TELEDYNE LECROY
Everywhere**you**look™

Oscilloscope Features, Options, and Accessories

HDO6000B
WaveRunner 8000HD
MDA 8000HD
WaveRunner 9000
WavePro HD
WaveMaster 8 Zi-B
LabMaster 10 Zi-A

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 100 MHz to 65 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.
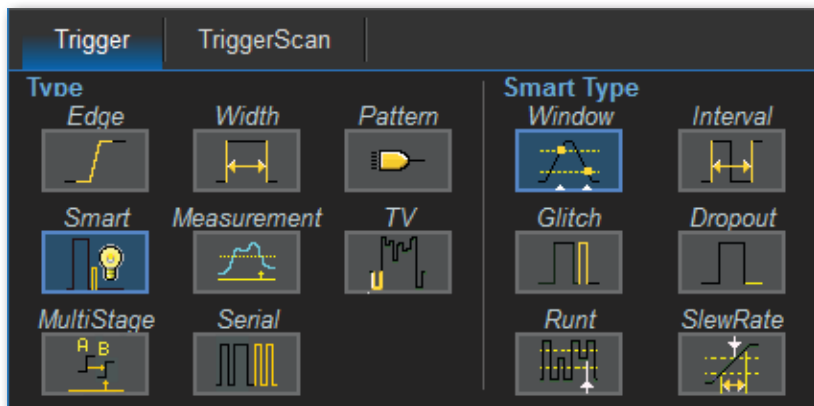
Advanced Triggering

- 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 TDME software options add protocol-specific triggers to the standard set.
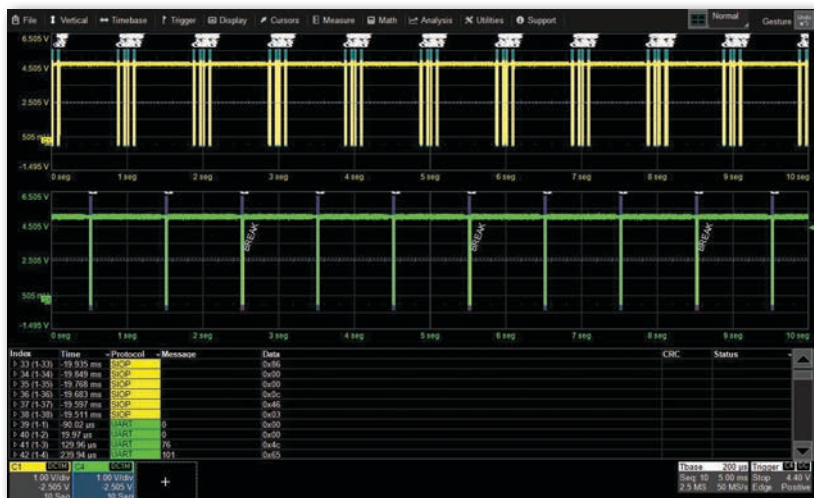
Flexible Sampling Modes

- 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 (on supported models.)
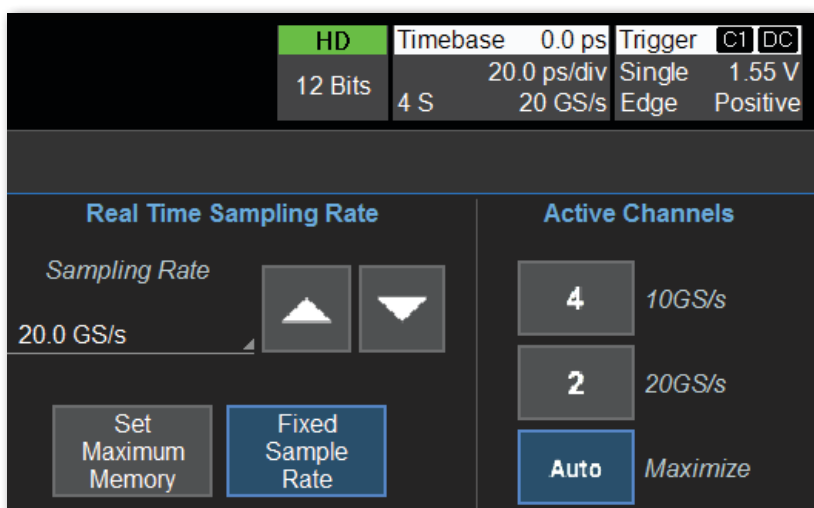
Acquisition Memory Upgrades
(Oscilloscope Options)

- Standard acquisition memory permits long waveform capture times at high sample rates.

- Interleaving doubles the acquisition memory and sample rate (on supported models).

- Memory upgrades available for most oscilloscope models—up to 5 Gpts/channel on some models.
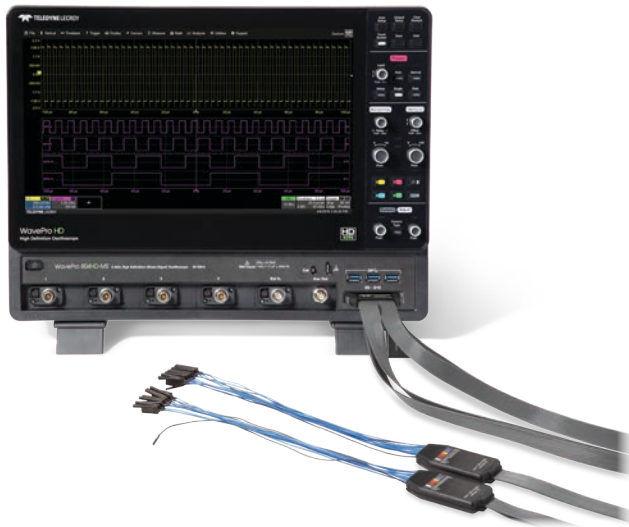
Mixed Signal Solutions
(-MS Models/MSO Oscilloscope Option)

- Integrated Mixed Signal interface enables 16 lines of digital input at 1.25 or 2.5 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-500 external logic pods provide similar capabilities.
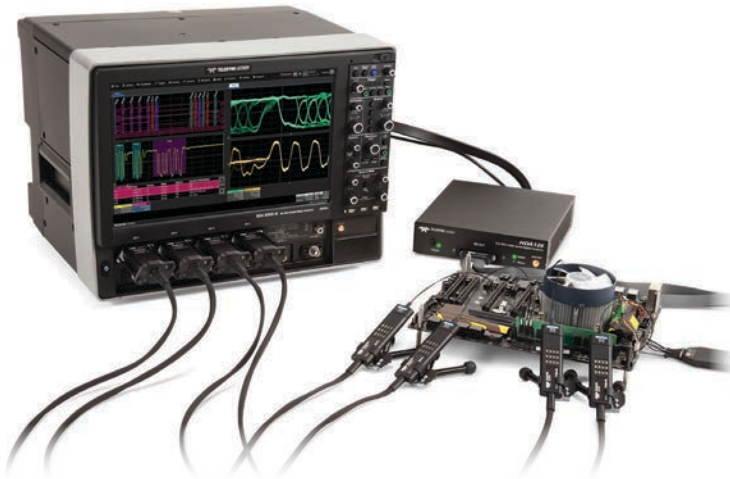
HDA125 High Speed Digital Analyzer
(Optional Hardware)

- 9- or 18-channel models available.

- 12.5 GS/s sampling rate for 80 ps timing accuracy.

- 3 GHz leadset for capturing digital signals up to 6 Gb/s .

- QuickLink probing system with differential solder-in tips works with both HDA125 digital leadset and analog differential probes.

- Ideal for enhanced DDR Debug.
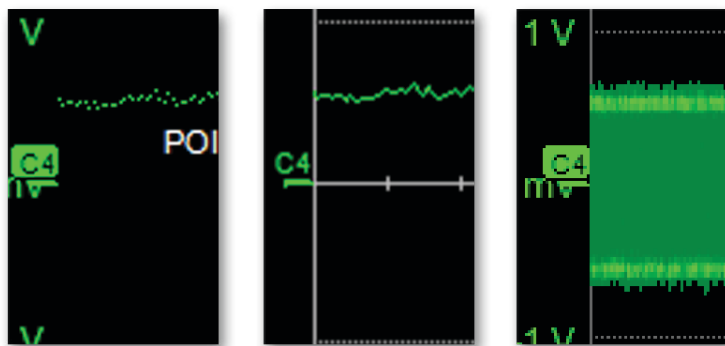
Configurable Displays

- 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: series of dots or joined lines.

Multi-Grid Display

- Maintains full vertical resolution when acquired waveforms are minimized in height.

- Many different multi-grid display selections, including X-Y and side-by-side.

- Completely user configurable—use drag-and-drop to arrange traces as desired.

- Locate any Channel, Math, Zoom, Memory, etc. trace in any grid location.
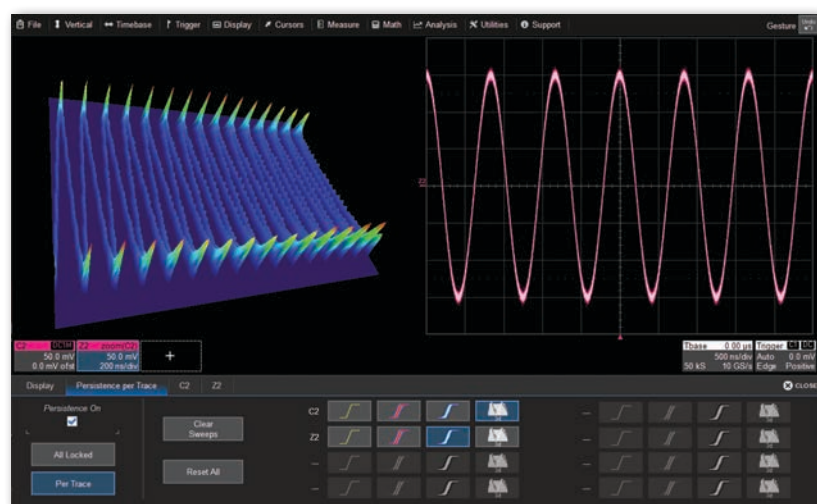
Display Persistence

- Build persistence maps from multiple acquisitions to understand how waveforms change over time.

- Select single-color analog or full-color displays.

- Generate 3D displays of persistence maps, and rotate 3D persistence maps on three axes.

- Global or independent (per-trace) persistence settings.

- Persistence (waveform) histogram capability for both Vertical and Horizontal.

Segment Waveform Display

- Show Sequence Mode acquisition segments in five different display modes.

- Adjacent shows segments sequentially, similar to a real-time waveform but without dead-time.

- Overlay mimics persistence by stacking all segments on top of each other, time synchronized.

- Waterfall, Mosaic and Perspective place segments in close proximity for comparison.

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.

- Create time-locked, Multi-Zoom groups, then track all zooms together.

- Touch result tables (Serial Decode, History, WaveScan, etc.) to zoom that part of the source waveform.
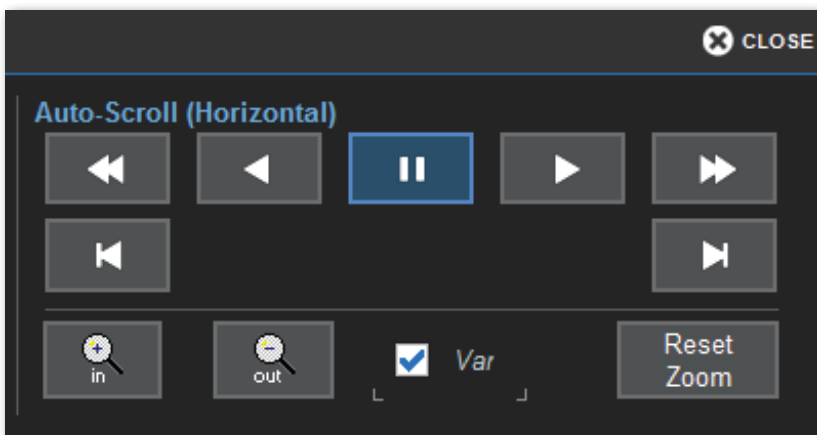
Auto Scroll

- 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

- 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 in chanel setup dialog.

- Math trace units intelligently converted based on input trace units and operation.

- Change the displayed Vertical Scale by entering a user-defined table of calibration data, ideal for non-linear electrical and magnetic field transducers (included with some optional software packages).
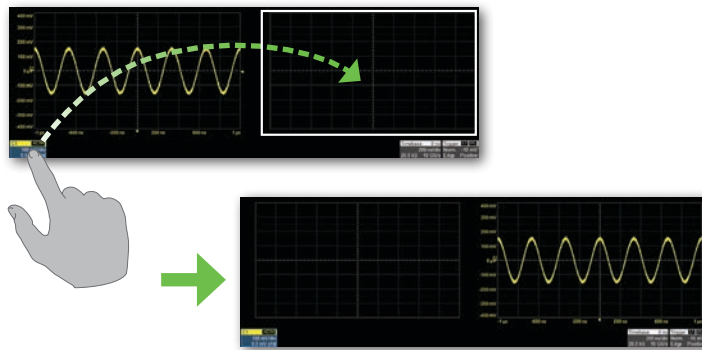
MAUI with OneTouch

- Most Advanced User Interface—designed for touch, built for simplicity, and made to solve.

- Use gestures to change setups, often with just one touch.

- Swipe to pan traces and lists.

- Drag to add new trace, copy measurement, or change source.

- Drag to move trace to new grid.

- Flick to remove traces and measurements.

- Pinch/unpinch traces to "zoom" in and out.
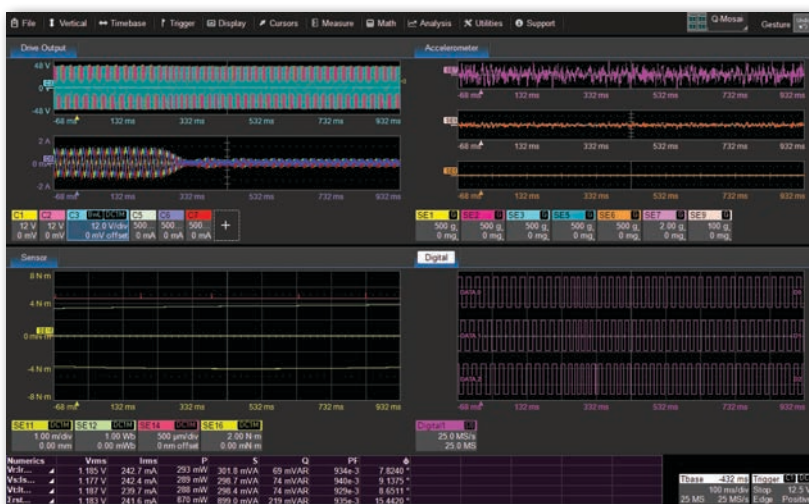
Q-Scape Multi-Tab Display

- Divide the screen into four display tabs to maximize your viewing area.

- Arrange tabs to facilitate waveform comparison: Single (stacked tabs), Dual (side-by-side tabs) or Mosaic (all tabs displayed).

- Configure each tab with different grid modes.

- Drag traces to different tabs just as you can drag them to different grids.

- Standard on all WaveRunner 8000HD and MDA 8000HD models; optional on others.

Advanced Measure

Configure up-to-12 parameters using the industry's most extensive set of standard measurements. Use custom scripts of your creation, perform math on measurement parameters, or create complex processing webs using Advanced Web Edit.

1. All-instance measurements for each acquisition
2. Full statistics (up-to-2 billion events)
3. Histicons provide snapshot and Histograms provide detail of statistical distribution
4. Simple/detailed Help Markers
5. Independent measurement gate for each parameter
6. Measurement Parameter Math
7. Measurement rescaling and unit conversion
8. User-defined measurement accept
9. Cyclic calculation of vertical parameters
10. Advanced Web Edit for complex measurements

Measurement Histograms & Statistics
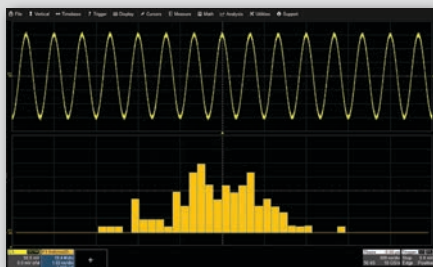
Histogram any measurement for quick visualization of statistical distribution. Apply special measurements to histogram plots for further statistical analysis.

Measurement Parameter Math
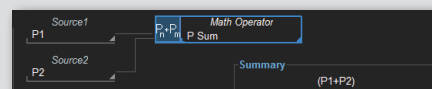
Add, subtract, multiply and divide parameters with each other or a constant. Rescale the measured parameter values.

Measurement Accept Capability
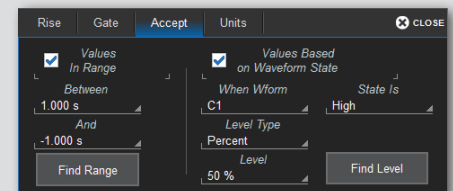
Only "accept" and display the measurement result if values are within a stated range or within another defined waveform state.

A

Advanced Math

Configure up-to-12 math functions using the industry's most extensive set of standard math operators. As with Measure, you can use custom scripts and algorithms of your creation, or create complex processing webs.
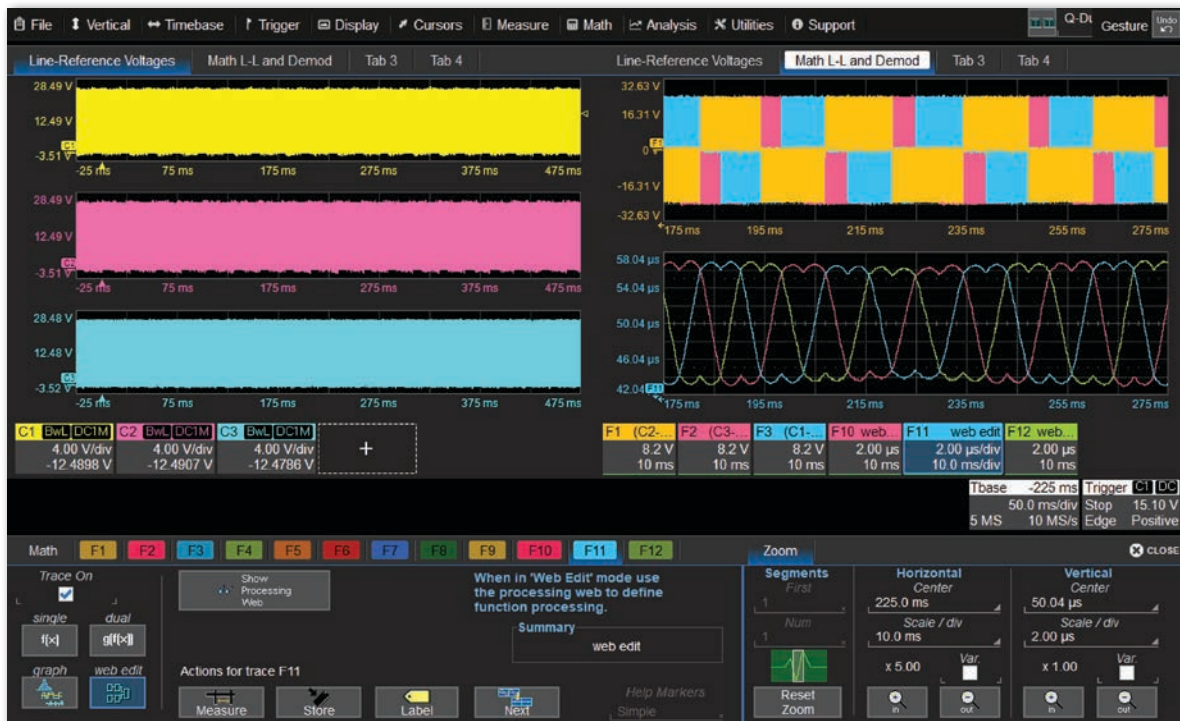
1. Dual-operator functions chain two operations

2. Advanced Web Edit for more complex functions

3. Use custom scripts in oscilloscope's real-time processing stream—MATLAB, Excel, C/C++, or VBS scripts supported (with XDEV option)

4. Vertically zoom math waveforms independently

5. Math waveform units intelligently rescaled and converted based on input trace units and operation

6. Graph histogram, track or trend of measurement

7. Plot X-Y waveforms (on supported models)

Persistence Trace and Histogram

Create math waveforms that show persistence mean (top right), range (bottom left) or standard deviation (bottom right) of multiple acquired waveforms. Waveforms are data and can be used as input for math, measure, pass/fail testing, etc.

Track & Trend Graphing
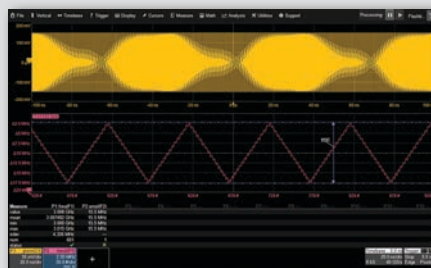
Use Track to show variation of a measurement parameter over time, time-correlated with original acquisition. Use Trend for chart recorder-like capabilities on the oscilloscope.

Advanced Web Edit

Create complex measurement or math processing "webs" using standard measurement parameters, math functions, custom scripts (with XDEV option) or any combination thereof. Unlimited chaining of operations permitted.

Digital Filter Package
(DFP2 Software Option)

- Optional package of 13 IIR and FIR filters added to the set of Math operators.

- Apply filters to eliminate undesired spectral components and enhance the ability to examine important signal components.

- Filters include: Low-pass, High-pass, Band-pass, Band-stop, Raised Cosine, Raised Root Cosine, Gaussian and Custom.

- IIR filters permit Butterworth, Chebyshev, Inverse Chebyshev or Bessel type selection.
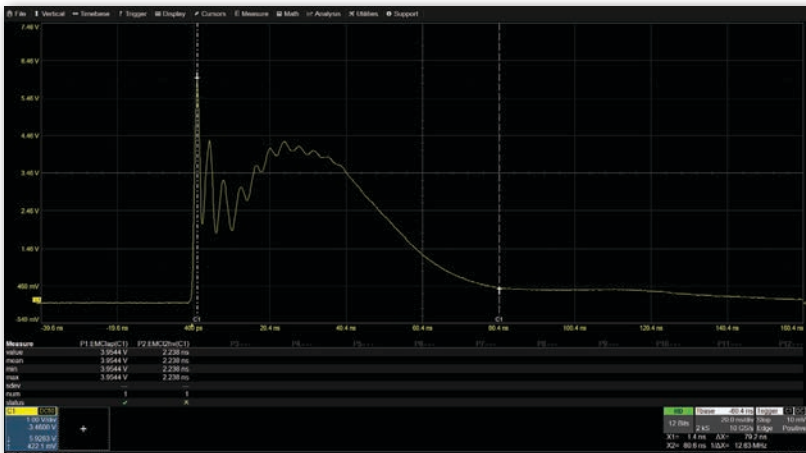
EMC Pulse Parameter Package
(EMC Software Option)

- Ignore undershoot, overshoot or tail perturbations when measuring EMC/ESD pulses.

- Set level for @level parameters using actual Peak-to-Peak, 0V - Max, or 0V − Min.

- Adds customizable measurements for EMC Level After Pulse and EMC Time to Half Value.

ADVANCED MEASURE & MATH

FFT Frequency Analysis

- Full record length FFT (500 Mpts).

- Best resolution bandwidth possible.

- Select for Magnitude, Phase, Power Spectrum, Power Density, Real, Imaginary or Magnitude Squared.

- Five different Window selections.

- Provides highest SNR when used with 12-bit HD4096 oscilloscopes.

- FFT averaging.
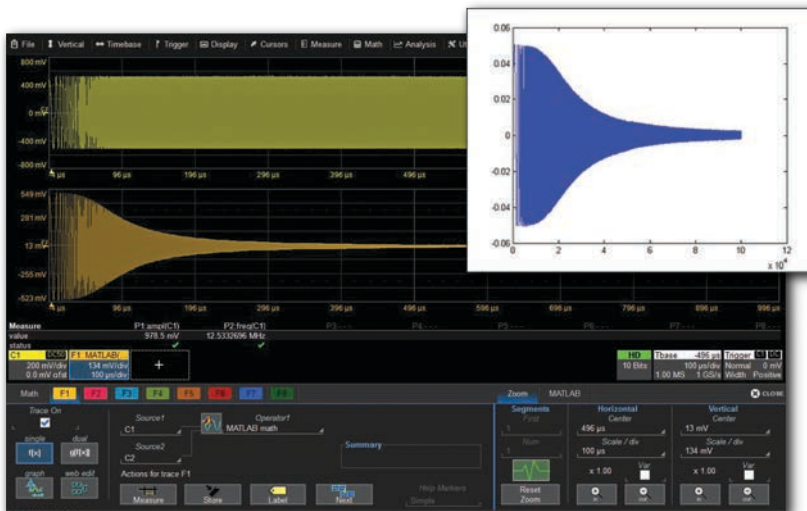
Advanced Customization
(XDEV Software Option)

- Insert proprietary measurements and math functions directly into oscilloscope's processing stream using scripts and view results in real time.

- Create plug-ins that add multiple processes with custom user interfaces.

- Support for VBScript, JavaScript, MATLAB® Script, MathCad Script, Excel® VBA, C/C++.

- Standard on WaveMaster and LabMaster models, available as an option on others.

PASS/FAIL Testing

Test waveforms against a custom set of up-to-12 unique "queries" consisting of a waveform mask, single parameter comparison or dual parameter comparison. Define test "PASS" or "FAIL" using complex Boolean comparison of multiple queries. Start/stop testing after defined number of sweeps, or run indefinitely.

Mask Testing

- Test waveforms against industry-standard or custom masks.
- Easily create new masks from "golden" waveforms.
- Mask violations clearly marked on waveform.
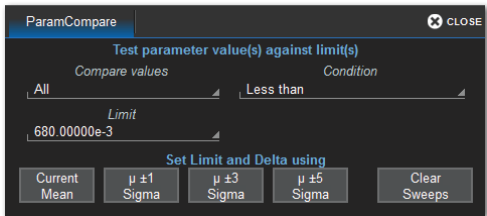
Parameter Compare with Boolean Conditions

- Test parameter measurement result against a limit or a second measurement, using a wide variety of conditions.
- Define "PASS" or "FAIL" query using complex Boolean criteria.
- Set criteria using absolute values/ranges, Mean or Sigma.
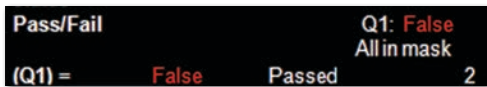
Intuitive Results Display

- Test queries all shown on intuitive table, with active queries highlighted.
- PASS or FAIL results over number of sweeps clearly displayed.

Actions

Choose one or more 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.
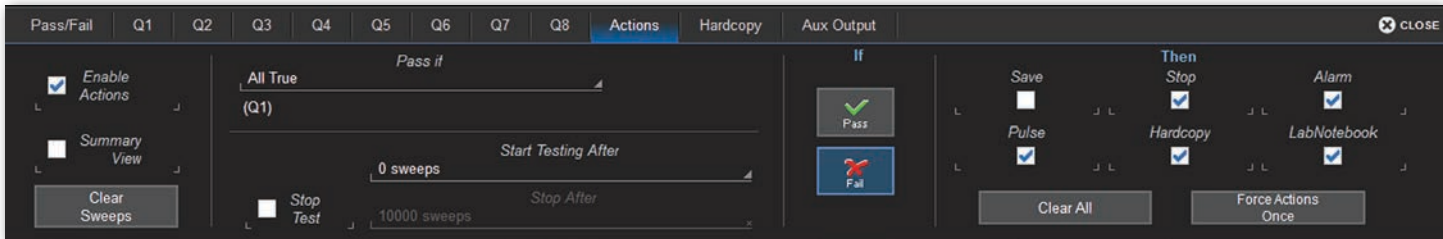
TriggerScan

- "Train" on the type of events found in your signals and automatically configures triggers designed to find those events.

- Edit generated triggers, or manually add triggers to setup.

- Save triggers as setup files for sharing, storage and quick reloading.

- Save only the triggers you want in discrete sets for different projects.
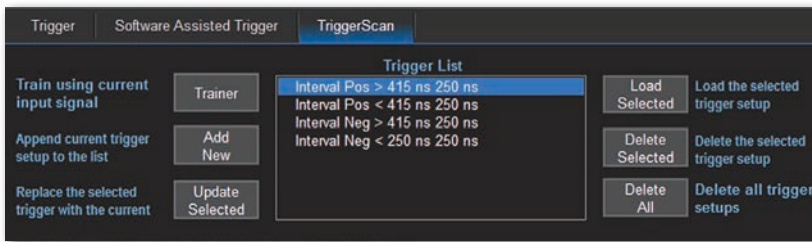
WaveScan® Advanced Search

- 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.

- ScanOverlay view marks events on the waveform with color overlays; ScanHistogram view shows statistical distribution of events.

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.

- Available on HDO6000B, WaveRunner 8000HD, MDA 8000HD, WaveRunner 9000 and WavePro HD.

13
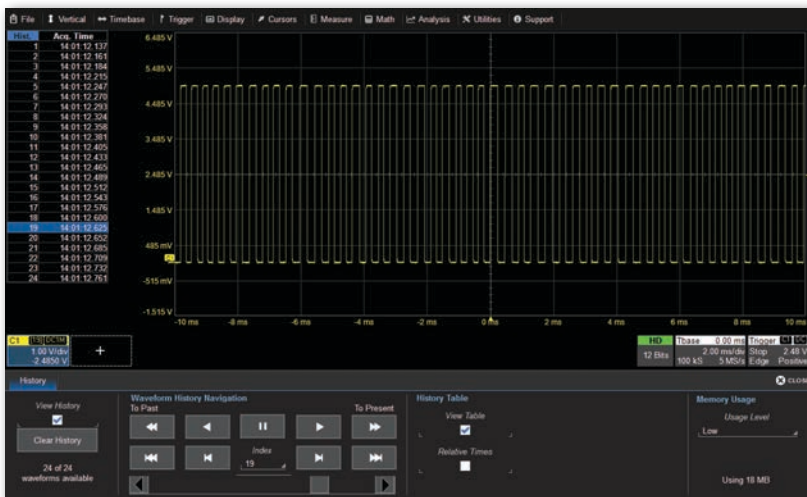
MAUI Studio puts the Teledyne LeCroy MAUI oscilloscope software on your desktop for offline analysis of waveforms and remote control of Teledyne LeCroy oscilloscopes. Work from home or while travelling. Supports Ethernet (TCP/IP) connection only.

MAUI Studio (complimentary)

- Simulates interface of HDO4000A oscilloscopes.

- Import LabNotebooks, trace files *and* other vendors' waveform files (Tek, Keysight, Rohde & Schwarz, Yokogawa) and analyze anywhere.

MAUI Studio Pro (optional)

- Simulates oscilloscope interface of your choice.

- Import LabNotebooks, trace files *and* other vendors' waveform files (Tek, Keysight, Rohde & Schwarz, Yokogawa) and analyze anywhere.

- Enhanced LabNotebook replicates source oscilloscope model type and software options with no additional purchase.

- Remote control Teledyne LeCroy oscilloscopes over Ethernet using all the connected oscilloscope's software options.

- Arbitrary Function Generator lets you simulate waveforms with custom noise/jitter characteristics.

- Offered with free, 30-day trial.

PC Requirements

- x64 Windows 10 Pro operating system

- Intel® CoreTM i7 Processor or better, 2.4 GHz or higher

- 4 GB RAM or better

- 2 GB or more available free space for the installed application

- Minimum 1280x780 pixel display, 1920x1080 recommended

Note: The host PC must have an active internet connection to download and register MAUI Studio software.

Download at teledynelecroy.com/mauistudio
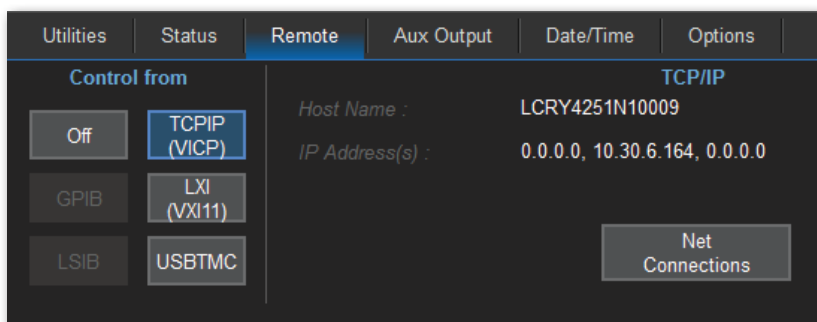
Microsoft COM Automation and IEEE 488.2 Remote Control

- Connect to oscilloscope via TCP/IP, LXI, USBTMC or GPIB (with optional card/adapter).

- Remote interface via DCOM, ActiveDSO (proprietary ActiveX control) or NI-VISA.

- Proprietary set of IEEE 488.2 remote commands supported on all oscilloscopes.

- COM Automation commands supported within IEEE 488.2 remote control programs.

Save LabNotebook

LabNotebook file
Setup
Waveforms
Screen Image

Recall LabNotebook
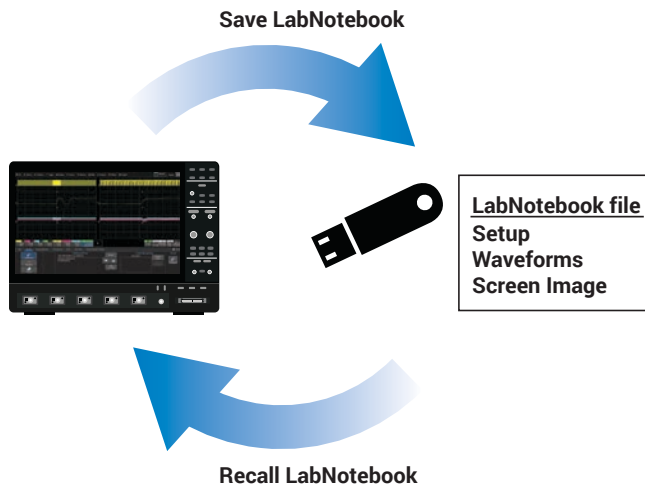
LabNotebook

- 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.

Generate Reports

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

Print/Save
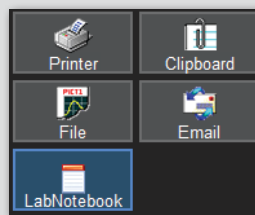
Configure front panel button to create a LabNotebook or screen image file with one press.

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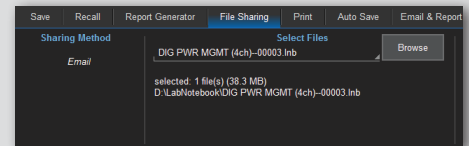
Email LabNotebooks and other files from the oscilloscope. Preset the recipient address to save time.

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.
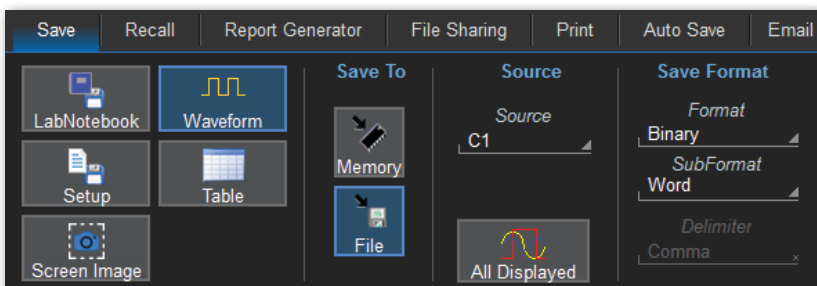
● = standard, o = available as an option

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
Waveform Acquisition						
Advanced Triggers	●	●	●	●	●	●
Sequence Sampling Mode	●	●	●	●	●	●
Roll Sampling Mode (5 MS/s)	●	●	●	●	●	
RIS Sampling Mode	●		●		●	
Acquisition System Hardware Modules, Options and Upgrades						
Integrated 16-line Digital Input w/Digital Leadset (-MS models/MSO option)	o[1]	o	o[1]	o[1]		
HDA125 High-speed Digital Analyzer with QuickLink Leadset					o[2]	o[2]
MS-500 External Mixed Signal Solution					o[2]	
Memory Options or Upgrades	o	o	o	o	o	o
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	●	●	●	●	●	●
Comprehensive Zooming Capabilities (Horizontal and Vertical)	●	●	●	●	●	●
Auto Scroll	●	●	●	●	●	●
Channel Rescaling and Unit Conversion	●	●	●	●	●	●
MAUI with OneTouch	●	●	●	●	●	●
Q-Scape Multi-Tab Display	o	●				
Advanced Measure & Math						
Comprehensive Standard Measurement Parameters	●	●	●	●	●	●
All Instance Measurements	●	●	●	●	●	●
Full Statistics (mean, min, max, sdev, number)	●	●	●	●	●	●
Histicon Display	●	●	●	●	●	●
Parameter Histogram with Histogram Measurements	●	●	●	●	●	●
Parameter Help Markers (Simple or Detailed)	●	●	●	●	●	●
Measurement Gates (Independent)	●	●	●	●	●	●
Parameter Math	●	●	●	●	●	●
Measurement Rescaling and Unit Conversion	●	●	●	●	●	●
Measurement Accept Capability	●	●	●	●	●	●
Cyclic Calculation of Vertical Measurement Parameters	●	●	●	●	●	●
Advanced Web Edit Measurements	●	●	●	●	●	●
Comprehensive Standard Math Functions	●	●	●	●	●	●
Single or Dual Operator Math Functions	●	●	●	●	●	●

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
Advanced Measure & Math (cont'd)						
Track and Trend Graphing of Parameters	●	●	●	●	●	●
Persistence Trace, Persistence Histogram	●	●	●	●	●	●
Automatic Math Rescaling and Unit Conversion with Manual Unit Override	●	●	●	●	●	●
X-Y Waveforms		●				
Advanced Web Edit Math Functions	●	●	●	●	●	●
Digital Filter Package (-DFP2)	o	o	o	o	o	o
EMC Pulse Parameters Package (-EMC)	o	o	o	o	o	o
Full Record Length (up-to-500 Mpts) FFT Frequency Analysis	●	●	●	●	●	●
Advanced Measure/Math Customization Package (-XDEV)	o	o	o	o	●	●
Advanced Anomaly Detection						
PASS/FAIL Mask Testing	●	●	●	●	●	●
PASS/FAIL Parameter Compare with Boolean Conditions	●	●	●	●	●	●
PASS/FAIL Actions	●	●	●	●	●	●
TriggerScan	●	●	●	●	●	●
WaveScan Advanced Search	●	●	●	●	●	●
History Mode Waveform Playback	●	●	●	●		
Remote Control & Connectivity						
MAUI Studio	●	●	●	●	●	●
MAUI Studio Pro	o	o	o	o	o	o
COM Automation	●	●	●	●	●	●
IEEE 488.2 Remote Control	●	●	●	●	●	●
10/100/1000BaseT Ethernet	●	●	●	●	●	●
USBTMC	●					
USBTMC over 3.1 Gen1		●	●	●		
IEEE 488.2 GPIB Interface Card					o	o
External USB-to-GPIB Adapter	o	o	o	o		
Documentation & Data Sharing						
LabNotebook with Extractable .LNB Files	●	●	●	●	●	●
Report Generator	●	●	●	●	●	●
Screen Capture	●	●	●	●	●	●
Network File Sharing	●	●	●	●	●	●
Email	●	●	●	●	●	●
Configurable Print/User Button	●	●	●	●	●	●
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 solution can be selected at time of initial purchase, or purchased later without return to service center.

SERIAL MESSAGE ANALYSIS OPTIONS

Serial TDME (Software Options, see Table of Options for details on availability)

Serial Trigger, Decode, Measure/Graph and Eye Diagram (TDME) 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.

Note: Oscilloscope bandwidth must be ≥ serial data bit rate, and sample rate must be ≥ four times the bit rate for decoders to function.
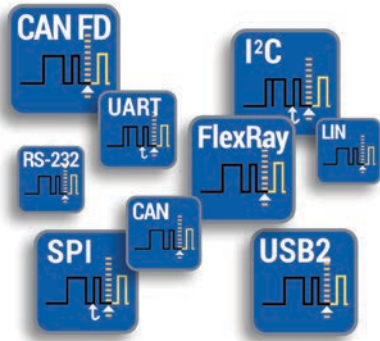
Trigger
- Trigger on protocol elements or specific DATA patterns. Includes powerful conditional DATA triggering.
- Highly adaptable ERROR Frame triggering to isolate protocol errors.
- Combine UART/SPI bytes into single "message frame" to trigger on proprietary protocols.
- Trigger on application level values with Symbolic options.

Decode
- Decode and display up-to-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.

Measure/Graph
- Apply automated timing measurements to decoded data for cause-effect analysis between messages, or between messages and analog signals.
- Serial Data DAC—use Message to Value measurement to extract digital data, rescale it to an analog value, and graph it over time.
- Apply various bus measurements.
- Use with full set of standard parameter analysis tools: statistics, gating, conditional accepting, etc.
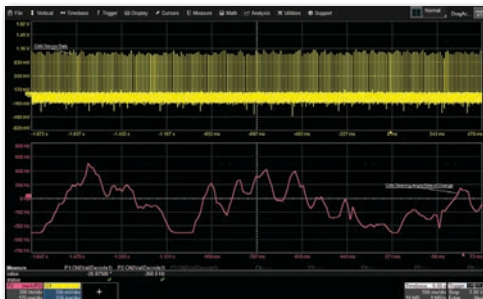
Eye Diagrams
- One "button" setup of four simultaneous eye diagrams.
- Examine different protocols, or same protocol at different points.
- Eye diagram mask tests with mask failure indicators.
- PHY test options (TDMP) provide additional eye diagrams and special measurements required by standard for high-speed/complex protocols.
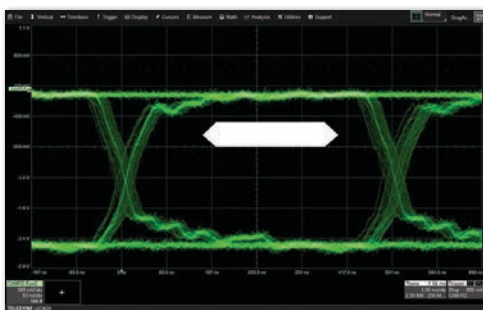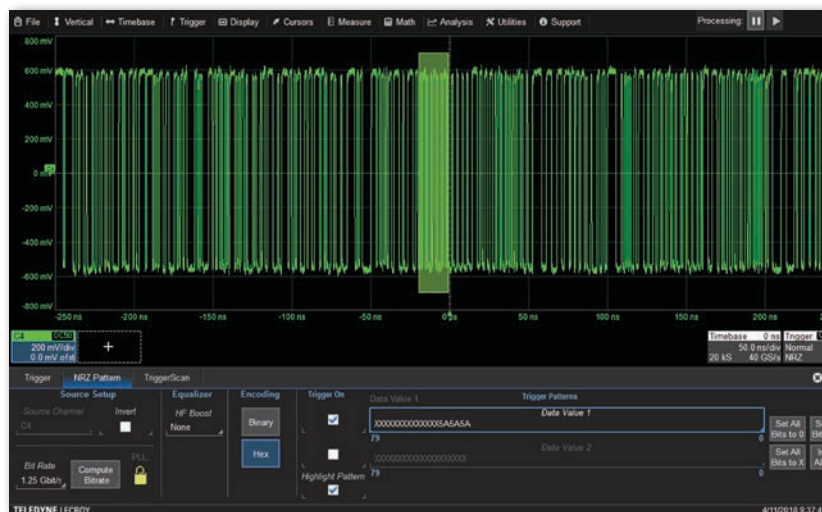
High Speed Serial Triggers
(Oscilloscope Options/Optional Hardware)

- Hardware serial triggers capable of signal speeds up to 3.125 Gb/s, 6.5 Gb/s or 14.1 Gb/s.

- Enable 80-bit serial pattern, 8b/10b or 64b/66b serial triggering (as appropriate for bit rate).

- Include 8b/10b and 64b/66b decoder software.

ProtoSync Software
(PROTOSYNC, PROTOSYNC-BT Options)

- View decoded data through a Protocol Analyzer-style user interface.

- Completely integrated with oscilloscope serial decoders; configure and launch ProtoSync view right from decoder software.

- BitTracer option shows bit-level decoding in ProtoSync view.

- Works with FiberChannel, PCIe, SAS, SATA, USB and UniPro decoders.

Serial Message Analysis Options Availability

T = Trigger, D = Decode, M/ME = Measure/Graph & Eye Diagram (except where noted), P = PHY tests (sold in combinations below)

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
100Base-T1bus TD or TDME	o	o	o	o	o	
6GBIT-80B-Symbol TD (incl. 80-bit NRZ D and 8B10B HW serial TD)			o			
14GBIT-80B-Symbol TD (incl. 80-bit NRZ D and 8B10B/64B66B HW serial TD)					o	o
8B10B D		o		o	o	o
64B66B Symbolic D					o	o

Serial Message Analysis Options Availability

T = Trigger, D = Decode, M/ME = Measure/Graph & Eye Diagram (except where noted), P = PHY tests (sold in combinations below)

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
ARINC429bus D or DME Symbolic (no Trigger)	o	o	o	o	o	o
AudioBus (I2S) D, TD or TDG (Graph only, no Measure or Eye Diagram)	o	o	o	o	o	o[1]
CANbus TD or TDME, with or without Symbolic Decode	o	o	o	o	o	o[1]
CAN FDbus TD or TDME (incl. Standard CAN), with or without Symbolic Decode	o	o	o	o	o	o[1]
Ethernet D	o	o	o	o	o	o
Fibre Channel D			o[2, 3]	o[2, 3]	o[2, 3]	o[3]
FlexRaybus TD or TDMP	o	o	o	o	o	o[1]
I2Cbus TD or TDME	o	o	o	o	o	o[1]
I3Cbus TD or TDME	o	o	o	o		
LINbus TD or TDME	o	o	o	o	o	o[1]
Manchester D	o	o	o	o	o	o
MDIO D	o	o	o	o	o	o
(MIL-STD) 1553 TD or TDME	o	o	o	o	o	o[1]
MIPI DigRF 3Gbus D	o[2]	o[2]	o[2]	o	o	o
MIPI DigRF V4bus D	o[2]	o[2]	o[2]	o	o	o
MIPI D-PHYbus D or DP	o[2]	o[2]	o[2]	o	o	o
MIPI M-PHYbus D or DP			o[2]	o[2]	o[2]	o
MIPI UniProbus D			o[2, 3]	o[2, 3]	o[3]	o[3]
(Packetized) NRZ D	o	o	o	o		
PCIe (1.0 - 5.0) D			o[2, 4]	o[2, 4]	o[2, 4]	o[2, 4]
PMBus TD or TDME	o	o	o	o		
SASbus (1.0 - 3.0) D			o[2, 3]	o[2, 3]	o[2, 3]	o[2]
SATA (Gen1 - Gen3) TD			o[2, 3]	o[1, 2, 3]	o[1, 2, 3]	o[1, 3]
SENTbus TD or TDME	o	o	o	o	o[1]	o[1]
SMBus TD or TDME	o	o	o	o		
SpaceWirebus D	o	o	o	o	o	o
SPIbus TD or TDME	o	o	o	o	o	o[1]
SPMIbus TD or TDME	o	o	o	o	o[1]	o[1]
UART-RS232bus TD or TDME	o	o	o	o	o	o[1]
USB2bus TD or TDME	o	o	o[3]	o[3]	o[3]	o[1, 3]
USB2-HSICbus D	o	o	o[3]	o[3]	o[3]	o[3]
USB3.2bus D (Gen1 & Gen2; incl. USB2bus TD)					o[2, 3]	o[3]
USB-PD TD or TDME	o	o	o	o		
ProtoSync, with or without BitTracer			o	o	o	o

1 Trigger, Measure/Graph & Eye Diagram not offered for this protocol on these models; decode only.
2 Highest speed decoded depends on oscilloscope sample rate and bandwidth.
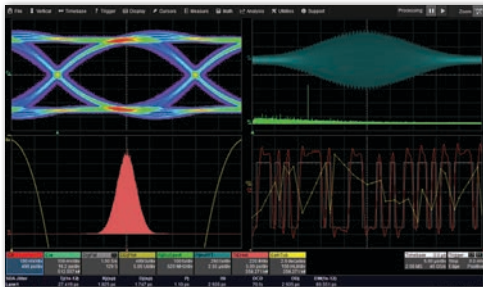3 Supports ProtoSync.
4 Supports ProtoSync through PCIe 4.0.

## SDAIII Serial Data Jitter, Noise and Crosstalk Analysis

SDAIII software options provide fast and complete characterization of serial data systems so you can rapidly isolate the source of problems and understand why serial data fails a compliance test.

Eye Diagram & Jitter Analysis
(SDAIII, SDAIII-COMPLETELINQ Software Options)

- Three dual-Dirac algorithms measure and separate jitter into Rj and Dj, with calculation of Tj. Dj decomposed further.

- Eye diagrams containing all acquired UIs rendered 10-100x faster than competitive systems.

- Eye diagram IsoBER plots, jitter tracks, histograms, bathtub curves and spectrum waveforms.

- Most comprehensive DDj analysis, including ISI behaviors.
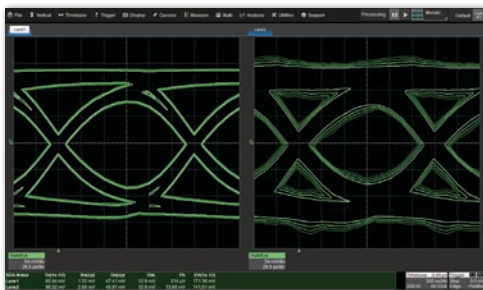
Vertical Noise & CrossTalk Analysis
(SDAIII, SDAIII-COMPLETELINQ Software Options)

- Tools for complete aggressor/victim analysis.

- Three dual-Dirac models measure and separate noise into Rn and Dn, with calculation of Tn. Dn decomposed into ISIn and Pn in real-time.

- View noise as track, histogram or spectrum waveform.

- Crosstalk eye shows probabilistic extent of noise inside/outside the eye.
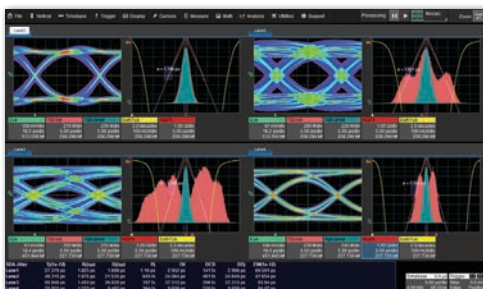
Multi-Lane Analysis
(SDAIII-COMPLETELINQ Software Option)

- Multi-lane jitter and eye diagram analysis of four data lanes plus a stored Reference lane.

- Each "lane" can be a different serial data stream, or a different analysis of data from a single stream.

- Selectable LaneScape™ Comparison modes to simultaneously compare from two to four lanes.

Eye Doctor II and Virtual Probe Integration (SDAIII-COMPLETELINQ Software Option)

The SDAIII-CompleteLinQ framework provides easy access to all features described above, plus integrates Eye Doctor II and Virtual Probe capabilities for TX/RX equalization, fixture/channel de-embedding and emulation.
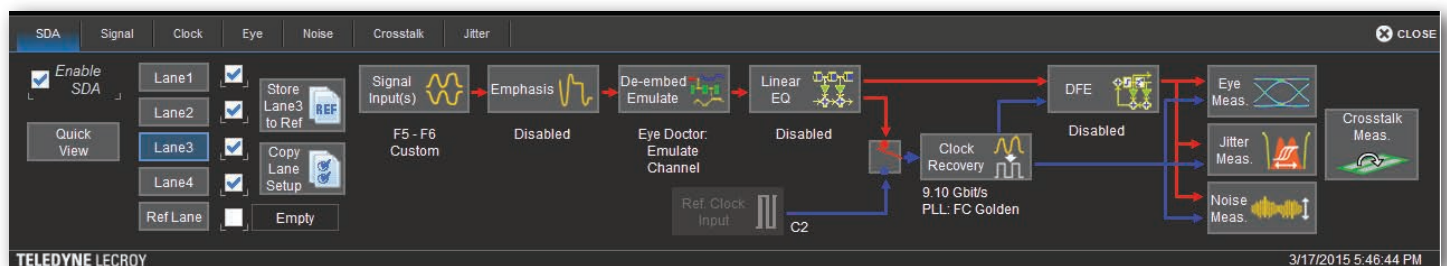
Eye Doctor II
(EYEDRII Software Option)

- De-embed the effects of fixtures, backplanes, etc., from simulated channel models.

- Add transmitter emphasis/de-emphasis to view the effects on channel models.

- Emulate the operation of receiver CTLE, DFE, or FFE equalizers on an acquired signal.

- Integrates with Virtual Probe and SDAIII.

Virtual Probe
(VIRTUALPROBE Software Option)
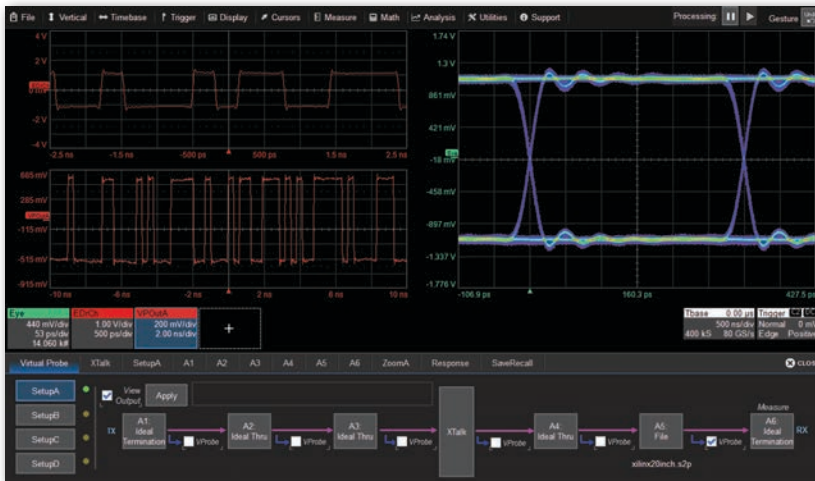
- Configure a multi-block circuit using S-parameters; Virtual Probe displays the signal as it would appear if probed before or after any block.

- Include, add or remove the electrical behavior of a block to reflect and transmit signals; also remove probe loading effects.

- View the eye at the receiver, even if not in reach of a differential probe.

- Use with Eye Doctor II to model CTLE, FFE and DFE equalizers used by your receiver.
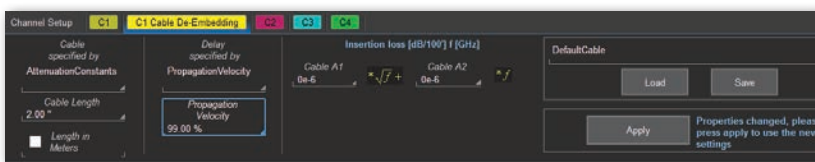
Cable De-embedding
(CBL-DE-EMBED Software Option)

- Remove the effects of propagation delays caused by cable lengths from acquired signals, improving measurement accuracy.

- Specify cable using attenuation constants; build and save table of constants per cable for quick re-loading.

Serial Data Mask Test
(SDM Software Option)

- Create and test eye diagrams using a comprehensive list of standard eye pattern masks or a user-defined mask.

- Removes effects of trigger jitter using a configurable software PLL.

- Mask violations are clearly marked on the display for easy analysis.

- Automatic mask alignment and custom mask adjustments.
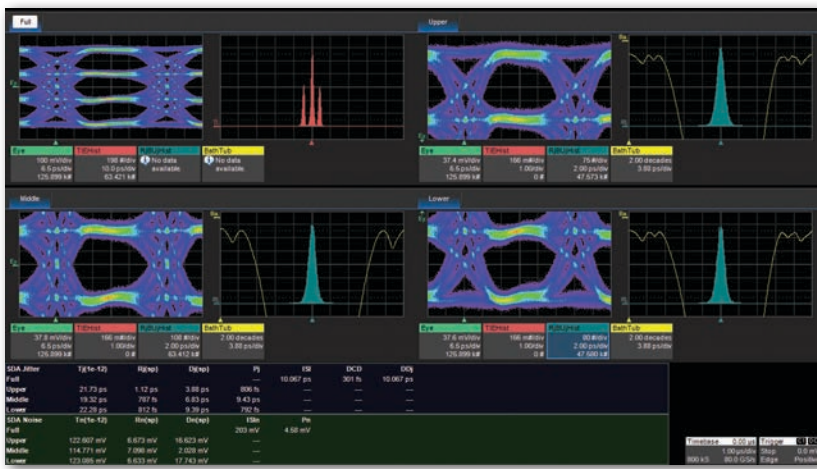
PAM4 Signal Analysis
(PAM4 Software Option)

- PAM4 eye diagramming with Eye Height and Eye Width @BER measurements.

- Separate jitter into Rj and Dj, and noise into Rn and Dn. Calculate Tj and Tn.

- Dj jitter and Dn noise decomposition.

- IsoBER contour plot; jitter and noise tracks, histograms and spectra.

- Integrates with Eye Doctor II for equalization of PAM4 signals.

- Simulate PAM4 waveforms with JitterSim.
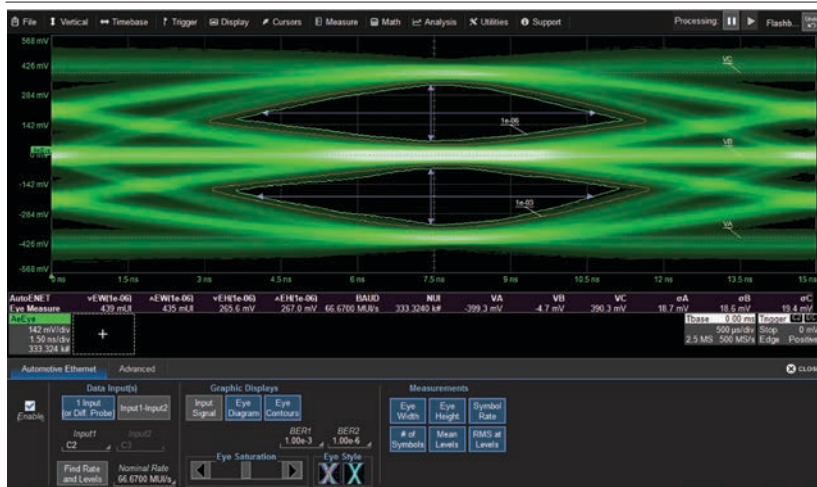
Automotive Ethernet Signal Analysis
(AUTO-ENET-TOOLKIT Software Option)

- Display eye diagram with our without equalization.

- Measure Eye Height, Eye Width, Mean Levels, and RMS Levels.

- BER contours show extrapolated eye at user defined levels.

- Supports 100Base-T1 (BroadR-Reach) and 1000Base-T1.

Serial Data Validation & Debug Options Availability

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
SDAIII Single-lane Eye, Jitter, Noise & Crosstalk Analysis		o	o	o	o[1]	o[1]
SDAIII-CompleteLinQ Multi-lane Eye, Jitter, Noise & Crosstalk Analysis with Integrated Eye Doctor II and Virtual Probe				o	o	o
Eye Doctor II De-embedding, Emulation and Equalization		o	o	o	o	o
Eye Doctor II and Virtual Probe Bundle				o	o	o
Virtual Probe Advanced De-embedding, Emulation and Virtual Probing		o	o	o	o	o
Cable De-embedding		o	o	o	o	o
Serial Data Mask Test	o	o	o	o	o	o
PAM4 Signal Eye, Jitter and Noise Analysis				o	o	o
Automotive Ethernet Signal Analysis		o	o	o	o	o

1 Standard on SDA models.

Clock/Clock-Data Jitter Analysis Toolkit
(JITKIT Software Option)

- Understand the basic system jitter performance of clock signals and clock-data activities.

- Four views of jitter—statistical, time, spectral and overlay.

- Direct display of jitter measurement values—max deviation + or -, worst case, peak-peak and standard deviation.

- Tabular readout of any eight (of more than 25 provided) jitter measurements.
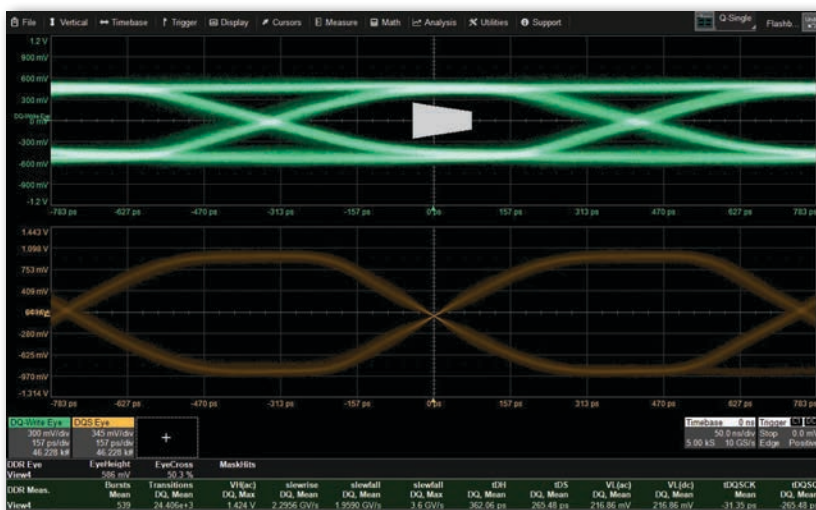
DDR Debug Toolkit
(DDR*-TOOLKIT Software Option)

- Separates Read/Write bursts to display eye diagrams, analyze jitter and calculate DDR-specific measurements.

- Advanced command triggering and searchable bus view when used with the HDA125 to acquire the DDR Command Bus.

- Support for both standard and custom speed grades of DDR2, LPDDR2, DDR3, DDR3L, LPDDR3, DDR4, LPDDR4, DDR5 and LPDDR5.

Clock/Clock-Data Validation & Debug Options Availability

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
JITKIT Clock/Clock-Data Jitter Analysis Software	o	o	o	o	o	o
DDR2 Debug Toolkit (DDR2 and LPDDR2)			o	o	o	o
DDR3 Debug Toolkit (DDR3, DDR3L, DDR2, LPDDR3 and LPDDR2)			o	o	o	o
DDR4 Debug Toolkit (DDR4, DDR3, DDR3L, DDR2, LPDDR3 and LPDDR2)					o	o
DDR5 Debug Toolkit (DDR5, DDR4, DDR3, DDR3L, DDR2, LPDDR5, LPDDR4, LPDDR3 and LPDDR2)					o	o

QualiPHY Serial Data Compliance
(QPHY-* Software Options)

- Automated physical layer compliance testing.

- Generates a comprehensive report of test results, including oscilloscope screen images.

- Demos and diagrams guide you step-by-step through each test, with instructions for connecting all compliance test hardware.

- Compliance test hardware available.

- TX, TX-RX and TX-RX + LEQ capabilities (depending on standard).

BERT Support

Select a few variables, and QualiPHY automates the connection to the Anritsu MP1900A BERT for Receiver and Link Equalization testing.

3rd-Party Software Integration
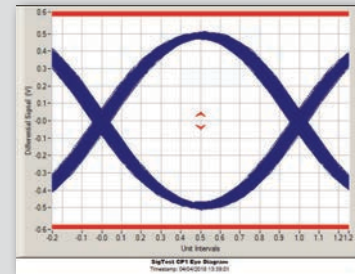
QualiPHY automates the interface with SigTest and other 3rd-party software required by standard.

Serial Data Compliance Test Options Availability

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
QualiPHY 10GBASE-KR					o	o
QualiPHY 10GBASE-T Transmitter and Return Loss					o	o
QualiPHY 10BASE-T1S and 10BASE-T1-TDR	o	o	o	o	o	o
QualiPHY 10BASE-T1L and 10BASE-T1-TDR	o	o	o	o	o	o
QualiPHY 100BASE-T1 (BroadR-Reach) and 100BASE-T1-TDR	o	o	o	o	o	
QualiPHY 1000BASE-T1 and 1000BASE-T1-TDR		o	o	o	o	o
QualiPHY 56G PAM4					o	o
QualiPHY DDR2 and LPDDR2			o	o	o	
QualiPHY DDR3, DDR3L and LPDDR3			o	o	o	o
QualiPHY DDR4 and LPDDR4					o	o
QualiPHY DisplayPort 1.4					o	o
QualiPHY Embedded DisplayPort					o	o
QualiPHY ENET	o	o	o	o	o	
QualiPHY HDMI 2.0					o	o
QualiPHY HDMI 2.1					o	o
QualiPHY MIPI D-PHY			o	o	o	
QualiPHY MIPI M-PHY					o	o
QualiPHY MOST150		o	o	o	o	
QualiPHY MOST50	o	o	o	o	o	
QualiPHY PCIe 1.0 and 2.0 TX				o	o	o
QualiPHY PCIe 1.0 - 3.0 Base TX					o	o
QualiPHY PCIe 1.0 - 3.0 CEM TX, RX, and LEQ					o	o
QualiPHY PCIe 1.0 - 4.0 CEM TX, LEQ, Base TX, Base RX and PLL						o
QualiPHY PCIe 1.0 - 5.0 Base TX and RX						o
QualiPHY SAS2 (1.5, 3.0 and 6.0 Gb/s)					o	o
QualiPHY SAS3 (1.5, 3.0, 6.0 and 12.0 Gb/s)					o	o
QualiPHY SATA (PHY, TSG, RSG and OOB)					o	o
QualiPHY SFI					o	o
QualiPHY USB 1.0, 1.1 and 2.0 TX	o[1]	o	o	o	o	
QualiPHY USB 3.2 TX and RX					o	o
QualiPHY USB4 TX and RX (includes Thunderbolt™ TX and RX)					o	o

1 Supports full and low speed only.

Note: QualiPHY products may require other software options or compliance test hardware. Oscilloscope model minimum bandwidth requirements apply. Consult your Teledyne LeCroy sales representative.

*Cross*Sync™ PHY
(CROSSSYNC-PHY Software Option)

- Simultaneously trigger oscilloscope and PCI Express® protocol analyzer on same high-level event.

- Simultaneously acquire all electrical and protocol behaviors.

- Navigate and analyze synchronous oscilloscope and protocol analyzer acquisitions using integrated CrossSync PHY display.

- Requires *Cross*Sync PHY-compatible equipment; see product datasheet.

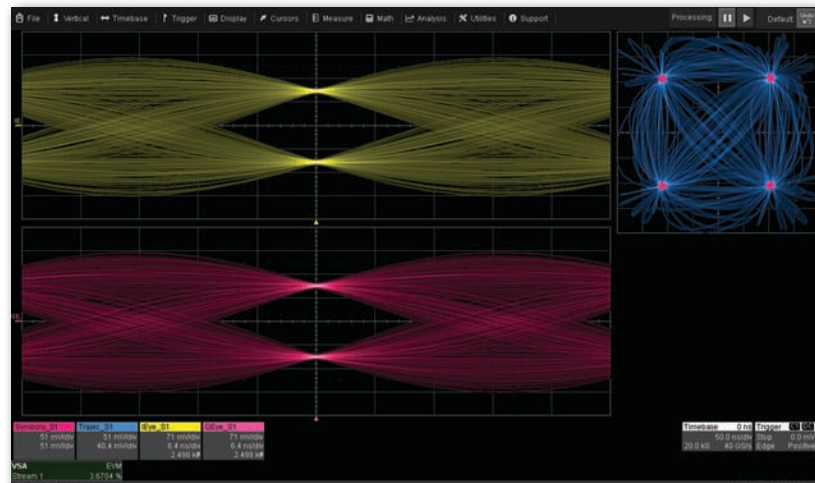## Cross-Layer Analysis Options Availability

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi
*Cross*Sync PHY for PCI Express					o	o

Optical Modulation Analysis
(OPTICAL-LINQ Software Option)

- Software tools and DSP algorithms to characterize optical signals; support for QPSK, 16QAM and 64QAM modulation formats.

- Constellations, trajectories, eye diagrams and tracks of I, Q and phase EVM.

- EVM%, I & Q Bias Error, Quad Error, IQ Skew and Offset measurements.

- True BER analysis using common presets or any custom-defined bit sequence/multiplex.

- Use with any coherent receiver.

Vector Signal Analysis
(VECTORLINQ, VECTORLINQ-ADV Options)

- Demodulation and analysis of eight data streams of RF modulated or direct I-Q inputs.

- Supports PSK, QAM, Circular QAM, ASK, FSK and Custom input signal types.

- Use built-in signal processing blocks or insert custom MATLAB processing blocks anywhere in the chain.

- I-Q constellation plots, eye diagrams, spectral views and comprehensive measurements.

- OFDM visualization and analysis with VectorLinQ Advanced.

Modulation Analysis Options Availability

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi
OpticalLinQ Optical Modulation Analysis Software					o	o
VectorLinQ Vector Signal Analysis Software		o	o	o	o	o
VectorLinQ Advanced Vector Signal Analysis Software					o	o

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.
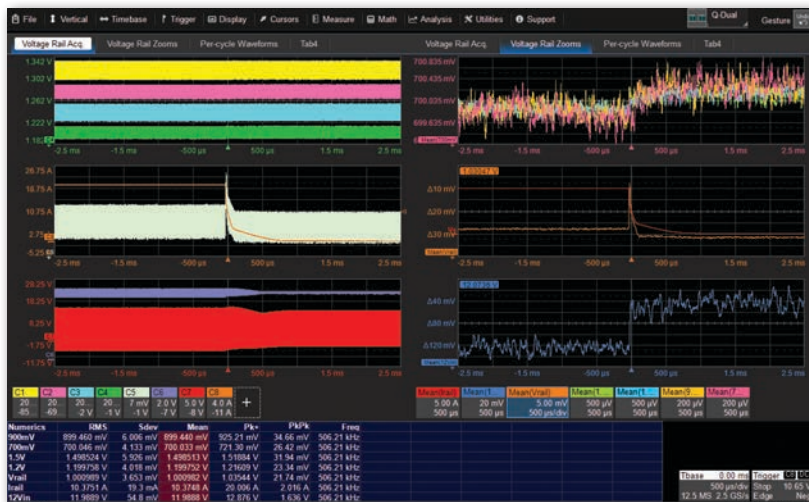
Digital Power Management Analysis
(DIG-PWR-MGMT Software Option)

- Provides complete and fast understanding of power rail behaviors, such as ripple, ringing, droop, noise, settling time, etc.

- Translates DC rail behaviors into easy-to-understand device switching cycle measurements and Waveforms.

- Ideally used with the RP4030 Active Voltage/Power Rail Probes.

3-Phase Power Analysis
(THREEPHASEPOWER Software Option)

- Complete static and dynamic 3-phase electrical power analysis, with results in a convenient Numerics table.

- Correlate high-speed control system behaviors with lower-speed power system behaviors.

- Calculate power during conventional power periods or during device switching cycles.

- Zoom+Gate mode permits fast understanding of complex, dynamic events.

- Standard on MDA 8000HD, with additional motor speed, position and torque sensor interface.

3-Phase Harmonics Option
(THREEPHASEHARMONICS and MDA-HARMONICS Software Options)

- Calculates harmonics on the line-side (fixed frequency) or inverter/drive output (variable frequency) up to a selected harmonic order.

- Displays results in a table with concurrent spectral views.

- Adds THD per-cycle measurement capability to the Numerics table, with per-cycle Waveforms of THD over time.

- Adds "Fundamental + N" and "Range" harmonic filters to the AC Input and Drive Output setups.
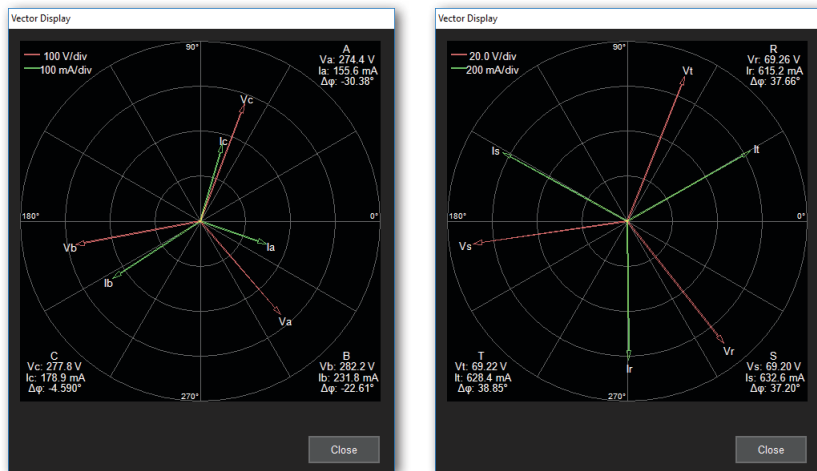
3-Phase Vector Display Option
(THREEPHASEVECTOR Software Option)

- Two, simultaneous vector displays.

- Zoom+Gate to show vector changes during dynamic events.

- Harmonically filter results in vector display.

- Option for Motor Drive Analyzers and 3-phase Power Analysis software.

Power Analysis Options Availability

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
Device and Switch-Mode Power Supply Power Analysis Software	o	o	o	o	o	o
Digital Power Management Analysis Software	o	o		o		
3-Phase Power Analysis Software	o	o[1]		o		
Harmonics Option for 3-Phase Power Analysis Software	o[2]	o[2]		o[2]		
Vector Display Option for 3-Phase Power Analysis Software	o[2]	o[2]		o[2]		
dq0 Transforms Option for Motor Drive Analyzers		o[3]				

1 Standard on MDA 8000HD, optional on WaveRunner 8000HD.

2 Requires prior installation of 3-Phase Power Analysis software.

3 Available for Motor Drive Analyzers only.

Spectrum Analyzer
(SPECTRUM-1 Software Option)

- One Magnitude, Power or Density spectrum integrated with other MAUI displays.

- Logarithmic horizontal and vertical scales.

- Non-linear "sniffer" probe correction factors.

- Peaks and markers tables.

- Persistence and averaging.

- 2D or 3D color spectrograms.
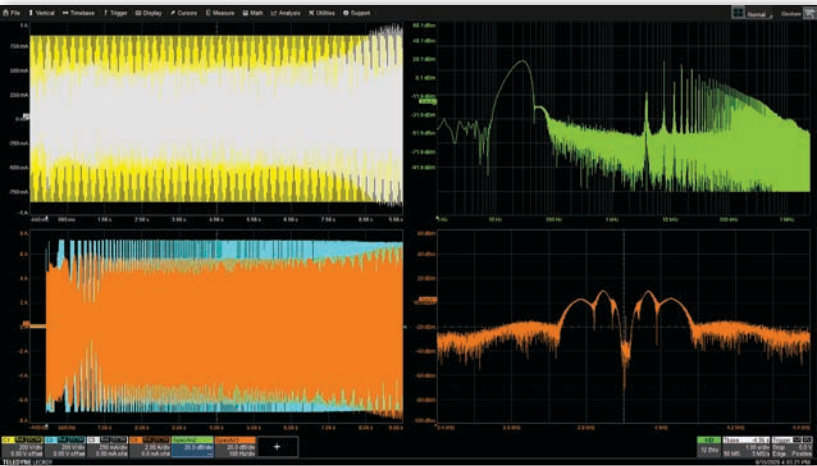
Advanced Spectrum Analyzer
(SPECTRUM-PRO-2R Software Option)

- Two, simultaneous Magnitude, Power or Density spectrums plus third, Reference spectrum integrated with other MAUI displays.

- Logarithmic horizontal and vertical scales.

- Non-linear "sniffer" probe correction factors.

- Spectral mask testing using .csv data masks.

- Background noise removal.

- Peaks and markers tables.

- Persistence and averaging.

- 2D or 3D color spectrograms.

Spectral Analysis Options Availability

|	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
SPECTRUM-1 Spectrum Analyzer Software	o	o	o	o	o	o
SPECTRUM-PRO-2R Spectrum Analyzer Software	o	o	o	o	o	o

Soft Storage Case
(SOFTCASE Accessory)

- Protection with less size/weight than a hard transit case.

- Hard foam-reinforced soft case.

- Thickest foam protective layer.

Soft Carrying Case
(CARRYCASE Accessory)

- Carrying bag designed for easy transport of oscilloscope.

- Collapsible—stores easily.

- Thin, soft foam protective layer.
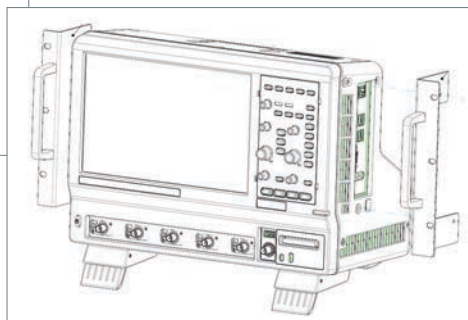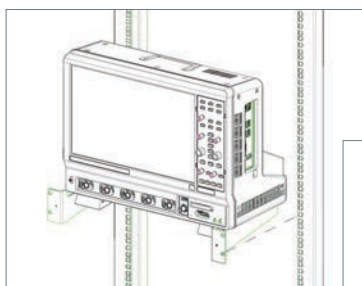
Rackmounts
(RACK, RACKMOUNT Accessories)

- 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 (Note: front cover plate not shown).

- Consult Customer Service for details on which Rackmount is provided for each oscilloscope.

Oscilloscope Cart
(OC1024-A Accessory)

- Supports larger/deeper oscilloscopes while allowing full mobility.

- Integrated strap holds oscilloscope to shelf.

- Ideal for oscilloscopes frequently used with other test equipment, or oscilloscopes shared between labs.

- Compatibility of oscilloscope model to cart is based on cart shelf size and ability of strap to fasten around oscilloscope correctly.

Removable Drives
(Oscilloscope Options and Accessories)

- Removable drives permit safekeeping of data in a secured location.

- Standard on most; some oscilloscopes require a factory-installed upgrade to a removable drive (RSSD option).

- Additional removable drives (RHD-02 and RSSD-02) may be ordered for use with the oscilloscope in different locations.

- Each removable drive is supplied complete with Windows and other files necessary to run the oscilloscope.

Oscilloscope Accessories Availability

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
Soft Storage Case					o	o
Soft Carrying Case	o	o	o	o		
Rackmounts	o	o	o	o	o	o
OC1024-A Oscilloscope Cart (with additional shelf and drawer)			o		o	
Standard Removable Drive with Optional Additional Removable Drives	o	o		o	o	o
Removable Drive Upgrade (RSSD) with 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).

Worry Free (WF)

- 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

	HDO6000B	WaveRunner 8000HD, MDA 8000HD	WaveRunner 9000	WavePro HD	WaveMaster/SDA 8 Zi-B	LabMaster 10 Zi-A
5-Year Annual Traceable Calibration	o	o	o	o	o	o
5-Year Extended Warranty	o	o	o	o	o	o
5-Year Extended Warranty with Annual Traceable Calibration	o	o	o	o	o	o
Worry Free Warranty	o	o	o	o	o	o

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