

# HDO6000

## High Definition Oscilloscopes

350 MHz – 1 GHz



### Key Features

- **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**
- **12.1" touch screen display**
- **Advanced Tools**
  - Spectrum Analyzer Mode
  - WaveScan – Search and Find
  - LabNotebook Documentation and Report Generation
  - History Mode - Waveform Playback
- **Advanced Triggering with TriggerScan and Measurement Trigger**
- **Power Analyzer Option**
- **Serial Data Trigger, Decode and Debug Toolkit Options**
- **16 Digital Channels with 1.25 GS/s**
  - Analog and Digital Cross-Pattern Triggering
  - Digital Pattern Search and Find
  - Analog and Digital Timing Measurements
  - Logic Gate Emulation
  - Activity Indicators

Combining Teledyne LeCroy's HD4096 high definition 12-bit technology, with long memory, a compact form factor, 12.1" touch screen display, powerful measurement and analysis tools, and mixed signal capability, the HDO6000 is the ideal oscilloscope for circuit validation, system debug and waveform analysis. The powerful feature set provides analytical tools and unique application packages to streamline the testing process. Tools such as WaveScan Search and Find and History Mode, combined with advanced triggering, identify and isolate problems while Spectrum Analyzer Mode provides analysis tools in the frequency domain.

### HD4096 Technology

HD4096 high definition technology consists of high sample rate 12-bit ADCs, high signal-to-noise 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 high sample rate and 16 times more resolution than other oscilloscopes.

### Long Memory

With up to 250 Mpts of memory the HDO6000 High Definition Oscilloscopes can capture large amounts of data with more precision than other oscilloscopes. The 2.5 GS/s, 250 Mpts architecture provides the ability to capture a fast transient or a long acquisition.

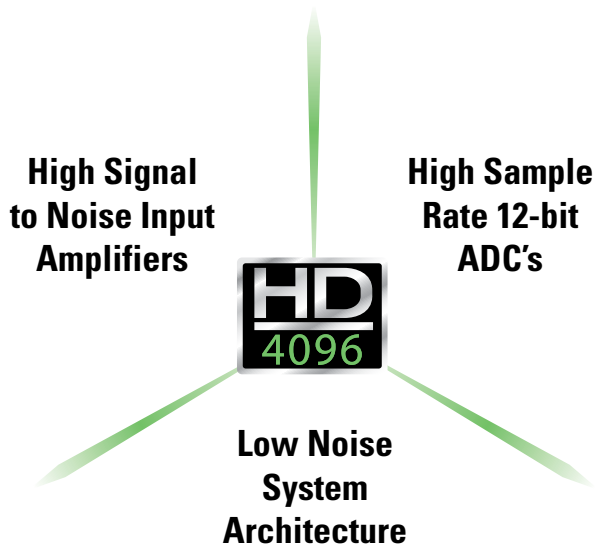
### Large 12.1" Touch Screen

Navigating complicated user interfaces is a thing of the past thanks to the large touch screen display of the HDO6000. The user interface was designed for touch screens which makes navigating the HDO6000 extremely intuitive.

### Comprehensive Analysis Tools

Advanced math and measurement parameters quantify analog and digital waveforms while tracks, trends and histograms show how they change over time. Advanced triggering with TriggerScan and Measurement Trigger ensure even the most complicated signals are captured.

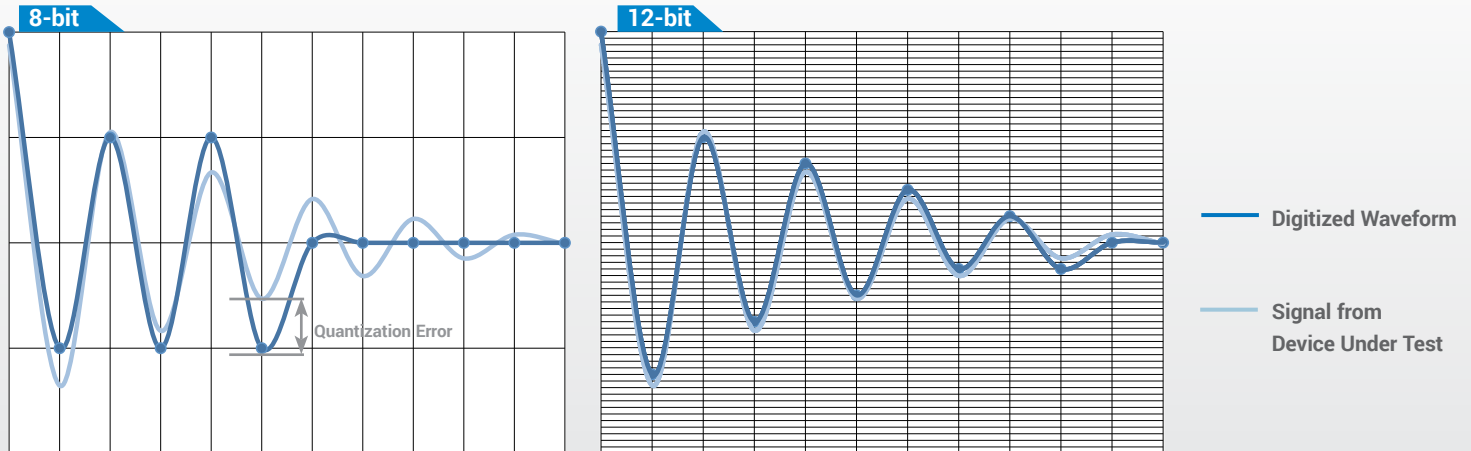
# HD4096 HIGH DEFINITION TECHNOLOGY



HD4096 high definition technology consists of high sample rate 12-bit ADCs, high signal-to-noise ratio amplifiers and a low-noise system architecture. This technology enables high definition oscilloscopes to capture and display signals of up to 1 GHz with high sample rate and 16 times more resolution than other oscilloscopes.

Oscilloscopes with HD4096 technology have higher resolution and measurement precision than 8-bit alternatives. The high sample rate 12-bit ADCs provide high resolution sampling at up to 2.5 GS/s. The high performance input amplifiers deliver phenomenal signal fidelity with a 55 dB signal-to-noise ratio and provide a pristine signal to the ADC to be digitized. The low-noise signal architecture ensures that nothing interferes with the captured signal and the oscilloscope displays a waveform that accurately represents the signals from the device under test.

## 16x Closer to Perfect



## 16x More Resolution

12-bits of vertical resolution provides sixteen times more resolution than 8-bits. The 4096 discrete levels reduce the quantization error. Signals captured with lower resolution oscilloscopes have a higher level of quantization error resulting in less accurate waveforms on the display. Signals captured on an oscilloscope with 12-bit HD4096 technology are accurately displayed with minimal quantization error.

# DEBUG IN HIGH DEFINITION WITH HD4096



Oscilloscopes with HD4096 have a variety of benefits that allow the user to debug in high definition. Waveforms displayed by high definition oscilloscopes are cleaner and crisper. More signal details can be seen and measured; these measurements are made with unmatched precision resulting in better test results and shorter debug time.

## Clean, Crisp Waveforms

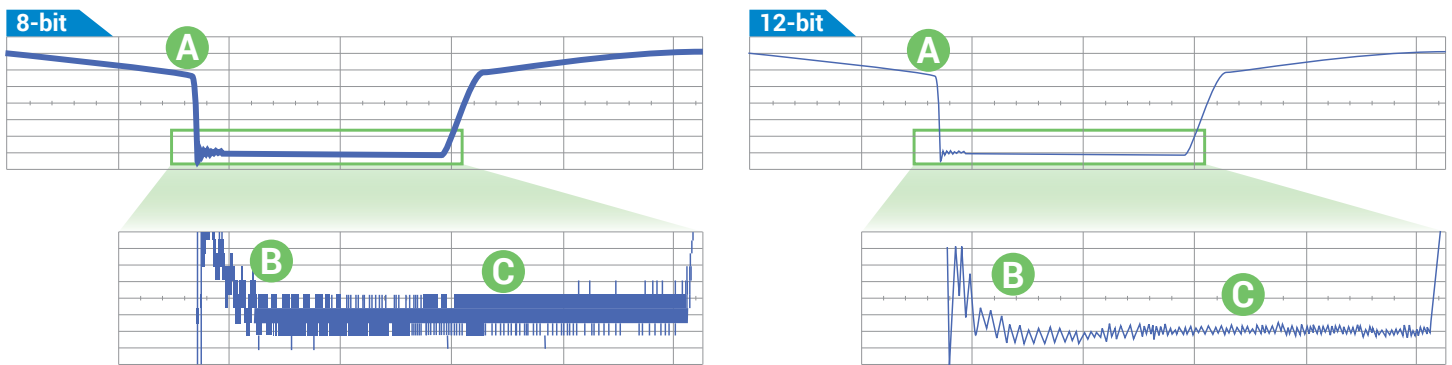
When compared to waveforms captured and displayed by 8-bit oscilloscopes, waveforms captured with HD4096 technology are dramatically crisper and cleaner. Oscilloscopes with HD4096 acquire waveforms at high resolution, high sample rate and low noise to display the most accurate waveforms.

## More Signal Details

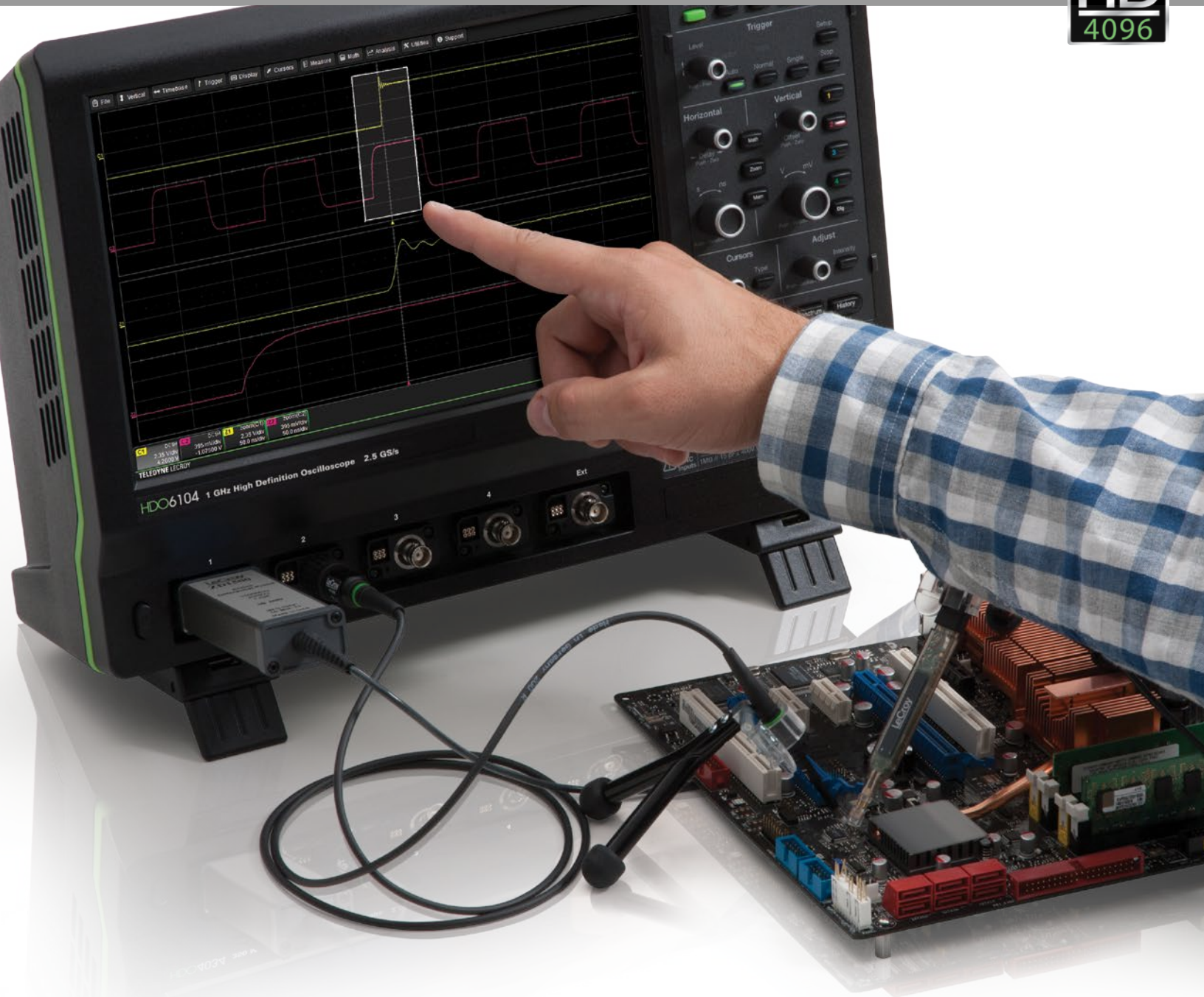
Signal details often lost in the noise are clearly visible and easy to distinguish when captured on oscilloscopes with HD4096. Details which were previously difficult to even see can now be easily seen and measured. Using the oscilloscope zoom capabilities gives an even closer look at the details for unparalleled insight to the signals on screen.

## Unmatched Measurement Precision

Precise measurements are critical for effective debug and analysis. HD4096 enables oscilloscopes to deliver unmatched measurement precision to improve testing capabilities and provide better results.



- 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



Don't waste time searching through a complex menu structure to find the proper setting. Configuring the HDO6000 is simple thanks to the intuitive touch screen user interface. Everything on the screen is interactive. To adjust channel, timebase, or trigger settings, simply touch the associated descriptor box and the appropriate menu is opened.

Measurements can be touched to adjust their settings and cursors can be positioned precisely by touching and dragging them to the proper location. A box can be drawn around a portion of a waveform to create a zoom of that waveform. Even waveform offset and delay can be adjusted simply by touching and dragging the waveform.



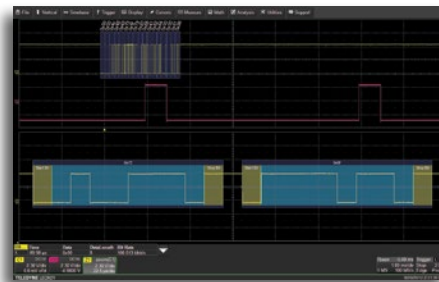
## Powerful Mixed Signal Capability

Debug complex embedded designs with integrated 16 channel mixed signal capability. Each of the 16 digital channels samples at 1.25 GS/s and can utilize up to 125 Mpts/ch. Powerful debug tools like Analog/Digital Cross-Pattern Triggers, Digital Timing Measurements, Parallel Pattern Search, Activity Indicators, and Logic Gate Emulation, make it possible to solve complex embedded design problems easily.



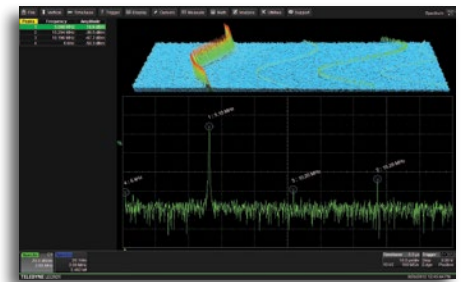
## WaveScan Advanced Search and Find Tool

Quickly scan analog, digital or parallel bus signals for runts, glitches or other anomalies with WaveScan.



## Serial Bus Trigger and Decode

View protocol information on top of analog or digital waveforms, trigger on messages, extract and graph data to monitor system performance.



## Spectrum Analyzer Mode

View signal details in the frequency domain with a spectrum analyzer style user interface.

## Sequence Mode Acquisition

Capture many fast pulses in quick succession or events separated by long periods of time.

## History Mode Waveform Playback

Scroll back in time to isolate anomalies that have previously been captured to quickly find the source of the problem.

## LabNotebook Documentation and Report Generation Tool

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

**HDO6000 High Definition Oscilloscopes combine Teledyne LeCroy's HD4096 high definition technology with long memory, powerful debug tools and mixed signal capability in a compact form factor with a 12.1" touch screen display.**

1. Only 13 cm (5") Deep – The most space-efficient oscilloscope for your bench from 350 MHz to 1 GHz
2. 12.1" Widescreen (16 x 9) high resolution WXGA color touch screen display. The most time-efficient user interface is even easier to use with a built-in stylus
3. Local language user interface – Select from 10 language preferences. Add a front panel overlay with your local language
4. "Push" Knobs – All knobs have push functionality that provides shortcuts to common actions such as Set to Variable, Find Trigger Level, Zero Offset, and Zero Delay
5. Waveform Control Knobs – Control channel, zoom, math and memory traces with the multiplexed vertical and horizontal knobs





6. Dedicated Cursor Knob – Select type of cursor, position them on your signal, and read values without ever opening a menu
7. Dedicated buttons to quickly access popular debug tools.
8. Easy connectivity with two convenient USB ports on the front, two on the side
9. Mixed Signal Capability - Debug complex embedded designs with integrated 16 channel mixed signal capability
10. Rotating and Tilting Feet provide 4 different viewing positions
11. Auxiliary Output and Reference Clock Input/Output connectors for connecting to other equipment
12. USBTMC (Test and Measurement Class) port simplifies programming



### 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

Teledyne LeCroy's HDO6000-MS High Definition mixed signal oscilloscope combines the high definition analog channels of the HDO6000 with the flexibility of 16 digital inputs. In addition, the many triggering and decoding options turn the HDO6000-MS into an all-in-one analog, digital, serial 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.

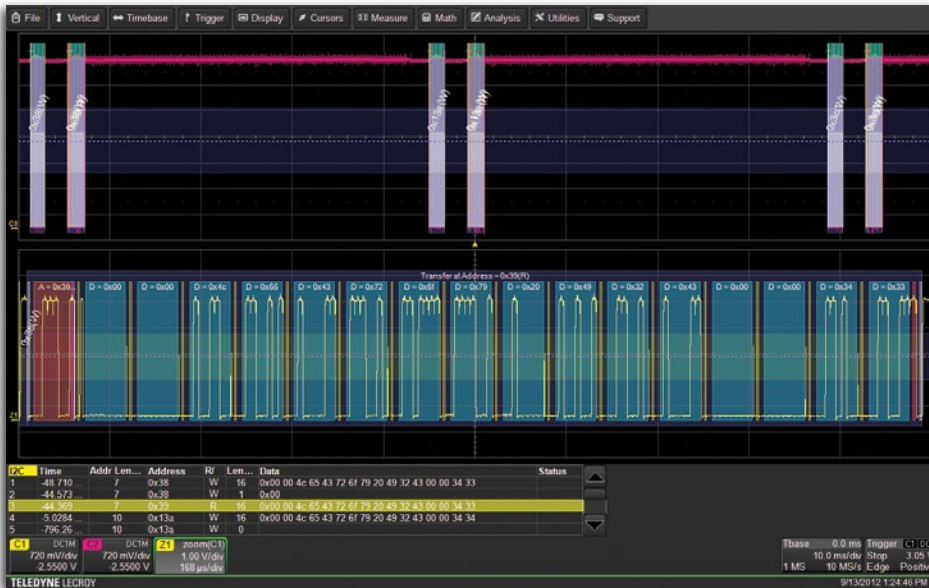
Use a variety of the many timing parameters to measure and analyze the characteristics of digital busses. Powerful tools like tracks, trends, statistics and histograms provide additional insight and help find anomalies.

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 HDO6000-MS 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 HDO6000 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.

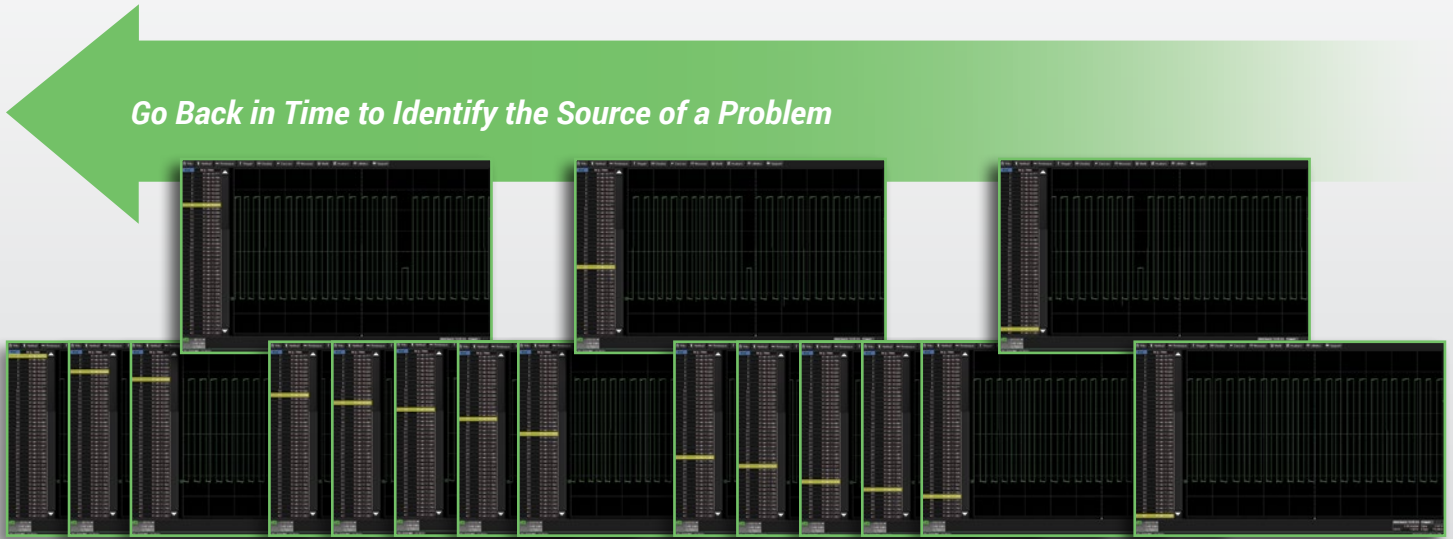
## Advanced Math and Measure

With many math functions and measurement parameters available, the HDO6000 can measure and analyze every aspect of analog and digital waveforms. By utilizing HD4096 technology, the HDO6000 measures 16 times more precisely than traditional 8-bit architectures. Beyond just measuring waveforms, the HDO6000 provides statistics, histograms, tracks and trends to show how waveforms change over time.



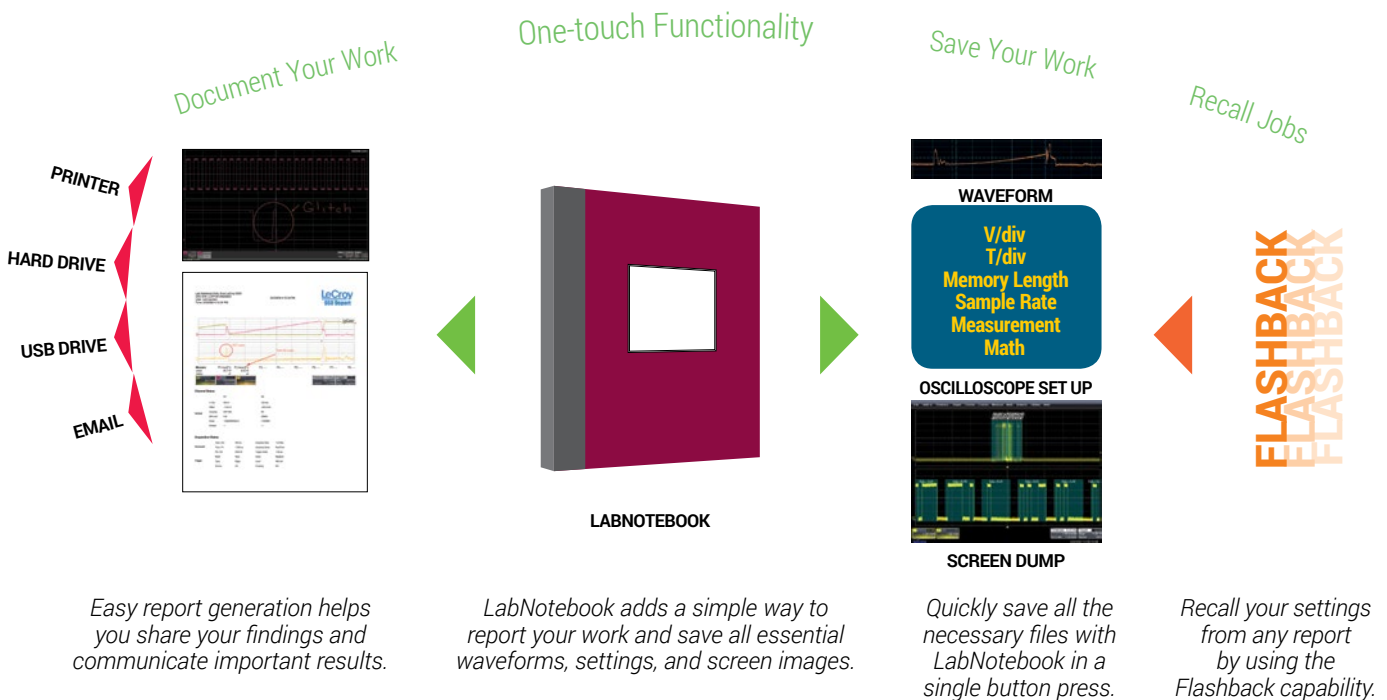
## History Mode Waveform Playback

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



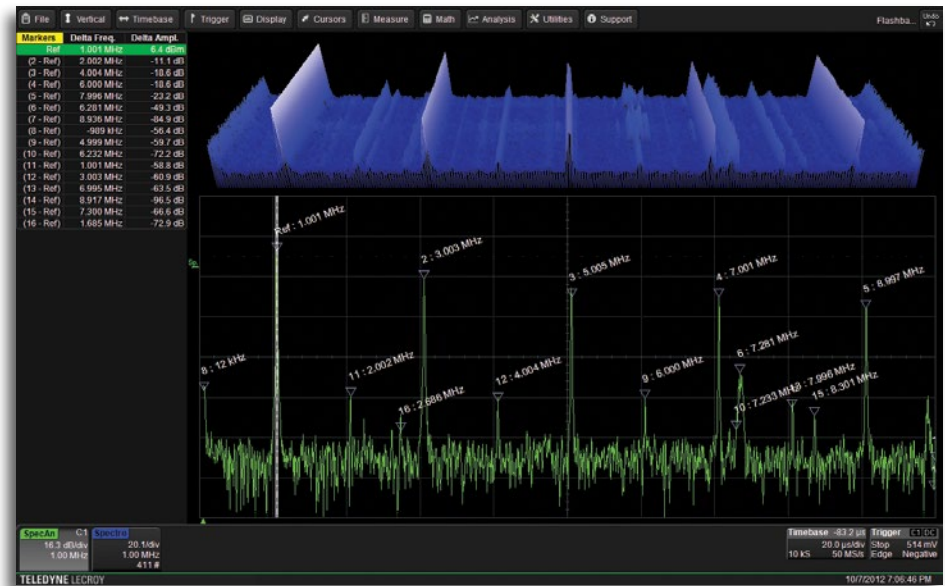
## LabNotebook

The LabNotebook feature of HDO6000 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.



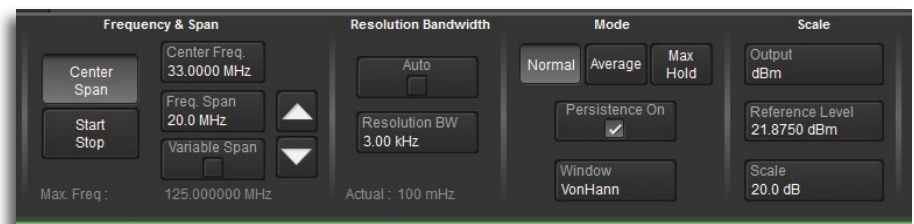
## Key Features

- 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

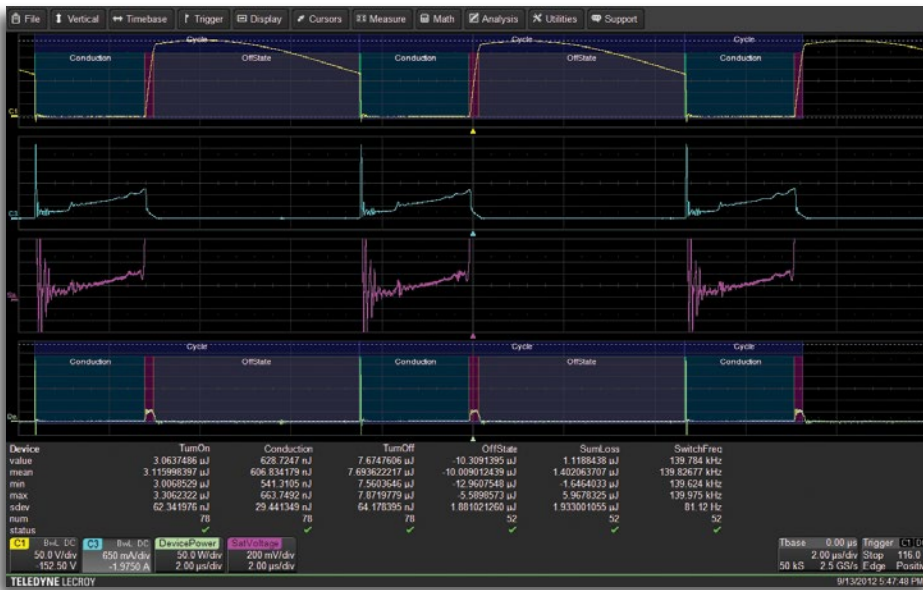


## Simplify Analysis of FFT Power Spectrum

Get better insight to the frequency content of any signal with use of the Spectrum Analyzer mode on the HDO6000. 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

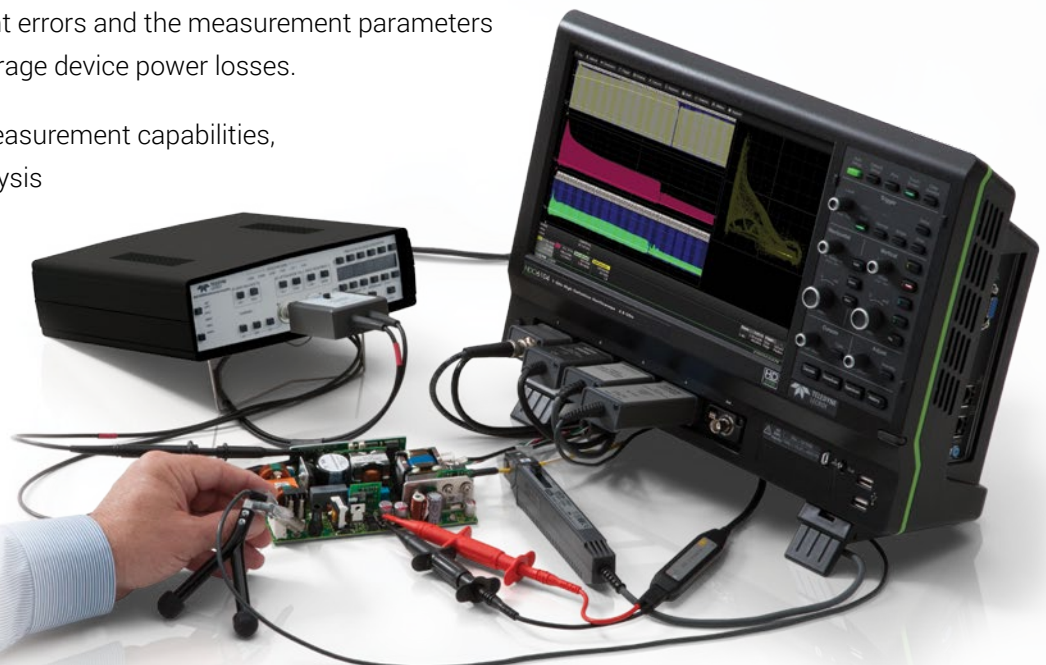
## Power Analyzer Automates Switching Device Loss Measurements

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

Power Analyzer provides quick and easy setup of voltage and current inputs and makes measurements as simple as the push of a button. Tools are provided to help reduce sources of measurement errors and the measurement parameters provide details of single cycle or average device power losses.

Beyond the advanced power loss measurement capabilities, the Power Analyzer modulation analysis capabilities provide insight to understand control loop response to critical events such as a power supply's soft start performance or step response to line and load changes. The Line Power Analysis tool allows simple and quick pre-compliance testing to EN 61000-3-2.

*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.*



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



Low cost active differential probes are intended for measuring higher voltages. The differential techniques employed permit measurements to be taken at two points in a circuit without reference to the ground, allowing the oscilloscope to be safely grounded without the use of opto-isolators or isolating transformers.

## High Voltage Passive Probes

HVP120, PPE1.2KV, PPE2KV,  
PPE4KV, PPE5KV, PPE6KV



High voltage probes are suitable for a wide range of applications where high-voltage measurements must be made safely and accurately. There are several fixed attenuation probes covering a range from 1 kV to 6 kV and varying transient overvoltage ratings. All of these high voltage probes feature a spring loaded probe tip and a variety of standard accessories to make probing high voltages safe and easy. Additionally, all of the high voltage probe have a probe sense pin to automatically configure the oscilloscope for use with 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.

## HDO6034 HDO6034-MS

## HDO6054 HDO6054-MS

## HDO6104 HDO6104-MS

### Analog - Vertical

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	4		
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 (Gain Component of DC 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%    15 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		
DC Vertical 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
Sample Rate (Repetitive)	125 GS/s, user selectable for repetitive signals (20 ps/div to 10 ns/div)
Record Length	Standard -STD: 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 dBm, sinewave synchronous to scope timebase
External Clock	DC to 100 MHz; (50 $\Omega$ /1 M $\Omega$ ), Ext. BNC input, 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 (Default) or Sin x/X

### Digital - Vertical and Acquisition (-MS Models 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 -STD: 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

## HDO6034 HDO6034-MS

## HDO6054 HDO6054-MS

## HDO6104 HDO6104-MS

### 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 4 channels)		
Trigger Sensitivity with Edge Trigger (Ch 1-4)	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-C4, Aux 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 selectable as low as 200 ps (depending on oscilloscope bandwidth); Maximum Width: 20 s
Pattern	Logic combination (AND, NAND, OR, NOR) of 5 inputs (4 channels and external trigger input). Each source can be high, low, or don't care. The High and Low level can be selected independently. Triggers at start or end of the pattern
Measurement Trigger	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)

### Smart Triggers

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 200 ps (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

### Multi-Stage Triggers

<b>Cascade (Sequence) Triggering</b>	
Capability	Arm on "A" event, then Trigger on "B" event. Or Arm on "A" event, then Qualify on "B" event, and Trigger on "C" event. Or Arm on "A" event, then Qualify on "B" then "C" event, and Trigger on "D" event
Types	A, B, C, or D event: Edge, Glitch, Width, Window, Dropout, Interval, Runt, Slew Rate, Pattern (analog), or Measurement.
Holdoff	Holdoff between A and B, B and C, C or D, or any is selectable by time or number of events
<b>Qualified First</b>	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
<b>Qualified</b>	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
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 8 parameters together with statistics, including their average, high, low, and standard deviations. Histicons 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 8 math function traces (F1–F8). 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, $\sin x/x$ ), 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

Histograms expanded 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, LabNotebook
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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 16 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 USB Ports
USB Device Port	(1) USBTMC Port
GPIO Port (Optional)	Supports IEEE – 488.2 (External)
External Monitor Port	Standard 15-pin D-Type SVGA-compatible DB-15 connector, DVI connector and HDMI connector
Remote Control	Via Windows Automation, or via Teledyne LeCroy Remote Command Set

### Processor/CPU

Type	Intel Core i5, 2.5 GHz (or better)
Processor Memory	8 GB standard
Operating System	Windows® Embedded Standard 7 Professional, 64-bit

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### Power Requirements

Voltage	100–240 VAC ±10% at 45–66 Hz; 100–120 VAC ±10% at 380–420 Hz; Automatic AC Voltage Selection; Installation Category: 300 V CAT II
Power Consumption (Nominal)	200 W / 200 VA
Max Power Consumption	350 W / 350 VA (with all PC peripherals and active probes connected to 4 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 ≤ 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)	11.48"H x 15.72"W x 5.17"D (291.7 mm x 399.4 mm x 131.31 mm)
Weight	5.86 kg (12.9 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
<b>HDO6000 Oscilloscopes</b>	
350 MHz, 2.5 GS/s, 4 Ch, 50 Mpts/Ch 12-bit HD Oscilloscope with 12.1" WXGA Touch Display	HDO6034
500 MHz, 2.5 GS/s, 4 Ch, 50 Mpts/Ch 12-bit HD Oscilloscope with 12.1" WXGA Touch Display	HDO6054
1 GHz, 2.5 GS/s, 4 Ch, 50 Mpts/Ch 12-bit HD Oscilloscope with 12.1" WXGA Touch Display	HDO6104

Product Description	Product Code
<b>HDO6000-MS Mixed Signal Oscilloscopes</b>	
350 MHz 2.5 GS/s,4+16Ch,50 Mpts/Ch 12-bit HD Mixed Signal Oscilloscope with 12.1" WXGA Color Display	HDO6034-MS
500 MHz 2.5 GS/s,4+16Ch,50 Mpts/Ch 12-bit HD Mixed Signal Oscilloscope with 12.1" WXGA Color Display	HDO6054-MS
1 GHz 2.5 GS/s,4+16Ch,50 Mpts/Ch 12-bit HD Mixed Signal Oscilloscope with 12.1" WXGA Color Display	HDO6104-MS

**Included with Standard Configurations (HDO6000 and HDO6000-MS)**  
 ±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, Protective Front Cover, 3-year Warranty

**Included with HDO6000-MS**  
 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	HDO6K-L
250 Mpts/ch Memory Option	HDO6K-XL

Hardware Options	
Removable Hard Drive Package (includes removable hard drive kit and two hard drives)	HDO6K-RHD
Additional Removable Hard Drive	HDO6K-RHD-02

General Accessories	
External GPIB Accessory	USB2-GPIB
Soft Carrying Case	HDO6K-SOFTCASE
Rack Mount Accessory	HDO6K-RACK
Accessory Pouch	HDO6K-POUCH

Local Language Overlays	
German Front Panel Overlay	HDO6K-FP-GERMAN
French Front Panel Overlay	HDO6K-FP-FRENCH
Italian Front Panel Overlay	HDO6K-FP-ITALIAN
Spanish Front Panel Overlay	HDO6K-FP-SPANISH
Japanese Front Panel Overlay	HDO6K-FP-JAPANESE
Korean Front Panel Overlay	HDO6K-FP-KOREAN
Chinese (Tr) Front Panel Overlay	HDO6K-FP-CHINES-TR
Chinese (Simp) Front Panel Overlay	HDO6K-FP-CHINES-SI
Russian Front Panel Overlay	HDO6K-FP-RUSSIAN

Software Options	
Electrical Telecom Mask Test Package	HDO6K-ET-PMT
Power Analysis Option	HDO6K-PWR
DFF2 Digital Filter Option	HDO6K-DFF2
Serial Data Mask Option	HDO6K-SDM
Clock and Clock-Data Timing Jitter Analysis Package	HDO6K-JITKIT
Developer's Tool Kit Option	HDO6K-XDEV
EMC Pulse Parameter Software Package	HDO6K-EMC

Product Description	Product Code
<b>Serial Data Options</b>	
ARINC 429 Symbolic Decode Option	HDO6K-ARINC429bus DSymbolic
Audiobus Trigger and Decode Option for I <sup>2</sup> S, LJ, RJ, and TDM	HDO6K-Audiobus TD
Audiobus Trigger, Decode, And Graph Option	HDO6K-Audiobus TDG
CAN TD Trigger and Decode Option	HDO6K-CANbus TD
CAN Bus Trigger, Decode & Measure/Graph Option	HDO6K-CANbus TDM
D-PHY Decode Option	HDO6K-DPHYbus D
DigRF 3G Decode Option	HDO6K-DigRF3Gbus D
DigRF v4 Decode Option	HDO6K-DigRFv4bus D
ENET Decode Option	HDO6K-ENETbus D
FlexRay Trigger and Decode Option	HDO6K-FlexRaybus TD
FlexRay Bus Trigger, Decode, and Physical Layer Test Option	HDO6K-FlexRaybus TDP
I <sup>2</sup> C, SPI and UART Trigger and Decode Option	HDO6K-EMB
I <sup>2</sup> C Bus Trigger and Decode Option	HDO6K-I2Cbus TD
LIN Trigger and Decode Option	HDO6K-LINbus TD
Manchester Decode Option	HDO6K-Manchesterbus D
MIL-STD-1553 Trigger and Decode Option	HDO6K-1553 TD
NRZ Decode Option	HDO6K-NRZbus D
SENT Decode Option	HDO6K-SENTbus D
Serial Debug Toolkit - Measure Analyze Graph	HDO6K-ProtoBusMag
SPI Bus Trigger and Decode Option	HDO6K-SPIbus TD
UART and RS-232 Trigger and Decode Option	HDO6K-UART-RS232bus TD
USB 2.0 Trigger and Decode Option	HDO6K-USB2bus TD
USB2-HSIC Decode Option	HDO6K-USB2-HSICbus D
Vehicle Bus Analyzer Bundle - Includes CAN TDM, CAN Symbolic, FlexRay TDP, LIN TD and Protobus MAG.	HDO6K-VBA

Probes and Amplifiers	
500 MHz Passive Probe, 10:1, 10 M $\Omega$	PP018
Set of 4 ZS1500, 1.5 GHz, 0.9 pF, 1 M $\Omega$ High Impedance Active Probe	ZS1500-QUADPAK
Set of 4 ZS1000, 1 GHz, 0.9 pF, 1 M $\Omega$ High Impedance Active Probe	ZS1000-QUADPAK
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
1,500 V, 25 MHz High-Voltage Differential Probe	HVD3012
1,500 V, 120 MHz High-Voltage Differential Probe	HVD3106
1 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A
100:1 or 10:1 Selectable, 250 MHz Passive Diff. Probe Pair	DXC100A
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
30 A; 50 MHz Current Probe – AC/DC; 30 A <sub>rms</sub> ; 50 A <sub>peak</sub> Pulse	AP015
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
Deskw Calibration Source for CP031, CP030 and AP015	DCS015
100:1 400 MHz 50 M $\Omega$ 1 kV High-voltage Probe	HVP120
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.**