

# HDO8000

## High Definition Oscilloscopes

### 350 MHz – 1 GHz



### Key Features

- 8 analog channels
- 12-bit ADC resolution, up to 15-bit with enhanced resolution
- 350 MHz, 500 MHz and 1 GHz bandwidths
- Long Memory – up to 250 Mpts/Ch
- 16 Digital Channel MSO option
- Q-Scape™ Multi-tab display architecture
- 12.1" WXGA touch screen display with Ultra HD (UHD) 3840 x 2160 pixel extended-desktop mode
- Wide probe selection for power electronics, embedded electronics, and mechatronics applications
- Advanced analysis and reporting toolsets
- Advanced Triggering supplemented with TriggerScan and Measurement Trigger
- Serial Data Trigger, Decode and Debug Toolkit Options

**HDO8000 High Definition Oscilloscopes have more channels, more resolution, more bandwidth and more memory than any other mid-range oscilloscope. Ideal for debugging and troubleshooting high power three-phase power electronics, automotive electronics, and embedded/mechatronic designs with high resolution sensor signals. Comprehensive digital logic (MSO), low-speed serial data trigger, decode and analysis toolsets, and the widest variety of probes and application packages complete the solution. Get the most intuitive long-memory analysis using the unique Q-Scape multi-tab display architecture.**

### HD4096 Technology

HD4096 high definition technology consists of 12-bit ADCs with (2.5 GS/s) sample rates, high signal-to-noise (55dB) input amplifiers and a low-noise system architecture. This technology enables high definition oscilloscopes to capture and display signals of up to 1 GHz with 16 times more resolution than conventional 8-bit oscilloscopes.

### Long Memory

Capture large amounts of data with more precision using the 250 Mpts of acquisition memory. Zoom in for detail, use Roll Mode for extremely long time periods, or 2.5 GS/s for capturing fast transients and slow events together over longer periods than ever before possible.

### Q-Scape Multi-tab Display Architecture

More waveforms requires new display architectures. Unique Q-Scape multi-tab display architecture speeds your understanding of your design with 4x the display area. Quickly move waveforms to different tabs through drag-and-drop. Extended desktop supports Ultra HD (UHD) 3840 x 2160 pixel displays.

### Comprehensive Analysis Tools

HDO8000 has the most comprehensive trigger, decode, math, measurement, and application toolsets available. Use tracks, trends and histograms to enhance understanding of complex behaviors. LabNotebook concisely documents and stores your results.

**HDO8000 High Definition Oscilloscopes provide more channels, more resolution, more bandwidth and more memory. They are ideal for debugging three-phase power electronics, automotive electronics, and mechatronic systems. Mixed Signal capability allows users to simultaneously analyze 8 Analog inputs and 16 Digital inputs. Serial data Trigger, Decode, and Analysis toolsets aid in debugging embedded systems. The unique Q-Scape multi-tab display makes it easy to work with multiple channels, and the solution is completed by a wide variety of probes and application packages.**

Additionally, complex embedded and mechatronic designs used in automotive and consumer products contain a huge number of analog, digital, power, serial data and sensor signals that makes debug challenging and time-consuming. New instrument paradigms – more channels with higher resolutions at high bandwidths – are needed to meet these expanding and emerging needs.

Teledyne LeCroy has this new instrument – the HDO8000 Series, an 8 channel, 12-bit resolution, 1 GHz mixed-signal oscilloscope with the most comprehensive serial data, probe and application package toolsets. Use the HDO8000 to examine power electronics device or three-phase output signals, high-speed microprocessor signals, or analog, digital or serial data traffic on an embedded control board. Now, you have enough to do it all.





## High-Power, Three-Phase Power Electronics

Variable frequency motor drive designs are increasingly down-deployed in lower cost applications, but with increasing control complexity. Distributed electric power generation

is increasing the demand for inverters and converters to interface these power sources to the grid, and is also driving new power electronics solutions to compensate, regulate and control the power flow from large amounts of distributed generation. With the HDO8000, it is possible to monitor three-phase voltages and currents simultaneously along with the DC bus or other control and sensor signals. Use serial/logic triggers to isolate/correlate control or external events to establish cause and effect. 12-bit resolution provides capability for full power section characterization from device switching and conduction losses to output measurements. 1 GHz bandwidth measures the fast rise times and switching speeds of SiC and GaN devices, and also permits embedded control debug on today's

fastest 32-bit microprocessors. 250 Mpts/ch of memory permits the most comprehensive analysis of mixed low-speed and high-speed events over long periods of time.

## Automotive Electronics, Hybrid/Electric Vehicle Propulsion

Hybrid electric and electric vehicles (HEVs and EVs) use high-power DC-DC converters for two-way conversion of power between propulsion systems and other loads and the high voltage, 48V, and 12V distributed DC buses/batteries.

Automotive electronic control units (ECUs) are tested to some of the most stringent standards – more channels provides more insight faster. 12-bits and 250 Mpts provides the amplitude and time resolution needed for better and more intuitive cause-effect analysis.

Deep digital logic, trigger, decode and analytic toolsets provides an all-in-one characterization tool for the complex, dynamic behavior of the vehicle ECUs.

## Embedded, Mechatronic Systems

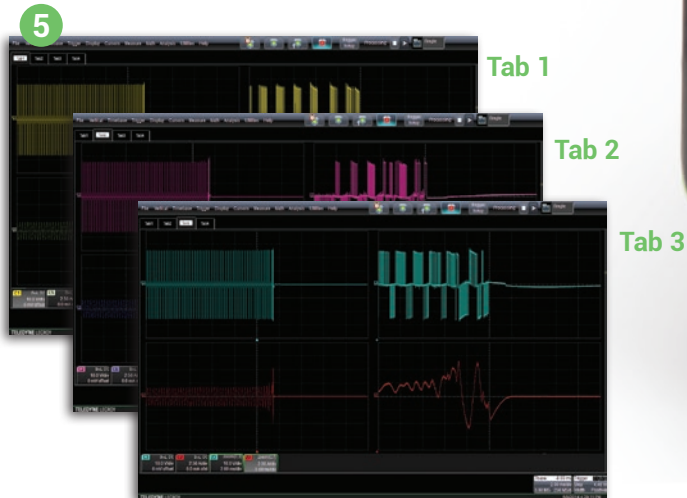
Today's consumer appliances and industrial systems combine complex embedded controls, power electronics, and sensors to achieve the highest efficiency and provide important benefits. Time-to-market, cost and quality pressures place exceptional demands on new product test, debug and troubleshooting. HDO8000 capabilities provide more insight faster.



# HDO8000 - 8 CHANNEL, 12-BIT HIGH DEFINITION

**HDO8000 High Definition Oscilloscopes provide the right capabilities for debug and troubleshooting of high power three-phase power electronics, automotive electronics, and challenging embedded or mechatronic designs.**

1. 8 analog input channels
2. 12-bit HDO4096 technology - 16x closer to perfect
3. Up to 1 GHz - enough bandwidth for today and tomorrow
4. 12.1" Widescreen (16 x 9) WXGA color touch screen display - Ultra HD (UHD) (3840 x 2160) extended-desktop display.
5. Q-Scape multi-tab display architecture - 4x the display area
6. Intel® Core™ i5-4570S Quad-core 2.9 GHz (per-core) CPU with up to 32 GB of RAM
7. ProBus probe interface supports every Teledyne LeCroy probe possible
8. Supports eight simultaneous current probes
9. Mixed Signal Capability - integrated 16 channel digital logic





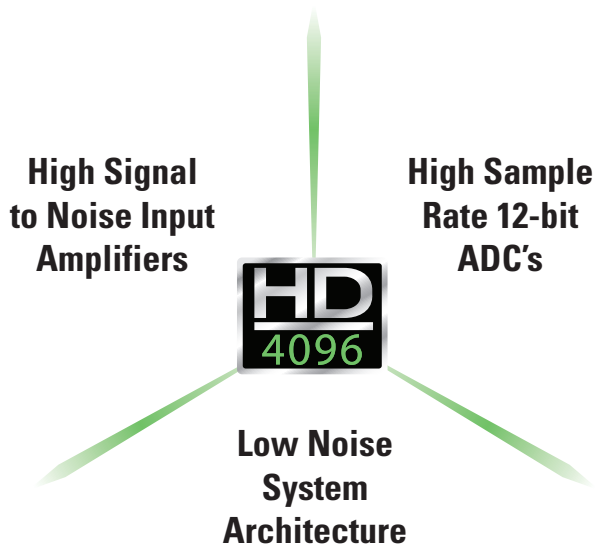


10. Built-in stylus to use with the most advanced user interface
11. "Push" Knobs – shortcuts to common actions such as Set to Variable, Find Trigger Level, Zero Offset, and Zero Delay
12. Waveform Control Knobs – Control channel, zoom, math and memory traces with the multiplexed vertical and horizontal knobs
13. Dedicated Cursor Knob – Select type of cursor, position them on your signal, and read values without ever opening a menu
14. Dedicated buttons to quickly access popular debug and documentation tools and Q-Scape displays
15. Auxiliary Output and Reference Clock Input/ Output connectors for connecting to other equipment
16. Local language user interface – Select from 10 language preferences. Add a front panel overlay with your local language

### Document and Share:

- Quickly save all files with LabNotebook
- Create custom reports with LabNotebook
- Save to internal hard disk or network drive
- Print to a USB printer
- Save to USB memory stick
- Connect with LAN or GPIB
- View data on a PC with free WaveStudio utility

# HD4096 TECHNOLOGY - 16X CLOSER TO PERFECT

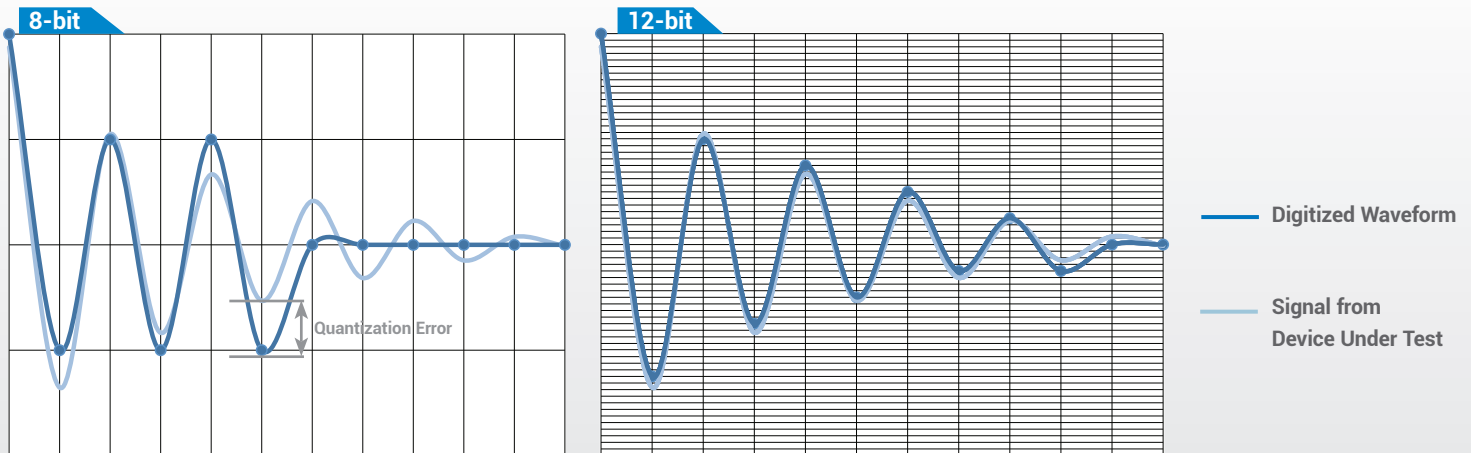


Teledyne LeCroy HDO high definition oscilloscopes use unique HD4096 technology to provide superior and uncompromised measurement performance:

- 12-bit ADCs with high (2.5 GS/s) sample rates
- High signal-to-noise amplifiers (55 dB)
- Low noise system architecture (to 1 GHz)

Oscilloscopes with HD4096 technology have higher resolution than conventional 8-bit oscilloscopes (4096 vs. 256 vertical levels) and low noise for uncompromised measurement performance. The 2.5 GS/s, 12-bit ADCs support capture of fast signals and oscilloscope bandwidth ratings up to 1 GHz. The high performance input amplifiers deliver pristine signal fidelity with a 55 dB signal-to-noise ratio. The low-noise system architecture provides an ideal signal path to ensure that signal details are delivered accurately to the oscilloscope display – 16x closer to perfect.

## 16x Closer to Perfect



### 16x More Resolution

HD4096 technology provides 12-bits of vertical resolution with 16x more resolution compared to conventional 8-bit oscilloscopes. The 4096 discrete vertical levels reduce the quantization error compared to 256 vertical levels. This improves the accuracy and precision of the signal capture and increases measurement confidence.

# EXPERIENCE THE DIFFERENCE



Experience HD4096 accuracy, detail, and precision and never use an 8-bit oscilloscope again. Whether the application is general-purpose design and debug, high-precision analog, power electronics, automotive electronics, mechatronics, or other specialized applications, the HD4096 technology provides unsurpassed confidence and measurement capabilities.

## Clean, Crisp Waveforms

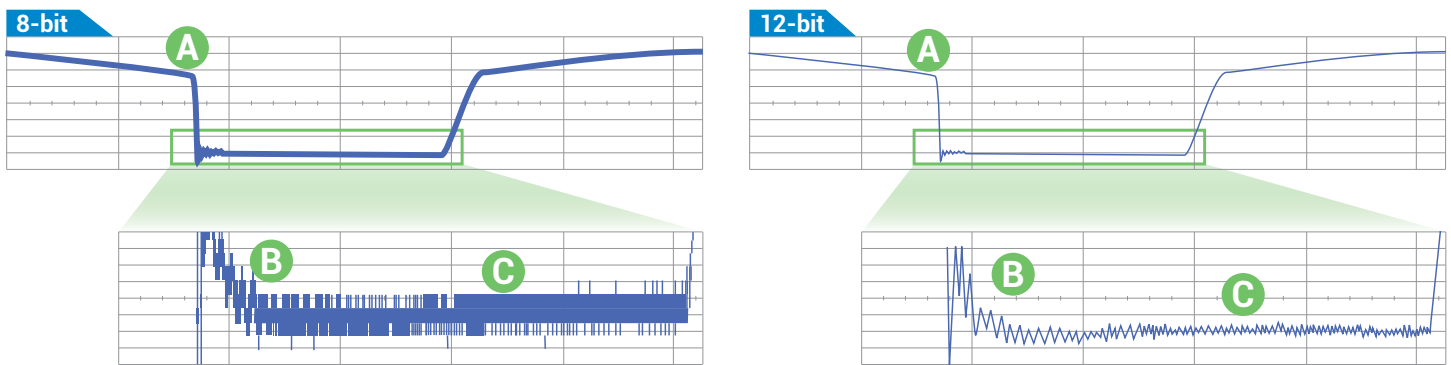
When compared to waveforms acquired and displayed using conventional 8-bit oscilloscopes, waveforms captured with HD4096 12-bit technology are dramatically crisper and cleaner, and are displayed more accurately. Once you see a waveform acquired with HD4096 technology, you will not want to go back to using a conventional 8-bit oscilloscope.

## More Signal Details

16x more resolution provides more signal detail. This is especially helpful for wide dynamic range signals in which a full-scale signal must be acquired while at the same time very small amplitude signal details must be analyzed. 12-bit acquisitions combined with the oscilloscope's vertical and horizontal zoom can be used to obtain unparalleled insight to system behaviors and problems.

## Unmatched Measurement Precision

HD4096 technology delivers measurement precision several times better than conventional 8-bit oscilloscopes. Higher oscilloscope measurement precision provides better ability to assess corner cases and design margins, perform root cause analysis, and create the best possible solution for any discovered design issue.



- A Clean, Crisp Waveforms** | Thin traces show the actual waveform with minimal noise interference
- B More Signal Details** | Waveform details lost on an 8-bit oscilloscope can now be clearly seen
- C Unmatched Measurement Precision** | Measurements are more precise and not affected by quantization noise

Teledyne LeCroy's HDO8000 mixed signal oscilloscope option combines the high definition analog channels of the HDO8000 with the flexibility of 16 digital inputs. In addition, the many triggering and decoding options available with the mixed signal option turn the HDO8000 into an all-in-one analog, digital, and serial data debug machine.

## High-performance 16-Channel Mixed Signal Capability

With embedded systems growing more complex, powerful mixed signal debug capabilities are an essential part of modern oscilloscopes. The 16 integrated digital channels and set of tools designed to view, measure and analyze analog and digital signals enable fast debugging of mixed signal designs.

## Extensive Triggering

Flexible analog and digital cross-pattern triggering across all 20 channels provides the ability to quickly identify and isolate problems in an embedded system. Event triggering can be configured to arm on an analog signal and trigger on a digital pattern.

## Advanced Digital Debug Tools

Using the powerful parallel pattern search capability of WaveScan, patterns across many digital lines can be isolated and analyzed. Identified patterns are presented in a table with timestamp information and enables quick searching for each pattern occurrence.

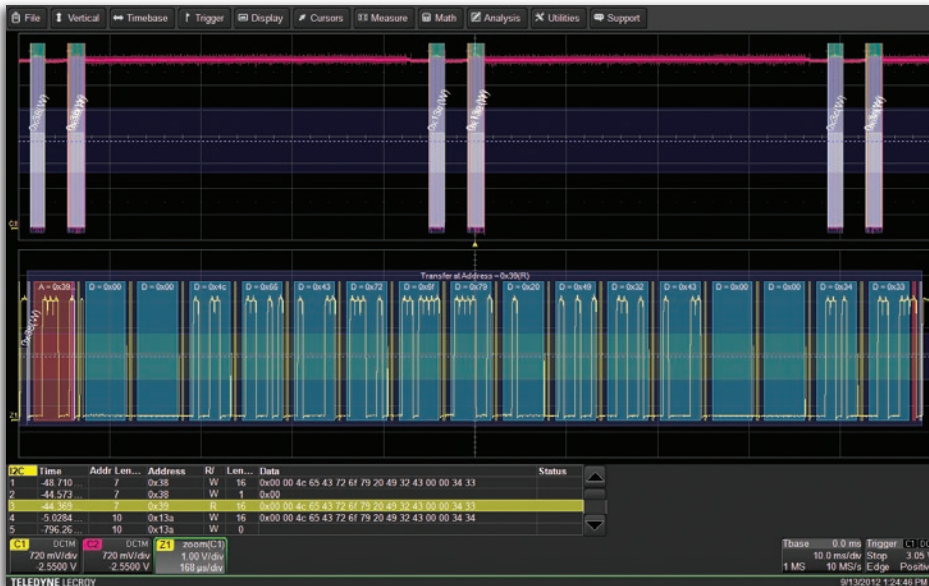
Use a variety of the many timing parameters to measure and analyze the characteristics of digital busses. Powerful tools like tracks, trends, statistics and histicons provide additional insight and help find anomalies.

Quickly see the state of all the digital lines at the same time using convenient activity indicators.

Simulate complete digital designs using logic gate emulation. When used with the web editor, many logic gates can be combined together in one math function to simulate complex logic designs. Choose from AND, OR, NAND, NOR, XOR, NOT and D Flip Flop gates.







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

## Supported Serial Data Protocols

- I<sup>2</sup>C, SPI, UART
- CAN, LIN, FlexRay™, SENT
- Ethernet 10/100BaseT, USB 1.0/1.1/2.0, USB 2.0-HSIC
- Audio (I<sup>2</sup>S, LJ, RJ, TDM)
- MIL-STD-1553, ARINC 429
- MIPI D-PHY, DigRF 3G, DigRFv4
- Manchester, NRZ

**Debugging serial data busses can be confusing and time consuming. The serial data and decode options for HDO8000 provide time saving tools for serial bus debug and validation.**

### Trigger and Decode

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

Protocol decoding is shown directly on the waveform with an intuitive, color-coded overlay and presented in binary, hex or ASCII. Decoding on the HDO8000 is fast even with long memory and zooming in to the waveform shows precise byte by byte decoding.

### Table and Search

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

Serial data messages can be quickly located by searching on address, data and other attributes specific to a particular protocol. Once found, the specific location containing the specified search criteria can be automatically zoomed to.

### PROTObus MAG Serial Debug Toolkit

PROTObus MAG Serial Data Debug Toolkit extends the trigger and decode functions of serial data through integration of measurement parameters with waveform math. Nine additional measurements quickly sets up and displays encoded data as an analog waveform. Define specific data frame filters and data field triggers to confirm performance of embedded nodes.



## Advanced Waveform Capture with Sequence Mode

Use Sequence mode to store up to 65,000 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.

## WaveScan Advanced Search

**WaveScan provides powerful isolation capabilities that hardware triggers can’t provide. WaveScan allows searching analog, digital or parallel bus signal in a single acquisition using more than 20 different criteria. Or, set up a scan condition and scan for an event over hours or even days.**

Since the scanning “modes” are not simply copies of the hardware triggers, the utility and capability is much higher. For instance, there is no “frequency” trigger in any oscilloscope, yet WaveScan allows for “frequency” to be quickly “scanned.” This allows the user to accumulate a data set of unusual events that are separated by hours or days, enabling faster debugging. When used in multiple acquisitions, WaveScan builds on the traditional Teledyne LeCroy strength of fast processing of data. Quickly scan millions of events looking for unusual

occurrences, and do it much faster and more efficiently than other oscilloscopes can. Found events can be overlaid with the ScanOverlay to provide a quick comparison of events; measurement based scans populate the ScanHistogram to show the statistical distribution of the events. Using the powerful parallel pattern search capability of WaveScan, patterns across many digital lines can be isolated and analyzed. Identified patterns are presented in a table with timestamp information and enables quick searching for each pattern occurrence.

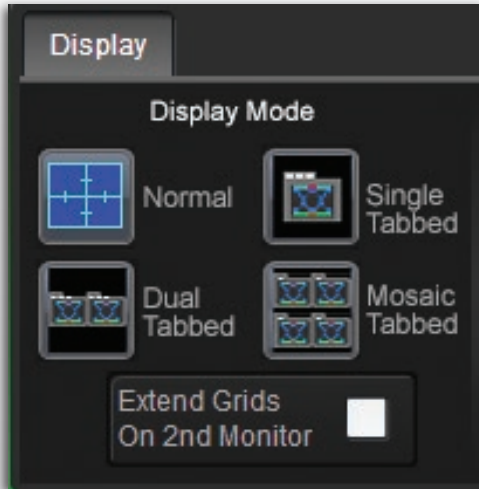
## Advanced Math and Measure

With many math functions and measurement parameters available, the HDO8000 can measure and analyze every aspect of analog and digital waveforms. By utilizing HD4096 technology, the HDO8000 measures 16 times more precisely than traditional 8-bit architectures. Beyond just measuring waveforms, the HDO8000 provides statistics, histograms, tracks and trends to show how waveforms change over time.



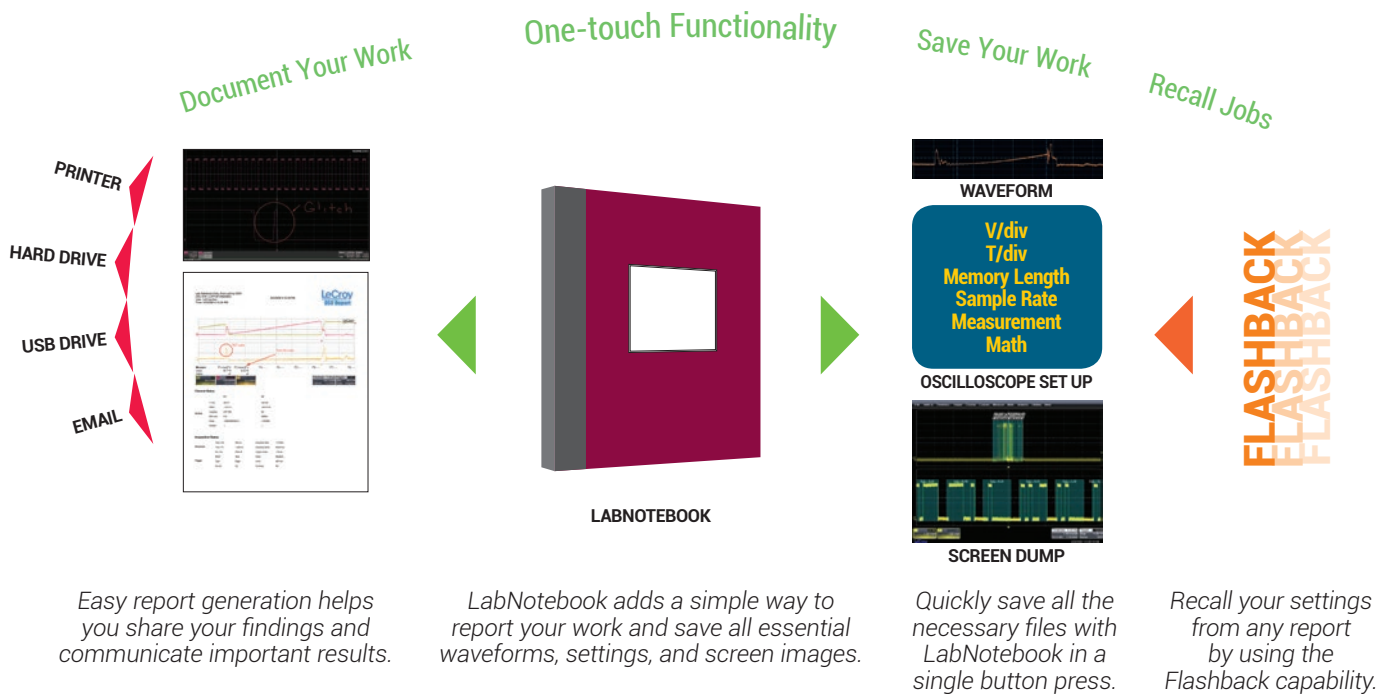
## Q-Scape Multi-Tab Display Architecture

Q-Scape tabbed displays maximize the display area and provide faster insight. Acquired or calculated waveforms can be located on any of four different “tabbed” oscilloscope grid displays, with individually selectable grid styles available for each tab. Q-Scape is ideal for three-phase analysis with many analog and digital acquired and calculated waveforms.



## LabNotebook

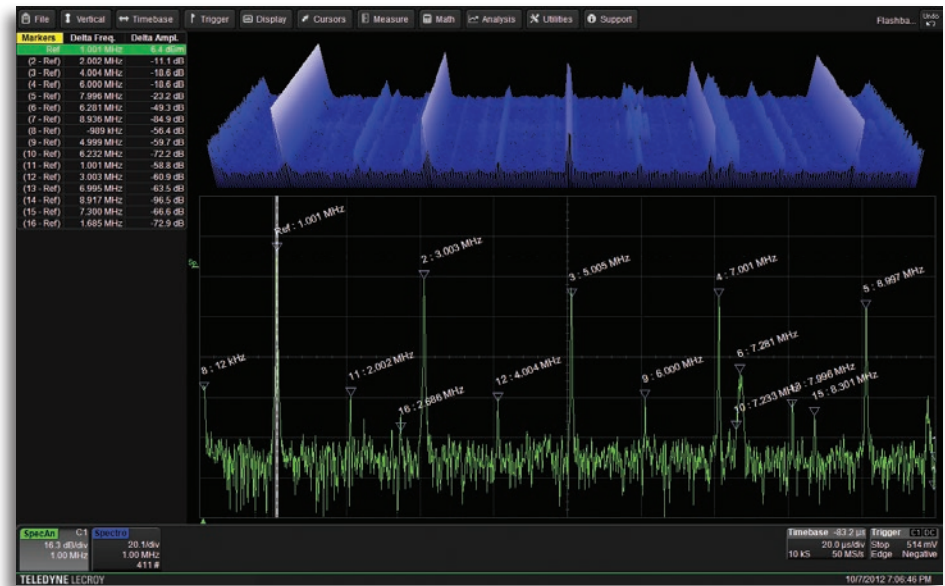
The LabNotebook feature of HD08000 provides a report generation tool to save and document all your work. Saving all displayed waveforms, relevant settings, and screen images is all done through LabNotebook, eliminating the need to navigate multiple menus to save all these files independently.





## Key Features

- Spectrum analyzer style controls for the oscilloscope
- Select from six vertical scales
- Automatically identify frequency peaks
- Display up to 20 markers, with interactive table readout of frequencies and levels
- Easily make measurements with reference and delta markers
- Automatically identify and mark fundamental frequency and harmonics
- Spectrogram shows how spectra changes over time in 2D or 3D views



## Simplify Analysis of FFT Power Spectrum

Get better insight to the frequency content of any signal with use of the Spectrum Analyzer mode on the HDO8000. This mode provides a spectrum analyzer style user interface with controls for start/stop frequency or center frequency and span. The resolution bandwidth is automatically set for best analysis or can be manually selected. Vertical Scale can be selected as dBm, dBV, dBmV, dBuV, Vrms or Arms for proper viewing and analysis while 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 quickly analyze frequency content by making measurements between reference and delta markers. To monitor how the spectrum changes over time, view the spectrogram which can display a 2D or 3D history of the frequency content.



*Spectrum analyzer style controls simplify waveform analysis in the frequency domain.*



## Key Features

- Automatic switching device measurements
- Color coded overlay to identify power losses
- Control loop and time domain response analysis
- Line power and harmonics tests to IEC 61000-3-2
- Total harmonic distortion table shows frequency contribution
- B-H Curve shows magnetic device saturation

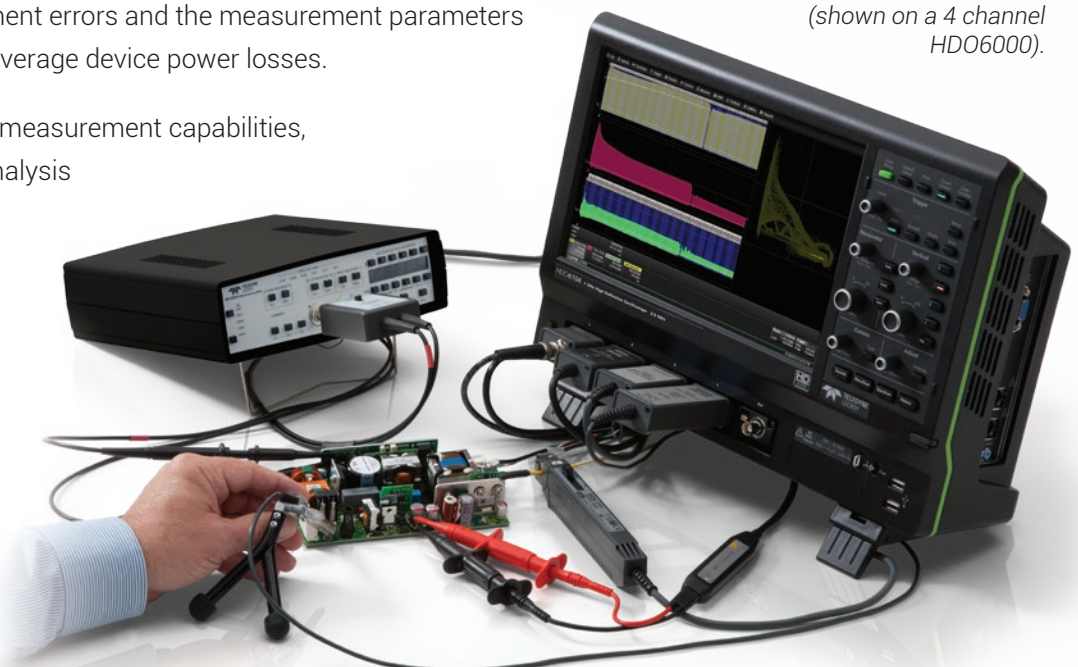
## Power Analysis Automates Switching Device Loss Measurements

Quickly measure and analyze the operating characteristics of power conversion devices and single-phase circuits with the Power Analysis 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 Analysis 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 Analysis 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 EN61000-3-2.

*Teledyne LeCroy has a variety of probes and probing accessories such as high common mode rejection ratio (CMRR) differential amplifiers, differential probes, current probes, and deskew fixtures (shown on a 4 channel HDO6000).*



The right probe is an essential tool for accurate signal capture and Teledyne LeCroy offers an extensive range of probes to meet virtually every probing need.

### ZS Series High Impedance Active Probes

ZS2500, ZS1500, ZS1000,  
ZS2500-QUADPAK,  
ZS1500-QUADPAK,  
ZS1000-QUADPAK



The ZS Series probes provide high impedance and an extensive set of probe tips and ground accessories to handle a wide range of probing scenarios. The high 1 M $\Omega$  input resistance and low 0.9 pF input capacitance mean this probe is ideal for all frequencies. The ZS Series probes provide full system bandwidth for all Teledyne LeCroy oscilloscopes having bandwidths of 1 GHz and lower.

### Differential Probes (200 MHz – 1.5 GHz)

ZD1500, ZD1000, ZD500,  
ZD200



High bandwidth, excellent common-mode rejection ratio (CMRR) and low noise make these active differential probes ideal for applications such as automotive development (e.g. FlexRay) and failure analysis, as well as wireless and data communication design. The ProBus interface allows sensitivity, offset and common-mode range to be displayed on the oscilloscope screen.

### High Voltage Differential Probes

HVD3102, HVD3106, AP031



HVD Series high voltage differential probes permit measurements on power electronics circuits with floating voltages without reference to the ground, allowing the oscilloscope to be safely grounded. Excellent CMRR is provided at high frequencies and is combined with low inherent noise, high offset voltage capabilities, and high DC gain accuracy to make them an ideal choice for probing high voltage and floating control signals in single and three-phase power electronics designs.

### High Voltage Passive Probes

PPE1.2KV, PPE2KV,  
PPE4KV, PPE5KV, PPE6KV



The PPE Series includes five fixed-attenuation probes covering a range from 2 kV to 20 kV, and one switchable probe providing  $\div 10/\div 100$  attenuation for voltage inputs up to 1.2 kV. All fixed-attenuation, standard probes automatically rescale compatible Teledyne LeCroy oscilloscopes for the appropriate attenuation of the probe.

### Current Probes

CP031, CP030, AP015,  
CP150, CP500, DCS015



Available current probes reach bandwidths of 100 MHz, peak currents of 700 A and sensitivities of 10 mA/div. Use multiple current probes to make measurements on three-phase systems or a single current probe with a voltage probe to make instantaneous power measurements. Teledyne LeCroy current probes enable the design and testing of switching power supplies, motor drives, electric vehicles, and uninterruptible power supplies.



## HDO8038

## HDO8058

## HDO8108

### Analog - Vertical

	HDO8038	HDO8058	HDO8108
Bandwidth @ 50 $\Omega$ (-3 dB)	350 MHz	500 MHz	1 GHz
Rise Time (10–90%, 50 $\Omega$ )	1 ns (typical)	700 ps (typical)	450 ps (typical)
Input Channels	8		
Vertical Resolution	12-bits; up to 15-bits with enhanced resolution (ERES)		
Sensitivity	50 $\Omega$ : 1 mV/div–1 V/div, fully variable 1 M $\Omega$ : 1 mV/div–10 V/div, fully variable		
DC Gain Accuracy	$\pm(0.5\%)$ F.S, offset at 0 V		
Bandwidth Limiters	20 MHz, 200 MHz		
Maximum Input Voltage	50 $\Omega$ : 5 Vrms, 1 M $\Omega$ : 400 V max (DC + Peak AC $\leq$ 10 KHz)		
Input Coupling	50 $\Omega$ : DC, GND; 1 M $\Omega$ : AC, DC, GND;		
Input Impedance	50 $\Omega$ $\pm$ 2.0%; 1 M $\Omega$ $\pm$ 2.0%    16 pF,		
Offset Range	50 $\Omega$ : 1 mV - 4.95 mV: $\pm$ 1.6 V, 5 mV - 9.9 mV: $\pm$ 4 V, 10 mV - 19.8 mV: $\pm$ 8 V, 20 mV - 1 V: $\pm$ 10 V 1 M $\Omega$ : 1 mV - 4.95 mV: $\pm$ 1.6 V, 5 mV - 9.9 mV: $\pm$ 4 V, 10 mV - 19.8 mV: $\pm$ 8 V, 20 mV - 100 mV: $\pm$ 16 V, 102 mV - 198 mV: $\pm$ 80V, 200 mV - 1 V: $\pm$ 160 V, 1.02 V - 10 V: $\pm$ 400 V		
Offset Accuracy	$\pm(1.0\%$ of offset value + 0.5%FS + 0.02% of max offset + 1mV)		

### Analog - Acquisition

Sample Rate (Single-shot)	2.5 GS/s on all 8 input channels
Sample Rate (Repetitive)	125 GS/s, user selectable for repetitive signals (20 ps/div to 10 ns/div)
Record Length	Standard: 50 Mpts/ch (all channels) Option - L: 100 Mpts/ch (all channels) Option -XL: 250 Mpts/ch (all channels)
Acquisition Modes	Real-time, Roll, RIS (Random Interleaved Sampling), Sequence (Segmented Memory up to 30,000 segments, 60,000 segments -L Option, 65,000 -XL option) with 1us intersegment dead-time
Timebase Range	20 ps/div - 5 ks/div with standard memory (up to 10 ks/div with -L memory, 25 ks/div with -XL memory); RIS available at $\leq$ 10 ns/div; Roll Mode available at $\geq$ 100 ms/div and $\leq$ 5 MS/s
Timebase Accuracy	$\pm$ 2.5 ppm for 5 to 40C + 1.0ppm/year from calibration
Channel-Channel Deskew Range	$\pm$ 9 x time/div. setting, 100 ms max., each channel
External Timebase Reference (Input)	10 MHz $\pm$ 25 ppm at 0 to 10 dBm into 50 $\Omega$
External Timebase Reference (Output)	10 MHz 2.0 dBm $\pm$ 1.5 dBm, sinewave synchronous to scope timebase
External Clock	DC to 100 MHz; (50 $\Omega$ /1 M $\Omega$ ), Ext. BNC input, for acquisition of channels 1-4 (channels 5-8 disabled). Minimum rise time and amplitude requirements apply at low frequencies

### Analog - Acquisition Processing

Averaging	Summed averaging to 1 million sweeps; continuous averaging to 1 million sweeps
Enhanced Resolution (ERES)	From 12.5- to 15-bits vertical resolution
Envelope (Extrema)	Envelope, floor, or roof for up to 1 million sweeps
Interpolation	Linear or Sin x/x

### Digital - Vertical and Acquisition (with HDO8k-MS option only)

Input Channels	16 Digital Channels
Threshold Groupings	Pod 2: D15 - D8, Pod 1: D7 - D0
Threshold Selections	TTL, ECL, CMOS (2.5 V, 3.3 V, 5 V), PECL, LVDS or User Defined
Maximum Input Voltage	$\pm$ 30V Peak
Threshold Accuracy	$\pm(3\%$ of threshold setting + 100mV)
Input Dynamic Range	$\pm$ 20V
Minimum Input Voltage Swing	400mV
Input Impedance (Flying Leads)	100 k $\Omega$    5 pF
Maximum Input Frequency	250 MHz
Sample Rate	1.25 GS/s
Record Length	Standard: 50 MS - 16 Channels Optional -L: 100 MS - 16 Channels Optional -XL: 125 MS - 16 Channels
Minimum Detectable Pulse Width	2 ns
Channel-to-Channel Skew	350 ps
User Defined Threshold Range	$\pm$ 10 V in 20 mV steps
User Defined Hysteresis Range	100 mV to 1.4 V in 100 mV steps

## HDO8038

## HDO8058

## HDO8108

### Triggering System

Modes	Auto, Normal, Single, Stop		
Sources	Any input channel, External, Ext/10, or line; slope and level unique to each source (except for line trigger)		
Coupling	DC, AC, HFRej, LFRej		
Pre-trigger Delay	0-100% of memory size		
Post-trigger Delay	0-10,000 Divisions in real time mode, limited at slower time/div settings or in roll mode		
Hold-off	From 2 ns up to 20 s or from 1 to 99,999,999 events		
Internal Trigger Level Range	±4.1 div from center (typical)		
External Trigger Input Range	Ext: ±400 mV, Ext/10: ±4 V		
Maximum Trigger Rate	1M Triggers/sec (in Sequence Mode, up to 8 channels)		
Trigger Sensitivity with Edge Trigger (Ch 1-8)	0.9 division: 10 MHz 1.0 divisions: 200 MHz 2.0 divisions: 350 MHz	0.9 division: 10 MHz 1.0 divisions: 200 MHz 1.5 divisions: 250 MHz 2.0 divisions: 500 MHz	0.9 division: 10 MHz 1.0 divisions: 200 MHz 1.5 divisions: 500 MHz 2.0 divisions: 1 GHz
External Trigger Sensitivity, (Edge Trigger)	0.9 division: 10 MHz 1.0 divisions: 200 MHz 2.0 divisions: 350 MHz	0.9 division: 10 MHz 1.0 divisions: 200 MHz 1.5 divisions: 250 MHz 2.0 divisions: 500 MHz	0.9 division: 10 MHz 1.0 divisions: 200 MHz 1.5 divisions: 500 MHz 2.0 divisions: 1 GHz
Max. Trigger Frequency, (C1-C8, Ext In, Smart Trigger)	350 MHz	500 MHz	1 GHz
Trigger and Interpolator Jitter	≤ 3.5 ps rms (typical) <0.1 ps rms (typical, software assisted)		

### Trigger Types

Edge	Triggers when signal meets slope (positive, negative, or either) and level condition
Width (Signal or Pattern)	Triggers on positive or negative glitches with selectable widths. Minimum width as low as 1.5ns (depending on oscilloscope bandwidth); Maximum width: 20 s
Pattern	Logic combination (AND, NAND, OR, NOR) of 9 inputs (8 channels 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
Measurement Trigger	Select from a large number of measurement parameters. Trigger on measurement with qualified limits.
TV-Composite Video	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)
<b>Smart Triggers</b>	
Window	Triggers when signal exits a window defined by adjustable thresholds
Interval (Signal or Pattern)	Triggers on intervals selectable between 1 ns and 20 s
Glitch	Triggers on positive or negative glitches with widths selectable as low as 1.5ns (depending on oscilloscope bandwidth) to 20 s, or on intermittent faults
Dropout	Triggers if signal drops out for longer than selected time between 1 ns and 20 s
Runt	Trigger on positive or negative runts defined by two voltage limits and two time limits. Select between 1 ns and 20 ns
Slew Rate	Trigger on edge rates. Select limits for dV, dt, and slope. Select edge limits between 1 ns and 20 ns
<b>Multi-Stage Triggers</b>	
Qualified First	In Sequence acquisition mode, triggers repeatably on event B only if a defined pattern, state, or edge (event A) is satisfied in the first segment of the acquisition. Holdoff between sources is selectable by time or events. (Note: event B pattern trigger cannot include analog channels).
Qualified	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. (Note: event B pattern trigger cannot include analog channels).
TriggerScan	A Trigger Trainer analyzes the waveforms, identifies normal behavior, and then sets up a large set of rare event smart trigger setups that target abnormal behavior. The trainer 'learns' trigger setups based on slew rates, periods, amplitudes outside of a range and then applies them sequentially.
Triggers with Exclusion Technology	Glitch, Width, Interval, Runt, Slew Rate - Trigger on intermittent faults by specifying the expected behavior and triggering when that condition is not met

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### Measurement Tools

Measurement Functionality	Display any 12 parameters together with statistics, including their average, high, low, and standard deviations. Histograms provide a fast, dynamic view of parameters and wave shape characteristics. Parameter Math allows addition, subtraction, multiplication, or division of two different parameters. Parameter gates define the location on the source waveform. Each occurrence of each parameter is measured and added to the statistics table.
Measurement Parameters	Amplitude, Area, Base (Low), Cycles, Data, Delay, Delta Delay, Duty Cycle, Duration, Fall time (90–10%, 80–20%, @ level), Frequency, First, Last, Level @ x, Maximum, Mean, Median, Minimum, Narrow band phase, Narrow band power, Number of points, + Overshoot, – Overshoot, Peak-to-peak, Period, Risetime (10–90%, 20–80%, @ level), RMS, Std. deviation, Top, Width, Median, Phase, Time @ minimum (min.), Time @ maximum (max.), Delta time @ level, Delta time @ level from trigger, X @ max., X @ min., Cycle-Cycle Jitter, N-Cycle, N-Cycle with start selection, Frequency @ level, Period @ level, Half Period, Width @ level, Time Interval Error @ level, Setup, Hold, Skew, Duty Cycle @ level, Duty Cycle Error, Edge @ lv (counts edges)

### Math Tools

Math Functionality	Display up to 12 math function traces (F1–F12). 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.
Math Operators	Absolute value, Average (summed), Average (continuous), Correlation (two waveforms), Cubic interpolation, Derivative, Deskew (resample), Difference (–), Enhanced resolution (to 15 bits vertical), Envelope, Exp (base e), Exp (base 10), FFT (power spectrum, magnitude, phase, power density, real, imaginary, magnitude squared, up to 128 Mpts and rectangular, VonHann, Hamming, FlatTop and Blackman Harris windows), Floor, Integral, Interpolate (cubic, quadratic, sinx/x), Invert (negate), Log (base e), Log (base 10), Product (x), Reciprocal, Rescale (with units), Roof, (SINx)/x, Sparse, Square, Square root, Sum (+), Zoom (identity). 2 dual operator math functions may be defined at a time.

### Measurement and Math Integration

Histogram capability with 19 histogram parameters and up to 2 billion events  
Trend (datalog) of up to 1 million events  
Track graphs of all parameters  
Persistence histogram, persistence trace (mean, range, sigma)

### Pass/Fail Testing

Test Types	Parameter limit testing, mask testing. Pass/Fail Actions include: Save, Stop, Alarm, Pulse, Hardcopy, LabNotebookv
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### Probes

Standard Probes	PP018 (5 mm) (Qty. 4)
Probing System	BNC and Teledyne LeCroy ProBus for Active voltage, current and differential probes

### 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 40 traces. Simultaneously display channel, zoom, memory and math traces
Grid Styles	Auto, Single, Dual, Quad, Octal, X-Y, Single+X-Y, Dual+X-Y, Tandem, Quattro, Twelve, Sixteen
Waveform Representation	Sample dots joined, or sample dots only

### Connectivity

Ethernet Port	(2) 10/100/1000Base-T Ethernet interface (RJ-45 connector)
USB Host Ports	(6) USB Ports Total – (2) Front USB2.0 Ports and (4) Rear USB3.0 Ports
USB Device Port	(1) USBTMC Port
GPIO Port (Optional)	Supports IEEE – 488.2 (External)
External Monitor Port	DisplayPort 1.2 compatible to support customer-supplied external monitor. Includes support for extended desktop operation with Ultra HD (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

### Processor/CPU

Type	Intel® Core™ i5-4570S Quad, 2.9 GHz (3.6 GHz in turbo mode) (or better)
Processor Memory	8 GB standard for 50 Mpt/ch standard memory with 32 GB optional (32 GB standard for -L and -VL options)
Operating System	Microsoft Windows® Embedded Standard 7 Professional, 64-bit



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### Power Requirements

Voltage	100–240 VAC $\pm$ 10% at 45–66 Hz; 100–120 VAC $\pm$ 10% at 380–420 Hz; Automatic AC Voltage Selection; Installation Category: 300 V CAT II
Power Consumption (Nominal)	400 W / 420 VA
Max Power Consumption	550 W / 570 VA (with all PC peripherals and active probes connected to 8 channels)

### Environmental

Temperature	Operating: 5 °C to 40 °C; Non-Operating: -20 °C to 60 °C
Humidity	Operating: 5% to 90% relative humidity (non-condensing) up to +31 °C, Upper limit derates to 50% relative humidity (non-condensing) at +40 °C; Non-Operating: 5% to 95% relative humidity (non-condensing) as tested per MIL-PRF-28800F
Altitude	Operating: 3,048 m (10,000 ft) max at $\leq$ 30C; Non-Operating: Up to 12,192 meters (40,000 ft)
Random Vibration	Operating : 0.31 $g_{rms}$ 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes; Non-Operating: 2.4 $g_{rms}$ 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 (HWD)	14.72"H x 16.41"W x 11"D (374 mm x 417 mm x 280 mm)
Weight	12.27 kg (27 lbs)

### Certifications

CE Certification	Low Voltage Directive 2006/95/EC EN 61010-1:2010, EN 61010-2-030:2010  EMC Directive 2004/108/EC EN 61326-1:2006, EN61326-2-1:2006
UL and cUL Listing	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**

**HDO8000 Oscilloscopes**

350 MHz, 8 Ch, 12-bit, 2.5 GS/s, 50 Mpts/Ch High Definition Oscilloscope with 12.1" WXGA Color Touch-screen Display, Ultra HD (UHD) Extended Desktop	HDO8038
500 MHz, 8 Ch, 12-bit, 2.5 GS/s, 50 Mpts/Ch High Definition Oscilloscope with 12.1" WXGA Color Touch-screen Display, Ultra HD (UHD) Extended Desktop	HDO8058
1 GHz, 8 Ch, 12-bit, 2.5 GS/s, 50 Mpts/Ch High Definition Oscilloscope with 12.1" WXGA Color Touch-screen Display, Ultra HD (UHD) Extended Desktop	HDO8108

**Mixed Signal Oscilloscope Option**

HDO8000 Series Model Mixed Signal Option	HDO8k-MS
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**Included with Standard HDO8000 Configurations**

+10 PP018 Passive Probe (Qty. 4), Getting Started Guide, Anti-virus Software (Trial Version), Microsoft Windows Embedded Standard 7 P 64-Bit License, Commercial NIST Traceable Calibration with Certificate, Power Cable for the Destination Country, 3-year Warranty

**Included with HDO8k-MS Option**

16 Channel Digital Leadset, Extra Large Gripper Probe Set (Qty. 22), Ground Extenders (Qty. 20), Flexible Ground Leads (Qty. 5)

**Memory Options**

100 Mpts/ch Memory Option	HDO8k-L
250 Mpts/ch Memory Option	HDO8k-XL

**Hardware Options**

8GB to 32GB CPU RAM Upgrade Option. (32 GB of RAM is included standard with HDO8k-L and HDO8k-VL memory options)	HDO8k-8-UPG-32GBRAM
Additional 500GB Removable Hard Disk Drive for HDO8000 Series. Includes Windows 7 OS, Teledyne LeCroy oscilloscope software and critical scope operational file duplicates	HDO8k-500GB-RHD-02

**General Accessories**

External GPIB Accessory	USB2-GPIB
Soft Carrying Case	HDO8k-SOFTCASE
Rack Mount Accessory	HDO8k-RACKMOUNT
Accessory Pouch	HDO8k-POUCH
Oscilloscope Cart	OC1021-A
Oscilloscope Cart with additional shelf and drawer	OC1024-A

**Local Language Overlays**

German Front Panel Overlay	HDO8k-FP-GERMAN
French Front Panel Overlay	HDO8k-FP-FRENCH
Italian Front Panel Overlay	HDO8k-FP-ITALIAN
Spanish Front Panel Overlay	HDO8k-FP-SPANISH
Japanese Front Panel Overlay	HDO8k-FP-JAPANESE
Korean Front Panel Overlay	HDO8k-FP-KOREAN
Chinese (Traditional) Front Panel Overlay	HDO8k-FP-CHNES-TR
Chinese (Simplified) Front Panel Overlay	HDO8k-FP-CHNES-SI
Russian Front Panel Overlay	HDO8k-FP-RUSSIAN

**Software Options**

Power Analysis Option	HDO8k-PWR
Digital Filter Option	HDO8k-DFF2
Serial Data Mask Option	HDO8k-SDM
Clock and Clock-Data Timing Jitter Analysis Package	HDO8k-JITKIT
Developer's Tool Kit Option	HDO8k-XDEV
EMC Pulse Parameter Software Package	HDO8k-EMC

**Product Description** **Product Code**

**Serial Data Options**

ARINC 429 Symbolic Decode Option	HDO8k-ARINC429bus DSymbolic
Audiobus Trigger and Decode Option for I <sup>2</sup> S, LJ, RJ, and TDM	HDO8k-Audiobus TD
Audiobus Trigger, Decode, And Graph Option	HDO8k-Audiobus TDG
CAN TD Trigger and Decode Option	HDO8k-CANbus TD
CAN Bus Trigger, Decode & Measure/Graph Option	HDO8k-CANbus TDM
D-PHY Decode Option	HDO8k-DPHYbus D
DigRF 3G Decode Option	HDO8k-DigRF3Gbus D
DigRF v4 Decode Option	HDO8k-DigRFv4bus D
I <sup>2</sup> C, SPI and UART Trigger and Decode Option	HDO8k-EMB
ENET Decode Option	HDO8k-ENETbus D
FlexRay Trigger and Decode Option	HDO8k-FlexRaybus TD
FlexRay Bus Trigger, Decode, and Physical Layer Test Option	HDO8k-FlexRaybus TDP
I <sup>2</sup> C Bus Trigger and Decode Option	HDO8k-I2Cbus TD
LIN Trigger and Decode Option	HDO8k-LINbus TD
Manchester Decode Option	HDO8k-Manchesterbus D
MIL-STD-1553 Trigger and Decode Option	HDO8k-1553 TD
NRZ Decode Option	HDO8k-NRZbus D
Serial Debug Toolkit - Measure Analyze Graph	HDO8k-ProtoBus MAG
SENT Decode Option	HDO8k-SENTbus D
SPI Bus Trigger and Decode Option	HDO8k-SPIbus TD
UART and RS-232 Trigger and Decode Option	HDO8k-UART-RS232bus TD
USB 2.0 Trigger and Decode Option	HDO8k-USB2bus TD
USB2-HSIC Decode Option	HDO8k-USB2-HSICbus D
Vehicle Bus Analyzer Bundle - Includes CAN TDM, CAN Symbolic, FlexRay TDP, LIN TD and Protobus MAG.	HDO8k-VBA

**Probes and Amplifiers**

Additional 500 MHz Passive Probe, 10:1, 10 M $\Omega$	PP018
1,500 V, 120 MHz High-Voltage Differential Probe	HVD3106
1,500 V, 25 MHz High-Voltage Differential Probe	HVD3102
30 A; 100 MHz Current Probe – AC/DC; 30 A <sub>rms</sub> ; 50 A <sub>peak</sub> Pulse	CP031
30 A; 50 MHz Current Probe – AC/DC; 30 A <sub>rms</sub> ; 50 A <sub>peak</sub> Pulse	CP030
150 A; 10 MHz Current Probe – AC/DC; 150 A <sub>rms</sub> ; 500 A <sub>peak</sub> Pulse	CP150
500 A; 2 MHz Current Probe – AC/DC; 500 A <sub>rms</sub> ; 700 A <sub>peak</sub> Pulse	CP500
Deskew Calibration Source for CP031, CP030 and HV Differential Probes	DCS015
200 MHz, 3.5 pF, 1 M $\Omega$ Active Differential Probe	ZD200
500 MHz, 1.0 pF, 1 M $\Omega$ Active Differential Probe	ZD500
1 GHz, 1.0 pF, 1 M $\Omega$ Active Differential Probe	ZD1000
1.5 GHz, 1.0 pF, 1 M $\Omega$ Active Differential Probe	ZD1500
1 GHz, 0.9 pF, 1 M $\Omega$ High Impedance Active Probe	ZS1000
Set of 4 ZS1000	ZS1000-QUADPAK
1.5 GHz, 0.9 pF, 1 M $\Omega$ High Impedance Active Probe	ZS1500
Set of 4 ZS1500	ZS1500-QUADPAK
1 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A
100:1 or 10:1 Selectable, 250 MHz Passive Diff. Probe Pair	DXC100A
1:1, 50 MHz Passive Differential Probe Pair	DXC200
100:1, 250 MHz, 2.5kV High Voltage Probe Pair	DXC5100
10x, 1 M $\Omega$ Passive Attenuator for DXC Series Probes	DA101
10:1/100:1 200/300 MHz, 50 M $\Omega$ High-voltage Probe	PPE1.2KV
600 V/1,2 kV Max. Volt. DC	
100:1 400 MHz 50 M $\Omega$ 2 kV High-voltage Probe	PPE2KV
100:1 400 MHz 50 M $\Omega$ 4 kV High-voltage Probe	PPE4KV
1000:1 400 MHz 50 M $\Omega$ 5 kV High-voltage Probe	PPE5KV
1000:1 400 MHz 50 M $\Omega$ 6 kV High-voltage Probe	PPE6KV

## Customer Service

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

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



1-800-5-LeCroy  
[teledynelecroy.com](http://teledynelecroy.com)

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