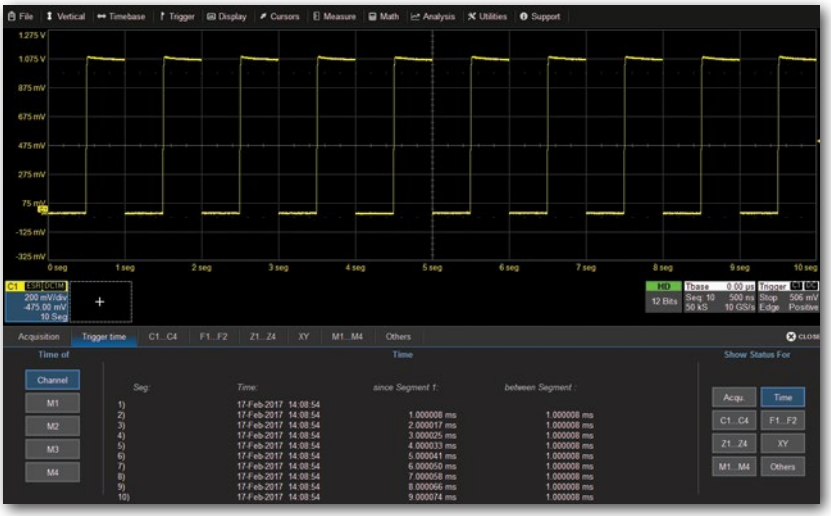
Our Probe Catalog showcases even more accessories for use with your Teledyne LeCroy oscilloscope. Go to **teledynelecroy.com/probes** to download a copy.

WAVEFORM CAPTURE



Advanced Triggering

- Multi-stage triggers permit complex qualification of multiple waveform events.
- Smart Triggers find anomalies such as runts, glitches and dropouts, or incorrect time intervals, slew rates and windows.
- Pattern Triggers permit AND, NAND, OR, or NOR qualification of parallel patterns across analog channels and digital lines.
- Measurement triggers utilize included oscilloscope measurements.
- Serial Trigger & Decode software options add protocol-specific triggers to the standard set.



Flexible Sampling Modes

- Sequence Mode provides efficient use of acquisition memory to capture hundreds or thousands of acquisition segments without “dead-time” between.
- Roll Mode displays acquired sample points “rolling” continuously from right to left at sample rates up to 5 MS/s.
- Random Interleaved Sampling (RIS) Mode allows effective sampling rates higher than the maximum single-shot sampling rate.
- Fast Update of over 130,000 waveforms per second easily displays random or infrequent events (on Wavesurfer 3000z).

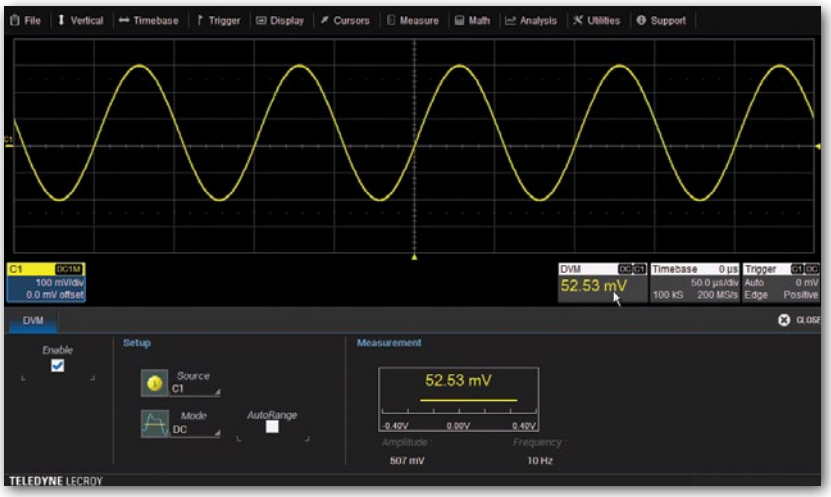
WAVEFORM CAPTURE

SAM40 Sensor Acquisition Module
(HDO4K-SAM40-8/-16/-24 Optional Hardware)

- Adds 8-, 16- or 24-channels of sensor input to supported 12-bit oscilloscope product lines.
- 24-bit resolution, 40 kHz bandwidth, 100 kS/s, high precision.
- Complete physical units conversion to more than 65 SI and English system units.
- IEPE/ICP sensor support with internal 4 mA bias.
- BNC input compatible with wide variety of off-the-shelf sensors.

Mixed-Signal Solutions
(-MS Models, -MSO Option, MS-xxx Hardware)

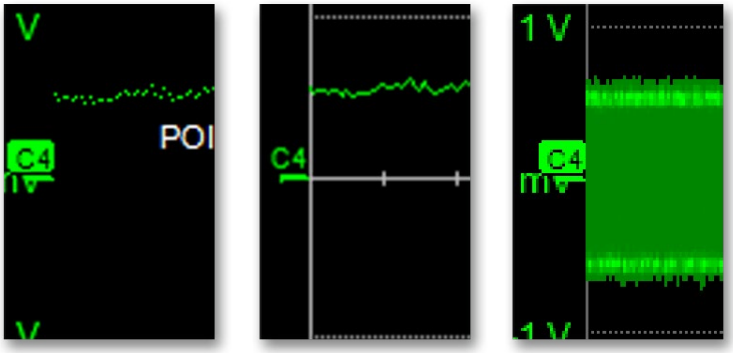
- Integrated Mixed Signal interface enables 16 lines of digital input at 1.25 GS/s.
- Flexible analog and digital cross-pattern triggering across all analog or digital channels.
- Utilize digital inputs for low-speed serial triggering or capture/decode.
- Provides advanced digital debug tools such as parallel pattern search, measurements and simulation.
- MS-250/MS-500 external logic pods provide similar capabilities.



Multi-Instrument Solutions
(WS3K-FG, WS3K-DVM Software Options)

- WaveSource Automatic Waveform Generator (-FG) allows you to output custom sine, square, triangle, pulse, DC, noise, and arbitrary waveforms from the oscilloscope.
- Free Digital Voltmeter (-DVM) download adds integrated 4-digit digital voltmeter and 5-digit frequency counter that operates through the same probes already attached to the oscilloscope channels.

COMPREHENSIVE WAVEFORM VIEWING

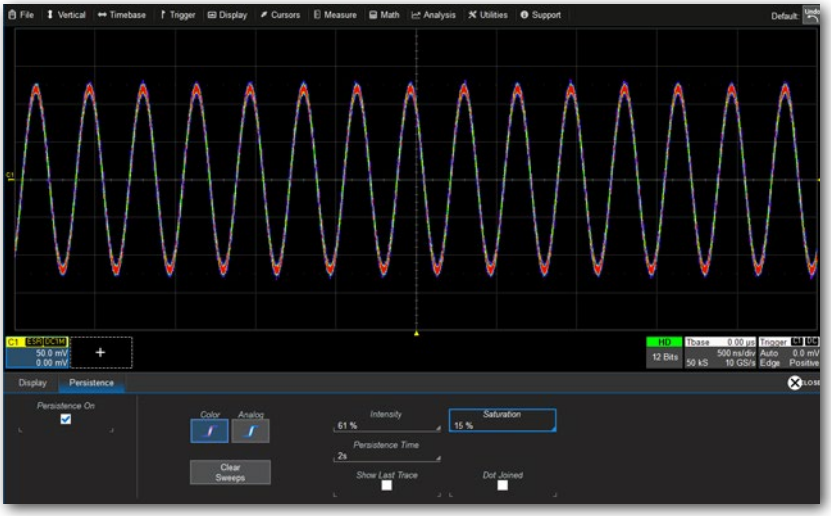


Configurable Displays

- Show/hide axis labels next to grid divisions.
- Add custom trace labels to mark points of interest on waveform.
- Adjust trace intensity to highlight rare or more frequent events in captured waveforms.
- Change intensity of grid lines relative to waveform traces.
- Choose style of waveform traces (on supported models): series of dots or joined lines.

Multi-Grid Display

- Maintains full vertical resolution when acquired waveforms are minimized in height.
- Several different multi-grid display selections, including X-Y and side-by-side.
- Completely user configurable (on HDO4000A)—use drag-and-drop to arrange traces as desired.



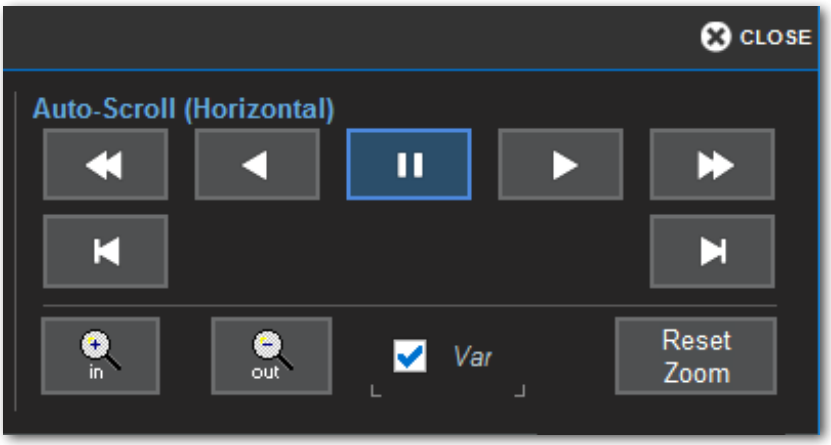
Display Persistence

- Build persistence maps from multiple acquisitions to understand how waveforms change over time.
- Select single-color analog or full-color displays.

COMPREHENSIVE WAVEFORM VIEWING

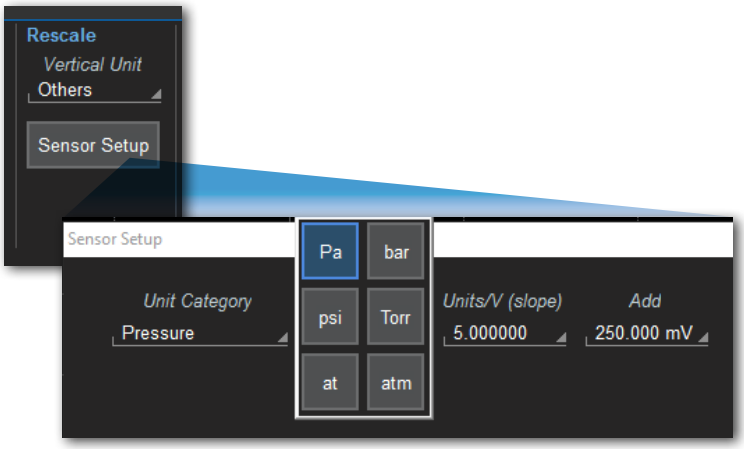
Comprehensive Zooming Capabilities

- Quick Zoom all waveforms with a single button press, or touch-and-drag over a trace to create individual zooms.
- Zoom both vertically and horizontally (on supported models).
- Touch result tables (Serial Decode, History, WaveScan, etc.) to zoom that part of the source waveform.



Auto Scroll

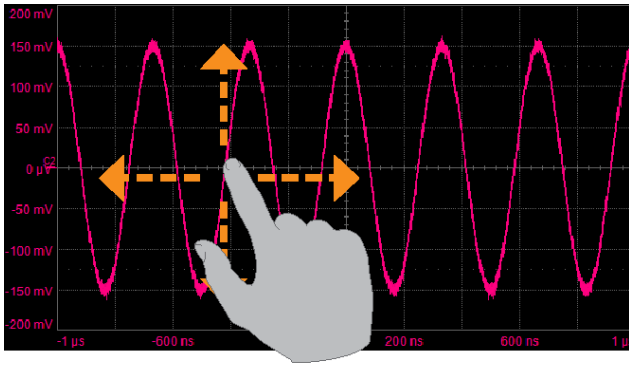
- Auto Scroll applies zoom to navigating History, WaveScan and Decode Search results.
- Automatically scroll through acquisition memory without manual knob turning.
- Forward or reverse direction at fast or slow speeds, single-stepped or continuous motion.



Channel Rescaling and Unit Conversion (HDO4000A and WaveSurfer 510)

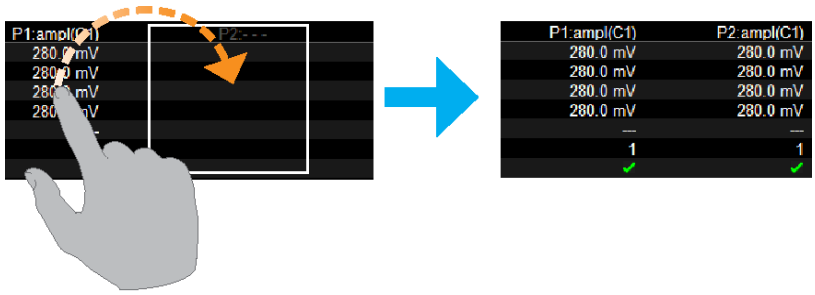
- Change the displayed Vertical Scale of any channel or sensor trace using a custom multiplier and/or additive constant.
- Convert to over 65 SI and English units conveniently on channel setup dialog.
- Math trace units intelligently converted based on input trace units and operation.

COMPREHENSIVE WAVEFORM VIEWING



MAUI

- Most Advanced User Interface—designed for touch, built for simplicity, and made to solve.
- All important controls always one touch away.
- Just drag to change Level, Offset or Delay, reposition cursors, or gate measurements.
- Swipe to pan traces and lists.



MAUI with OneTouch
(HDO4000A and WaveSurfer 510)

- Use gestures to change setups, often with just one touch.
- Drag to add new trace, copy measurement, or change source.
- Drag to move trace to new grid (on HDO4000A).
- Flick to remove traces and measurements.
- Pinch/unpinch traces to “zoom” in and out.

ADVANCED MEASURE & MATH

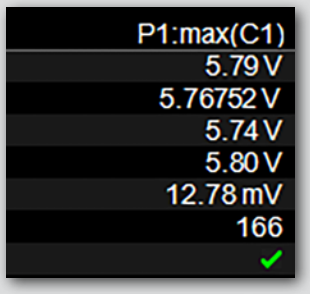
Advanced Measure

Configure up-to-six or eight parameters using the industry's most extensive set of standard measurements.

1. All-instance measurements for each acquisition
2. Full statistics (up-to-2 billion events)
3. Histicons provide snapshot of statistical distribution
4. User-defined measurement gate
5. Cyclic calculation of vertical parameters
6. At-level measurement for select parameters*

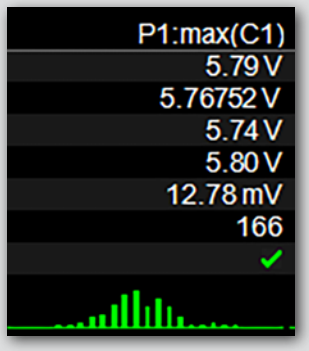
* On HDO4000A

Measurement Statistics



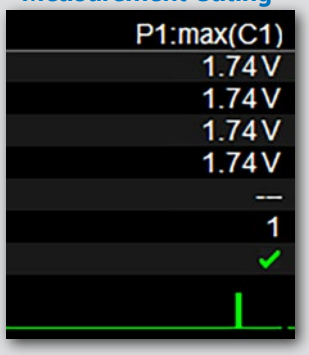
Statistics automatically calculated for all instance measurements, simply opt to display them or not.

Measurement Histicons



Turn on measurement histicons (miniature histograms) for quick visualization of statistical distribution.

Measurement Gating



Restrict measurements to region of trace within gates. Drag gate indicators to set gates. Image above shows effect of gating measurements to area around runt.

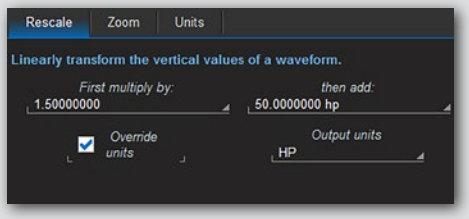
Advanced Math

Configure two concurrent math functions using the industry's most extensive set of standard math operators.

1. Dual operator functions chain two operations**
2. Vertically zoom math waveforms independently
3. Math waveform units intelligently rescaled and converted based on input trace units and operation
4. Override unit in which math trace is displayed**
5. Graph trend of a measurement

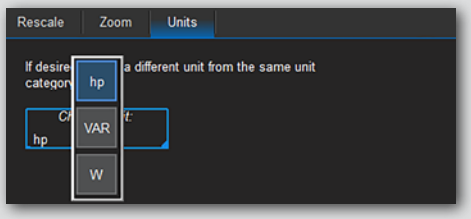
* *On HDO4000A and WaveSurfer 510

Rescale Math Function



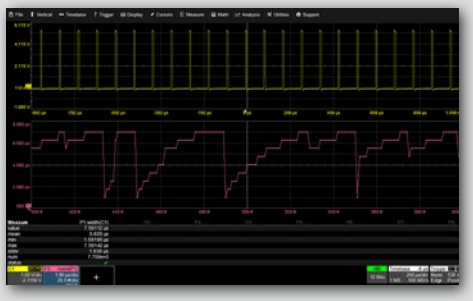
Use Rescale function to add custom multiplier and/or additive constant to another trace. Rescale can be applied to any channel, math, memory or zoom trace.

Unit Override



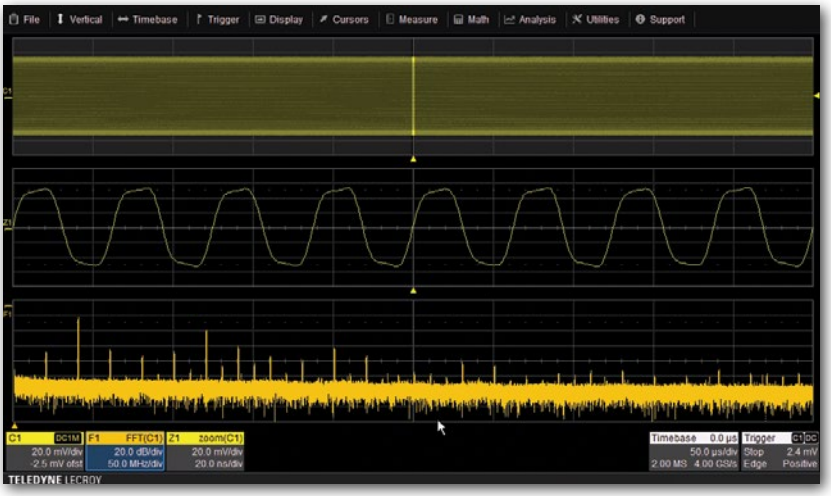
Change unit in which math trace is displayed to another within the same dimensional group (on supported models).

Trend Graphing



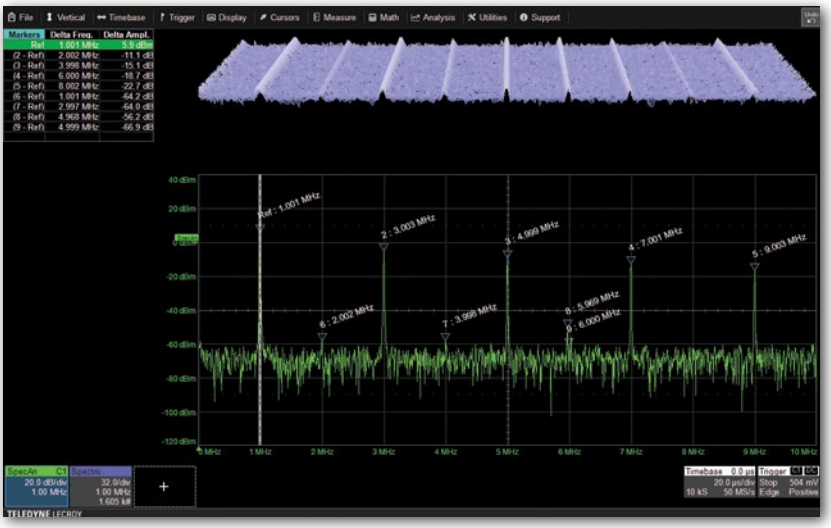
Use trends for chart recorder-like capabilities on the oscilloscope.

FFT & SPECTRAL ANALYSIS



FFT Frequency Analysis

- Full record length FFT (on supported models).
- Best resolution bandwidth possible.
- Select for Magnitude or Power Spectrum.
- Five different Window selections.
- Provides highest SNR when used with 12-bit HD4096 oscilloscopes.
- FFT averaging.



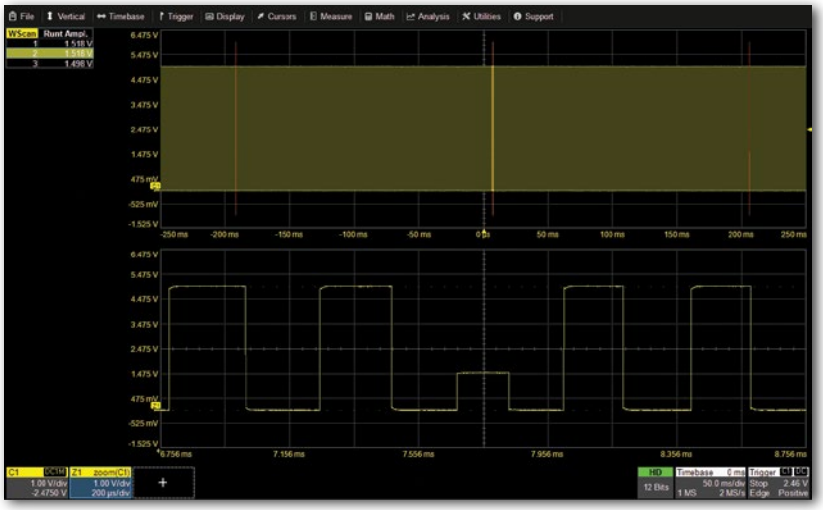
Spectrum Analyzer
(HDO4K-SPECTRUM, WS510-SPECTRUM)

- Spectrum Analyzer-style controls.
- Automatically identify and mark peak frequencies, fundamental frequencies and harmonics on FFT traces.
- 2D or 3D spectrogram shows how spectra change over time. .

ADVANCED ANOMALY DETECTION

PASS/FAIL Mask Testing

- Test waveforms against industry-standard or custom masks.
- Easily create new masks from “golden” waveforms.
- Mask violations clearly marked on waveform.
- Start/stop testing after defined number of sweeps, or run indefinitely. PASS/FAIL results over number of sweeps clearly displayed.
- Choose actions to take when a test is passed or failed: save waveform data, save a screen image, save a LabNotebook, sound an alarm signal, send a pulse or stop acquisition..



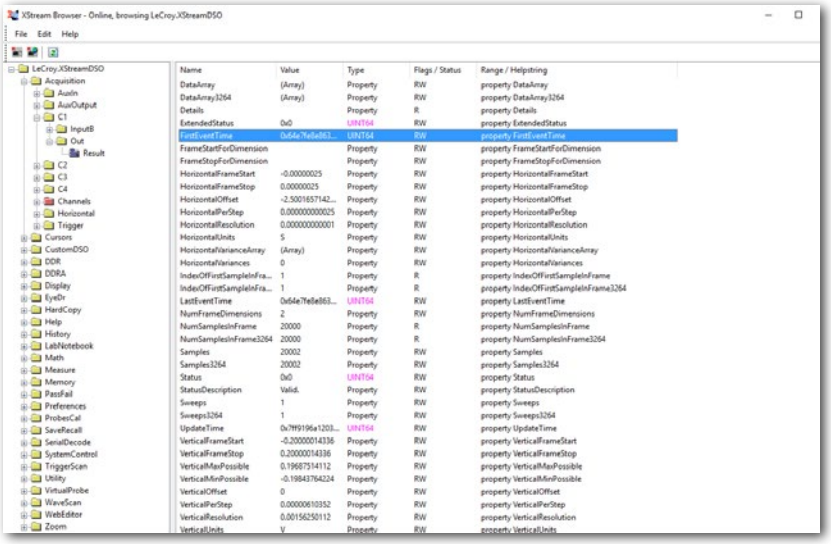
WaveScan® Advanced Search

- Search analog, digital or parallel bus signals using more than 20 different criteria, isolating events hardware triggers alone can’t find, like frequencies.
- Set up a condition and scan single or multiple acquisitions over hours or days.
- Touch timestamped WaveScan table to zoom to that event.

History Mode Waveform Playback

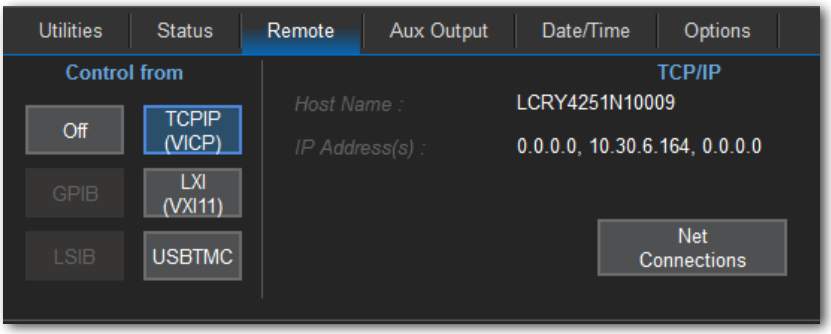
- Never miss a waveform: History Mode stores a buffer of acquisitions for later viewing and analysis.
- Always enabled and easily accessible.
- Touch timestamped History table to display a specific acquisition.
- Cursor readouts and Measure table reflect the visible acquisition.

REMOTE CONTROL & CONNECTIVITY



Windows Automation

- Native control language of MAUI oscilloscopes; use it to control every aspect of the oscilloscope.
- Run Automation programs remotely or locally on oscilloscope.
- Remote interface via DCOM, ActiveDSO (proprietary ActiveX control) or NI-VISA.
- Free XStreamBrowser utility shows full Automation setup; use it for remote control or as programming support.



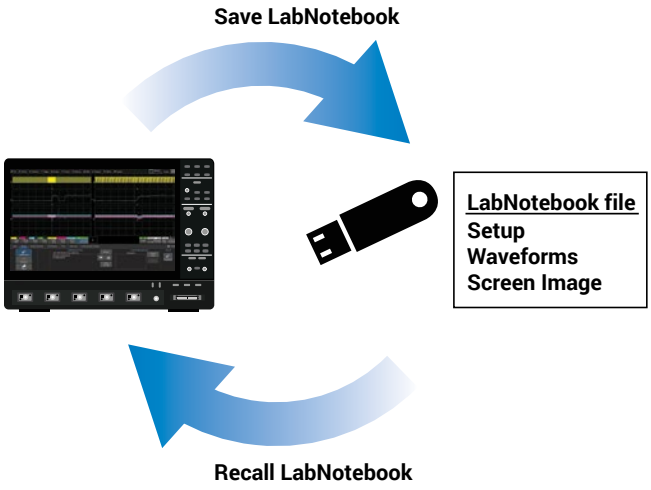
IEEE 488.2 Remote Control

- Proprietary set of IEEE 488.2 remote commands supported on all oscilloscopes.
- Connect via TCP/IP, LXI, USBTMC or GPIB (with optional card or adapter, see below).
- Windows Automation commands supported within IEEE 488.2 remote control programs.

Data Transfer

- 10/100 or 10/100/1000BaseT Ethernet interfaces are provided on all instruments.
- USBTMC port available on many models.
- USB-GPIB Adapter (shown at left) enables the oscilloscope to connect from any USB 2.0 port to the GPIB interface of host instruments.

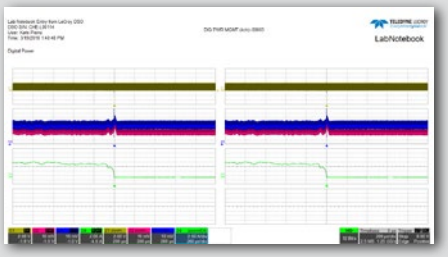
DOCUMENTATION & DATA SHARING



LabNotebook

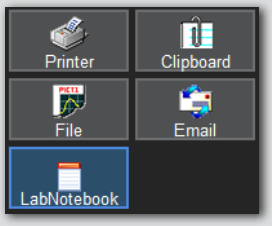
- Store all setups, waveforms and screen image in a single LabNotebook file.
- Add descriptive notes to LabNotebooks, or mark up screen images.
- Recall ("Flashback") LabNotebooks to restore oscilloscope to past state—including all setups, waveforms and table data.
- Extract component files from .LNB format files, or append other files to .LNB (on supported models).

Generate Reports



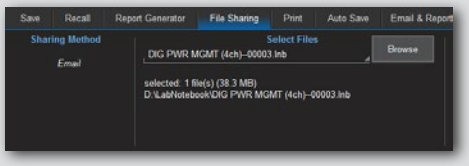
Generate preformatted .PDF, .RTF or .HTML reports from saved LabNotebooks or the oscilloscope current state (on supported models). Reports can show your company logo or use Print color palette to save ink/toner.

Print

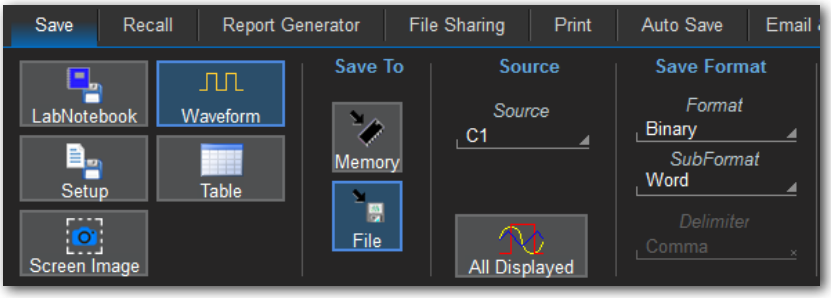


Configure Print button to create a LabNotebook or screen capture file.

Email



Email LabNotebooks and other files from the oscilloscope. Preset the recipient address to save time.



Save/Recall

- Save all setups/waveforms to file or internal memory; recall to quickly set up oscilloscope or analyze waveforms further.
- Capture screen image and save to .JPG, .PNG, .TIF or .BMP file.
- Save table data to Excel or text file for storage and sharing.
- Auto Save waveform and table data to file with each trigger.
- Save/recall files from any network folder accessible to the oscilloscope.

STANDARD TOOLBOX AVAILABILITY

● = standard, o = available as an option

	WaveSurfer 3000z	WaveSurfer 510	HDO4000A
Waveform Acquisition			
Advanced Triggers	●	●	●
Sequence Sampling Mode	●	●	●
Roll Sampling Mode (5 MS/s)	●	●	●
RIS Sampling Mode	●	●	●
Fast Update Mode	●		
Acquisition System Hardware Modules, Options and Upgrades			
SAM40 Sensor Acquisition Module			o
Integrated 16-line Digital Input w/Digital Leadset (-MS models or MSO option)	o[1]		o[1]
MS-250/MS-500 External Mixed Signal Solution		o[2]	
Memory Options or Upgrades (Mpts/Ch)			o
Bandwidth Upgrade	o[3]		
Comprehensive Waveform Viewing			
Axis and Trace Labels	●	●	●
Trace and Grid Intensity Adjustment	●	●	●
Dot or Joined Trace Style Selection		●	●
Multi-Grid Display	●	●	●
X-Y Displays	●	●	●
Display Persistence	●	●	●
Segment Waveform Displays	●	●	●
Horizontal Channel Zooming	●	●	●
Vertical Channel Zooming		●	●
Auto Scroll	●	●	●
Channel Rescaling and Unit Conversion		●	●
Most Advanced User Interface (MAUI)	●	●	●
MAUI with OneTouch		●	●
Advanced Measure & Math			
Comprehensive Standard Measurement Parameters	●	●	●
All Instance Measurements	●[4]	●	●
Full Statistics (mean, min, max, sdev, number)	●	●	●
Histicon Display	●	●	●
Measurement Gate	●	●	●
Cyclic Calculation of Vertical Measurement Parameters	●	●	●
Comprehensive Standard Math Functions	●	●	●
Single or Dual Operator Math Functions		●	●
Horizontal or Vertical Zoom Math Function	●	●	●
Automatic Math Rescaling and Unit Conversion	●	●	●
Manual Math Unit Override		●	●
Trend Graph of Measurement Parameters	●	●	●

STANDARD TOOLBOX AVAILABILITY

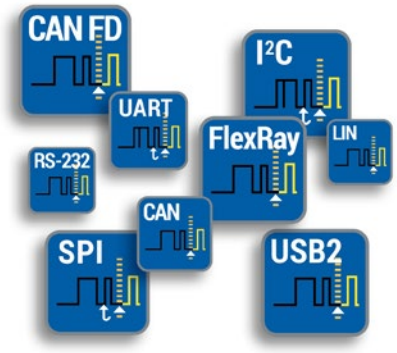
	WaveSurfer 3000z	WaveSurfer 510	HDO4000A
FFT & Spectral Analysis			
FFT Frequency Analysis	●	●	●
Full Record Length FFT		●	●
Spectrum Analyzer Capabilties (-SPECTRUM)		o	o
Advanced Anomaly Detection			
PASS/FAIL Mask Testing	●	●	●
WaveScan Advanced Search	●	●	●
History Mode Waveform Playback	●	●	●
Remote Control & Connectivity			
Windows Automation	●	●	●
IEEE 488.2 Remote Control	●	●	●
10/100BaseT or 10/100/1000BaseT Ethernet	●	●	●
USBTMC	●		●
External USB-to-GPIB Adapter	o	o	o
Documentation & Data Sharing			
LabNotebook	●	●	●
Extractable .LNB Files		●	●
Report Generator		●	●
Screen Capture	●	●	●
Network File Sharing	●	●	●
Email	●	●	●
Configurable Print Button	●	●	●
Use Print Colors	●	●	●
Configurable Print Color Palette		●	●
Save/Recall Setups, Waveforms, Table Data	●	●	●
Auto Save	●	●	●

1 Integrated digital input capabilities must be selected at time of initial purchase.
2 External MS-xxx solution can be selected at time of initial purchase, or purchased later without return to service center.
3 Contact Teledyne LeCroy Service. Upgrade may require return to service center.
4 Measurements calculated for all instances in Single trigger mode.

SERIAL MESSAGE ANALYSIS OPTIONS

Serial Trigger & Decode (Software Options, see Table of Options for details on availability)

Serial Trigger and Decode software options offer complete serial message debug and validation for over 20 supported protocols. Extend your knowledge of cause-effect behaviors and physical layer problems.



Trigger

- Trigger on protocol elements or specific DATA patterns. Includes powerful conditional DATA triggering.
- Highly adaptable ERROR Frame triggering to isolate protocol errors.
- Combine UART/SPI bytes into single “message frame” to trigger on proprietary protocols.
- Trigger on application level values with Symbolic options.

Decode

- Decode and display up-to-two or four protocols of any type simultaneously.
- Transparent, color-coded overlay marks protocol elements (ID, DATA, CRC, complete frame, etc.) on waveform. Decoded data listed on overlay.
- Interactive table displays interleaved records from all protocol decoders; touch a record to zoom to the waveform location. Export table data to file. Customize table display.
- User-defined decode Search zooms to the next match it finds.

SERIAL MESSAGE ANALYSIS OPTIONS

Serial Message Analysis Options Availability

D = Decode only, TD = Trigger & Decode

	WaveSurfer 3000z	WaveSurfer 510	HDO4000A
ARINC 429 Symbolic D		o	o
AudioBus (I2S) TD	o	o	o
AUTO Bundle: CAN and LIN TD	o		
CAN TD		o	o
CAN FD TD (incl. Standard CAN)	o	o	o
EMBEDDED Bundle: I2C, SPI, UART and RS-232 TD	o	o	
ENET D		o	o
FlexRay TD	o	o	o
I2C TD		o	o
LIN TD		o	o
Manchester D		o	o
MDIO D		o	o
MIL-STD-1553 TD		o	o
MIPI DigRF 3G D		o	o
MIPI DigRF V4 D		o	o
MIPI D-PHY D		o	o
NRZ (packetized NRZ) D		o	o
SENT D		o	o
SpaceWire D		o	o
SPI TD		o	o
SPMI D		o	o
UART and RS-232 TD		o	o
USB 2.0 TD		o	o
USB 2.0 HSIC D		o	o

Note: Oscilloscope bandwidth must be ≥ serial data bit rate, and sample rate must be ≥ four times the bit rate for decoders to function.

POWER ANALYSIS OPTIONS

Device and Switch-Mode Power Supply Power Analysis (PWR Software Option)

- Control loop and time domain response analysis.
- Automatically identifies device measurement zones with color-coded overlays.
- Line power and harmonics tests to IEC 61000-3-2. Total harmonic distortion table shows frequency contribution.
- Measurement parameters provide details of single cycle or average device power losses.
- B-H Curve shows magnetic device saturation.

Power Analysis Options Availability

	WaveSurfer 3000z	WaveSurfer 510	HDO4000A
Device and Switch-Mode Power Supply Power Analysis Software	o	o	o

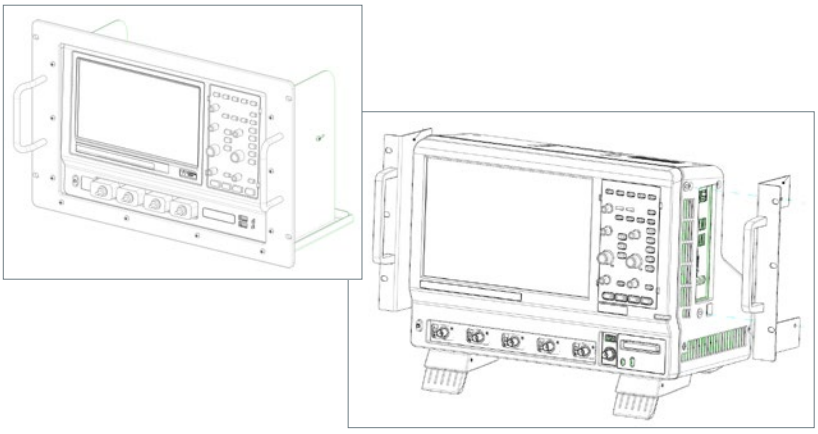
OSCILLOSCOPE ACCESSORIES

Soft Storage Case
(SOFTCASE Accessory)

- Hard case designed for long-term storage and protection in transit.
- Foam-reinforced soft case offers protection with less size/weight than a hard case.

Soft Carrying Case
(CARRYCASE Accessory)

- Carrying bag designed for easy transport of oscilloscope.
- Collapsible—stores easily.
- Thin, soft foam protective layer.



Rackmounts
(RACK, RACKMOUNT Accessories)

- Support the oscilloscope for 19” rack installation.
- Uniquely designed for each model.
- Rackmount ears (shown right) attach to sides of oscilloscope to permit direct mounting into rack.
- Rackmount shelf (shown left) supports oscilloscope on shelf that mounts to rack.
- Consult Customer Service for details on which Rackmount is provided for each oscilloscope.

Removable Drives
(HDO4K-RSSD, HDO4K-SSD-02)

- Removable drives permit safekeeping of data in a secured location.
- Requires a factory-installed upgrade to a removable drive (RSSD option, left).
- Additional removable drives (SSD-02, right) may be ordered for use with the oscilloscope in different locations (after upgrade).
- Each removable drive is supplied complete with Windows and other files necessary to run the oscilloscope.

Oscilloscope Accessories Availability

	WaveSurfer 3000z	WaveSurfer 510	HDO4000A
Soft Storage Case	o		o
Soft Carrying Case		o	
Rackmounts	o	o	o
Removable Drive Upgrade and Optional Additional Removable Drives			o

MAINTENANCE AGREEMENTS

5-Year Annual Traceable Calibration (C5)

- C5 provides Annual NIST Traceable Calibration.
- C5/MIL provides Annual Z540 Traceable Calibration (before and after data included).
- C5/17025 provides Annual ISO17025 Accredited Calibration with Uncertainties (before and after data included).

5-Year Extended Warranty (W5)

- W5 extends total warranty coverage to 5 years (including oscilloscope standard 3-year warranty).

5-Year Extended Warranty with Annual Traceable Calibration (T5)

- T5 extends total warranty coverage to 5 years (including oscilloscope standard 3-year warranty) and also includes an annual NIST Traceable Calibration.
- T5/MIL extends total warranty coverage to 5 years (including oscilloscope standard 3-year warranty) and also includes an annual Z540 Traceable Calibration (before and after data included).

5-Year Worry Free (WF5)

- WF5 extends total warranty coverage to 5 years (including oscilloscope standard 3-year warranty) and also includes coverage for EOS/ESD events or minor mechanical damage.

Maintenance Agreements Availability

	WaveSurfer 3000z	WaveSurfer 510	HDO4000A
5-Year Annual Traceable Calibration	o	o	o
5-Year Extended Warranty	o	o	o
5-Year Extended Warranty with Annual Traceable Calibration	o	o	o
5-Year Worry Free Warranty	o	o	o

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