Telemeter Electronic

TELEDYNE LECROY
Everywhereyoulook™

CAPTURE EVERY DETAIL

HDO6000B

HD 4096

350 MHz - 1 GHz
High Definition Oscilloscopes

- **Highest Resolution** HD4096 Technology, 12 bits all the time
- **Bigger Display**, smaller footprint, most bench space
- **More Capability**, increased productivity

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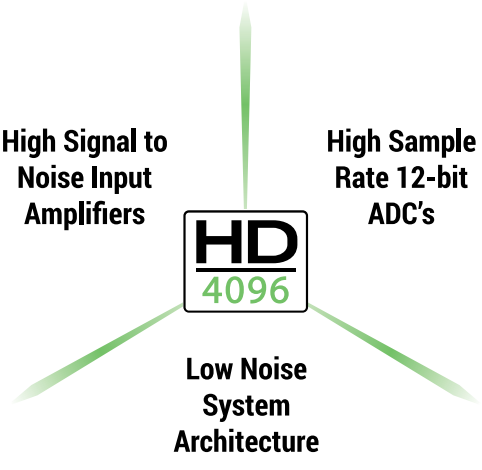
Highest Resolution

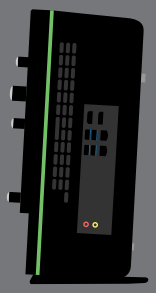


12 bits **all the time.**

+

Bigger Display

- Bigger display
- Smaller footprint
- Most bench space



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More Capability

MAUI with OneTouch
IVN Tools
MSO
LabNotebook
Q-Scape
15.6" Touch
HD 4096
DVM
AFG
Pass/Fail
Protocol Analysis
Spectrum Analysis
History Mode
Power Conversion
MAUI Studio Pro

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Capture Every Detail

Providing **12 bits all the time,** a **bigger display, smaller footprint,** and **more capability,** the **HDO6000B captures every detail.**

12 bits **all the time.**

HD 4096 HDO6000B

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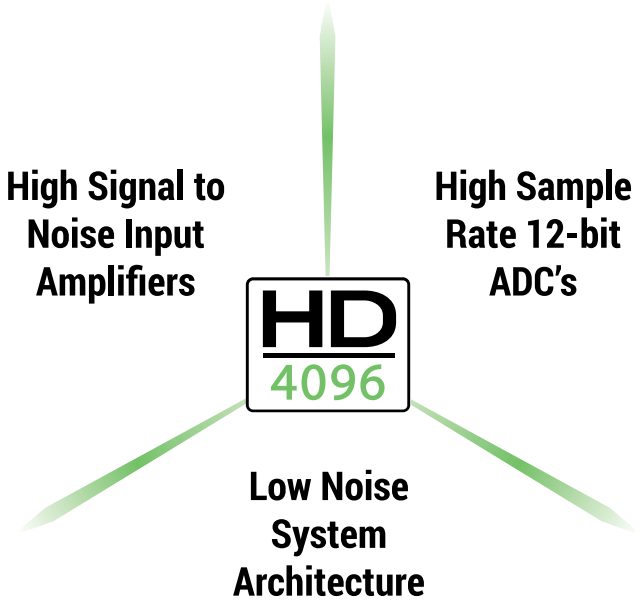
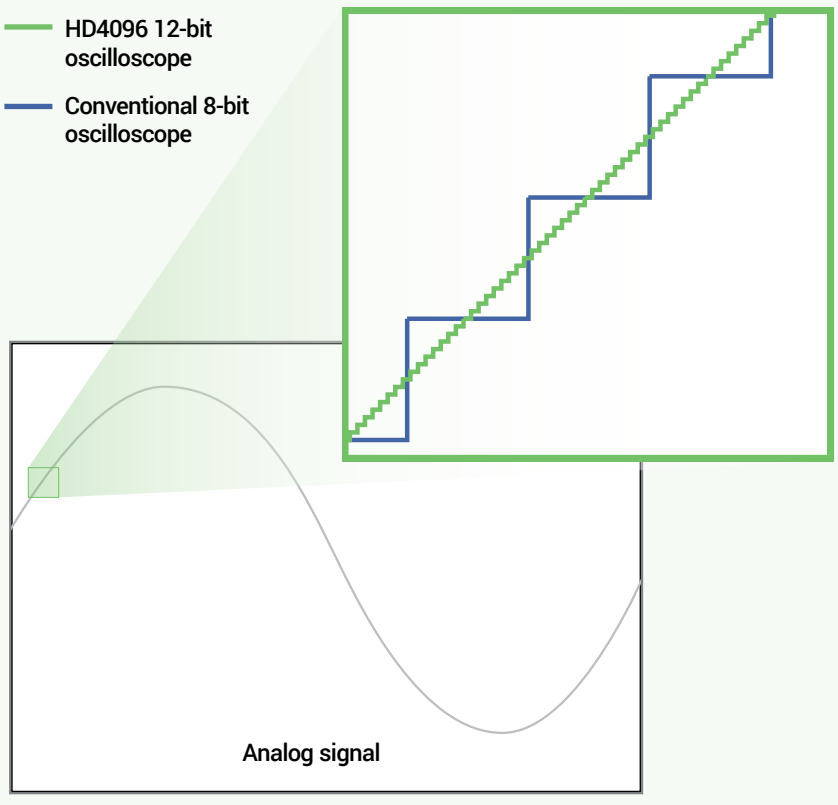
HD4096 TECHNOLOGY - 16X CLOSER TO PERFECT



Teledyne LeCroy high definition 12-bit oscilloscopes use unique HD4096 technology to provide superior and uncompromised measurement performance:

- **12-bit ADCs with high sample rates**
- **High signal-to-noise amplifiers**
- **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 12-bit ADCs support capture of fast signals at oscilloscope bandwidth ratings up to 1 GHz, while Enhanced Sample Rate to 10 GS/s ensures the highest measurement accuracy and precision. The high performance input amplifiers deliver pristine signal fidelity, and 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 — 16x more resolution than 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.

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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 sensors, power electronics, automotive electronics, mechatronics or other specialized applications, the HD4096 technology provides unsurpassed confidence and measurement capabilities.

Clean, crisp waveforms

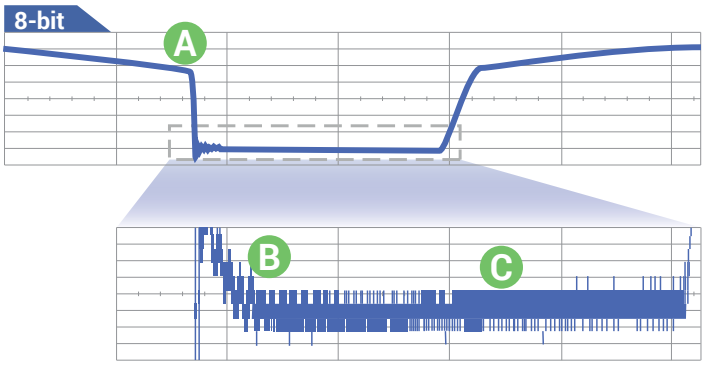
When compared to waveforms acquired and displayed using conventional 8-bit oscilloscopes, waveforms captured with HD4096 12-bit technology are dramatically crisper and cleaner, and are displayed more accurately. Once you see a waveform acquired with HD4096 technology, you will not want to go back to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

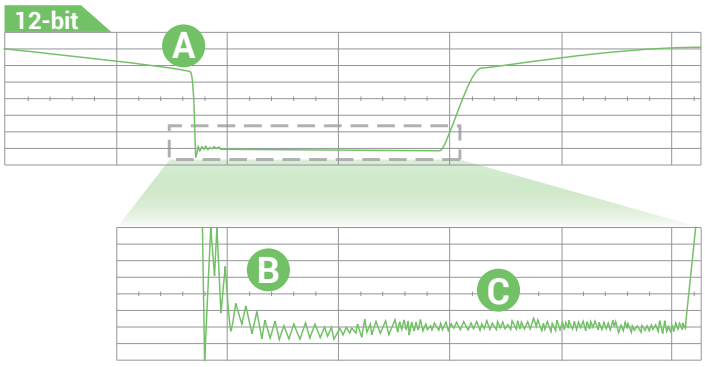
More signal details

16x more resolution provides more signal detail. This is especially helpful for analyzing wide dynamic range signals where very small amplitude signal details must be viewed. 12-bit acquisitions combined with the oscilloscope's vertical and horizontal zoom capabilities provide unparalleled insight into system behaviors and problems.

Unmatched measurement precision

HD4096 technology delivers measurement precision several times better than conventional 8-bit oscilloscopes. Higher oscilloscope measurement precision results in 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 can now be clearly seen on an HD4096 12-bit oscilloscope.

C **Unmatched measurement precision** | Measurements are more precise and not affected by quantization noise.

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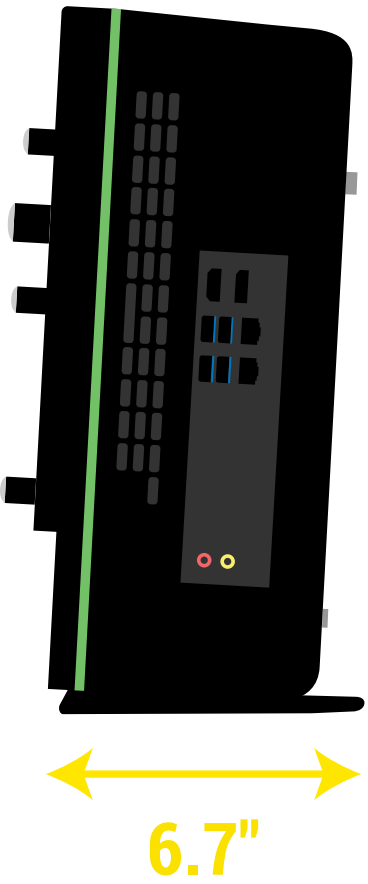
BIGGER DISPLAY, SMALLER FOOTPRINT, MORE BENCH SPACE



Capture every detail with the HDO6000B's bigger 15.6" display.

Bigger display

With a 15.6" display and 1920x1080 resolution, the HDO6000B allows you to capture more detail. Connect to a second monitor, and view the extended desktop in glorious 4K resolution.

Smallest footprint

At only 6.7" deep and 25% thinner than competitive products, the HDO6000B is the sleekest instrument in the market.

Most bench space

The HDO6000B occupies less bench space than the competitive products, allowing you to spread out test circuits and probes to help focus on solving problems.

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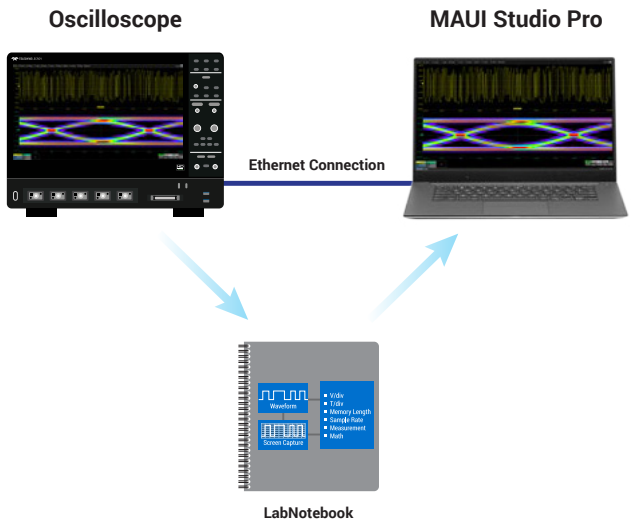
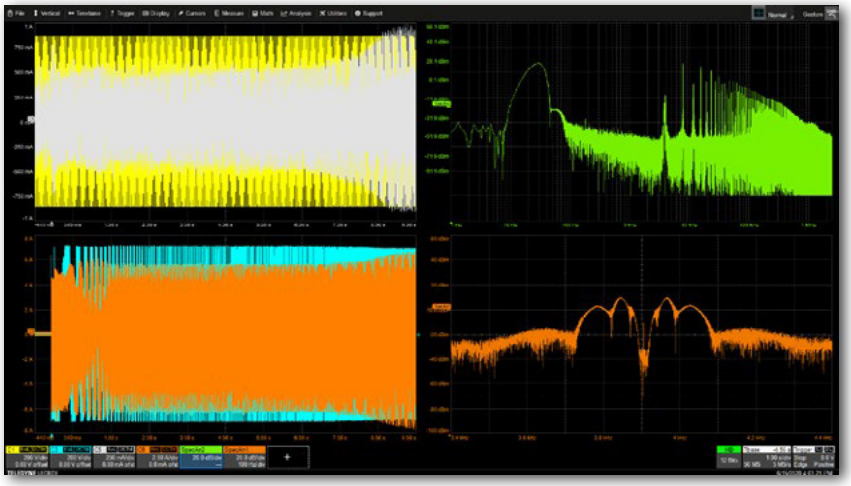


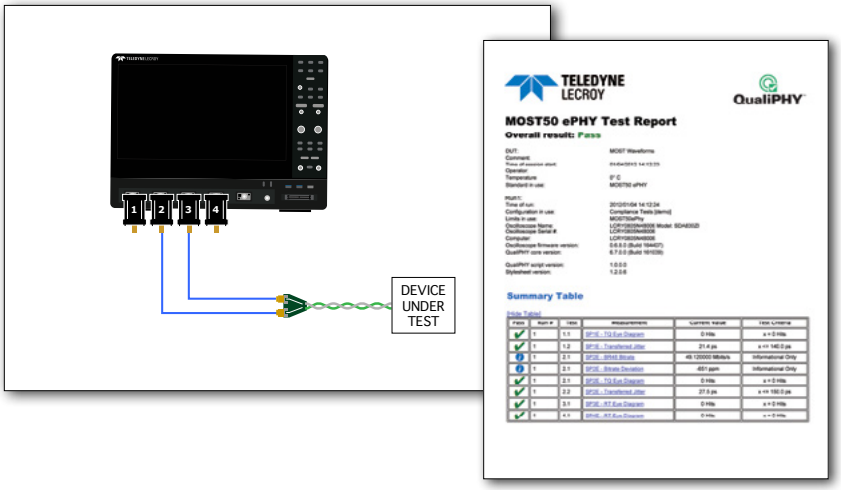
MAUI Studio

Unleash the power of a Teledyne LeCroy oscilloscope anywhere, using a PC with MAUI Studio. Work from anywhere while having the full functionality of an oscilloscope at your fingertips. Collaborate with ease by giving everyone access to the same software options to use for offline analysis.



Spectrum Analysis

Spectrum-Pro-2R provides the most flexible spectral analysis with a logarithmic scale and drag-and-drop spectrum traces. Leverage long acquisition memory to perform analysis down to 1 Hz with resolution bandwidth up to 100 mHz.



QualiPHY Compliance Testing

The QualiPHY framework provides an automated and easy-to-use compliance testing platform for a number of serial data standards. QualiPHY reduces time and effort by guiding you through each setup and fully document all results.

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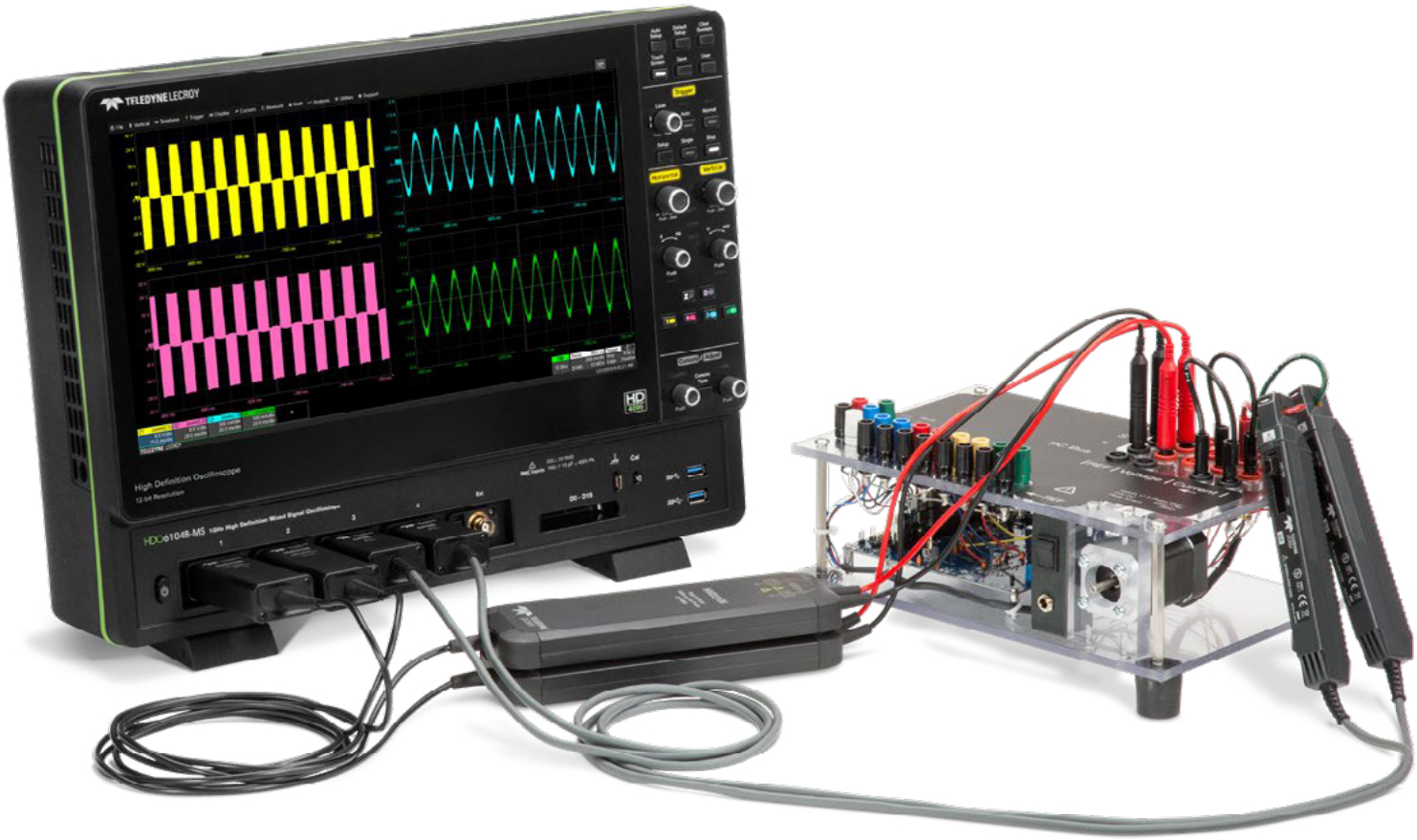


HDO6000B 12-bit oscilloscopes deliver 4 analog channels, 3-phase power analysis software, and high performance probes for inverter subsection, power system and control testing.

Flexible Power Calculations

Analyze short or long acquisitions. The mean value Numerics table summarizes static performance, while per-cycle Waveforms help you understand dynamic behaviors. Use Zoom+Gate to isolate and correlate power system behaviors to control system activity during time periods as short as a single device switching cycle.

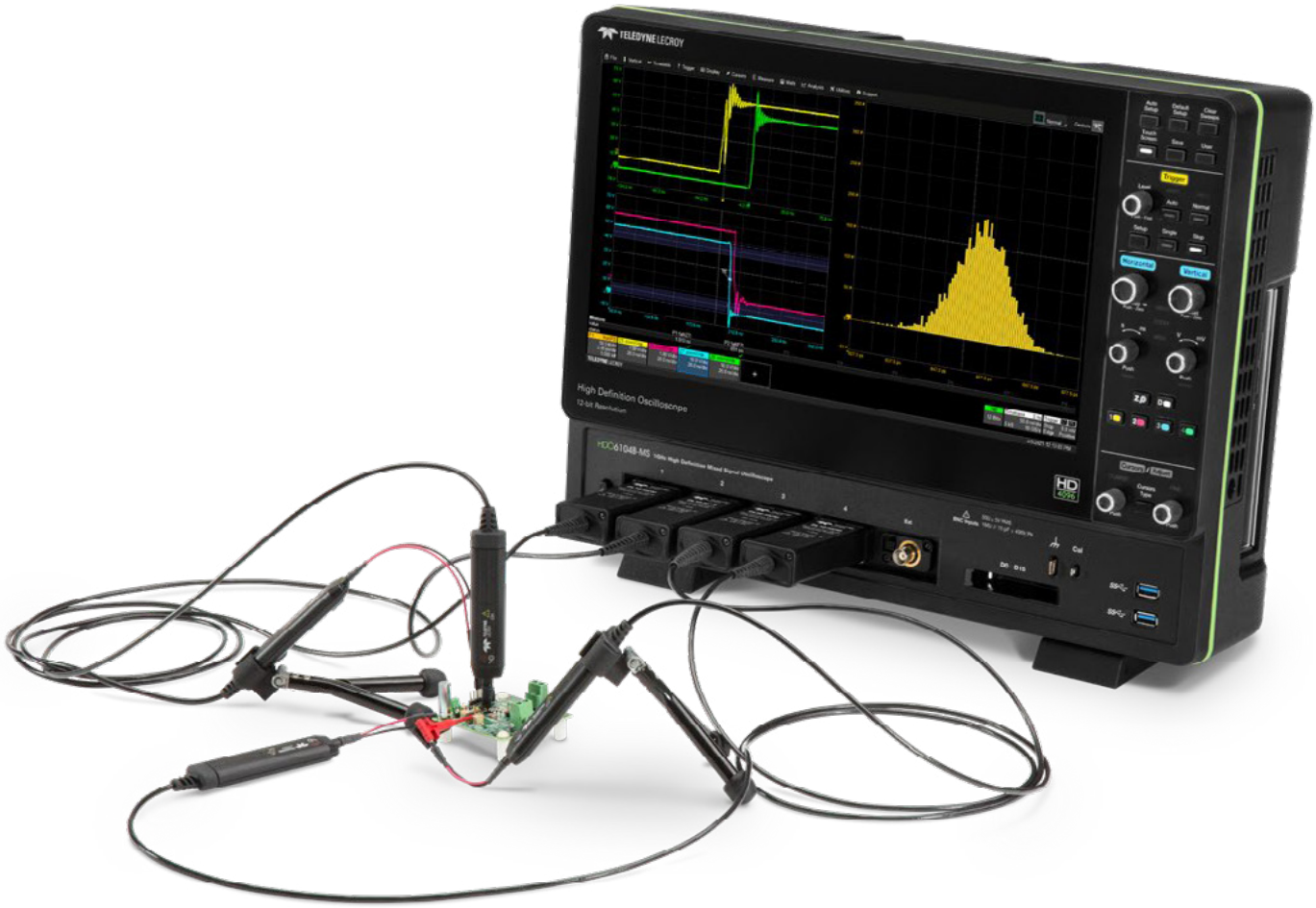
Comprehensive probing

HVD series high voltage differential probes have 65 dB CMRR at 1 MHz with upto 0.35% gain accuracy, the widest voltage ranges, and up to 6 kV common-mode rating. Connect current probes or use your own transducers with the programmable CA10 current sensor adapter to create a customized “probe”. HVFO and DL-HCM probes are ideal for gate drive probing.

Two-wattmeter Support

Both 1-phase and 3-phase measurements are supported. The two-wattmeter measurement method allows 3-phase power measurements to be made using two voltage and two current signals; therefore, 3-phase measurements can be made using 4 channels instead of 6.

Want 8 or 16 channels? The WaveRunner 8000HD has you covered. Learn more at www.teledynelecroy.com/wr8000hd



HDO6000B 12-bit oscilloscopes provide a wide range of probing solutions, compliance testing, and debug software to best address the specific test needs of the automotive industry.

Ideal probe for 48 V systems

The DL-HCM, 60 V Common Mode Differential Probes are the ideal probes for 48 V battery-powered motor and drive systems. When combined with HDO6000B 12-bit oscilloscopes, the DL10-HCM provides 1 GHz bandwidth with the highest accuracy, the best CMRR, and lowest noise.

Superior IVN tools

Unique capabilities that build on our legacy serial data trigger and decode provide the most complete in-vehicle networking (IVN) debug and validation. Cover all aspects of physical layer 10Base-T1S and 100Base-T1 Automotive Ethernet compliance testing and debug.

EMI/EMC pre-compliance test

12-bit resolution for spectral analysis provides more insight. Specialized EMC/EMI pulse parameters provide measurement flexibility. Support for all relevant electrical and magnetic field units of measure. Capability to measure sub-1 Hz magnetic field strengths.

HDO6000B 12-bit oscilloscopes' high resolution and long memory let you validate and debug all aspects of power supply, delivery and consumption – for complete confidence.

Accurate PDN measurements

Make sensitive measurements like rail collapse characterization with total confidence thanks to HDO6000B's high dynamic range and 0.5% gain accuracy. Its HD4096 architecture means an exceptionally low noise floor, for easily pinpointing noise sources.

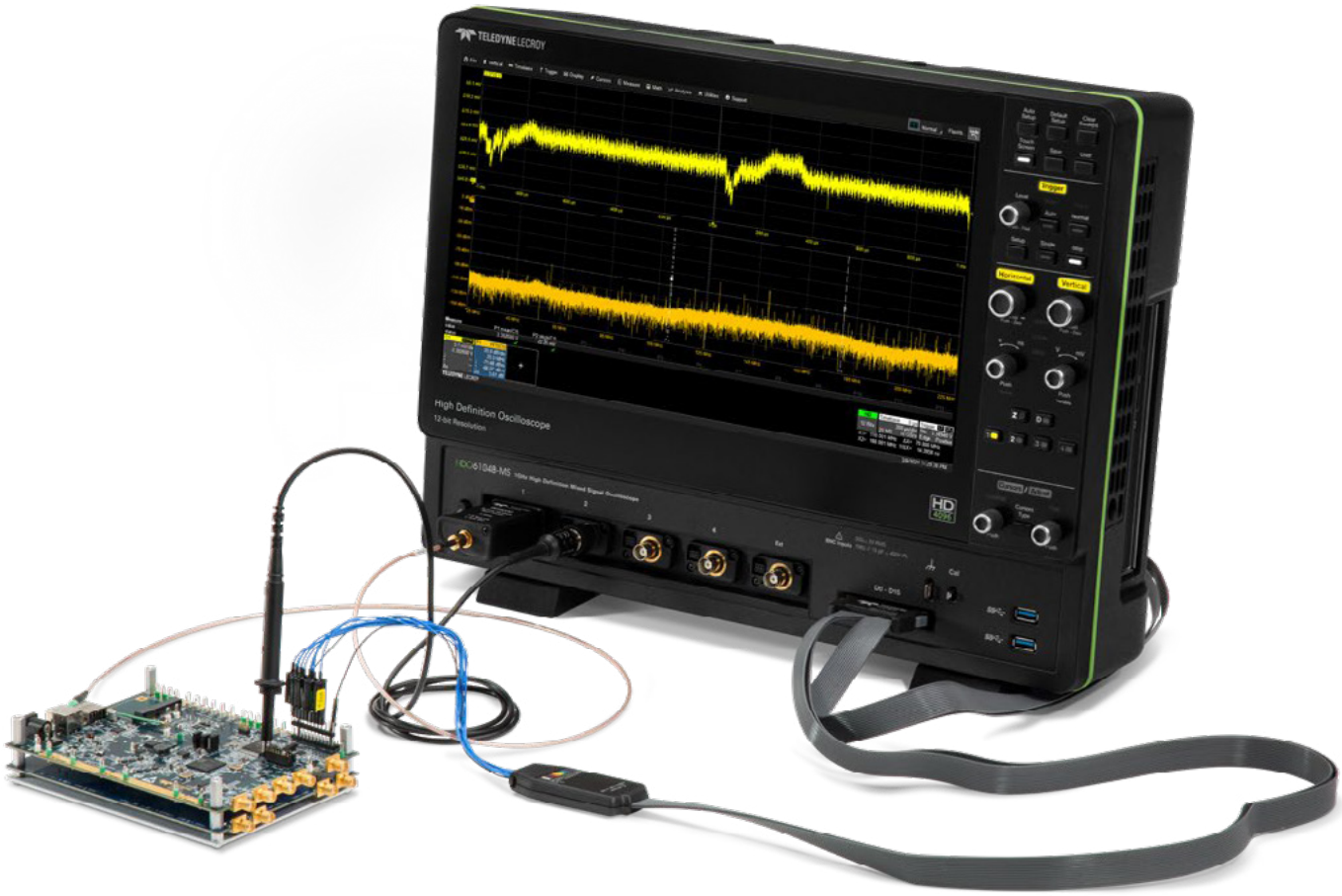
Specialized power probes

Combine HDO6000B with the RP4030 Power Rail Probe for unsurpassed insight into PDN behavior. The variety of probe tips ensures easy connectivity, and its low loading characteristics minimize disruption to the device under test.

Spectrum Analysis

Narrow in on interference causing problems in PDNs by enabling unique debug features such as spectral background removal on Spectrum-Pro-2R to eliminate spurious interference from environmental or other sources.

BEST EMBEDDED SYSTEM DEBUG



HDO6000B 12-bit oscilloscopes acquire long records at the highest resolution for the most comprehensive deeply embedded computing system analysis (analog, digital, serial data, and sensor).

Clock Analysis

Enable better analysis of clock sources by combining HDO6000B's all-instance measurements, to measure every clock edge, with the ability to capture long records and build statistics faster. Then, trend values over time or build a statistical distribution.

Protocol Analysis

HDO6000B uses powerful conditional DATA triggering to trigger on protocol elements or specific DATA patterns. Highly adaptable ERROR frame triggering helps isolate protocol errors while Search & Zoom helps correlate protocol events to embedded signals.

Power Management Tools

HDO6000B supports decoding of I^2C, SPMI, SMBus, and PMBus protocols to provide insight into dedicated power manangement serial protocols and speeding up test and debug of designs.

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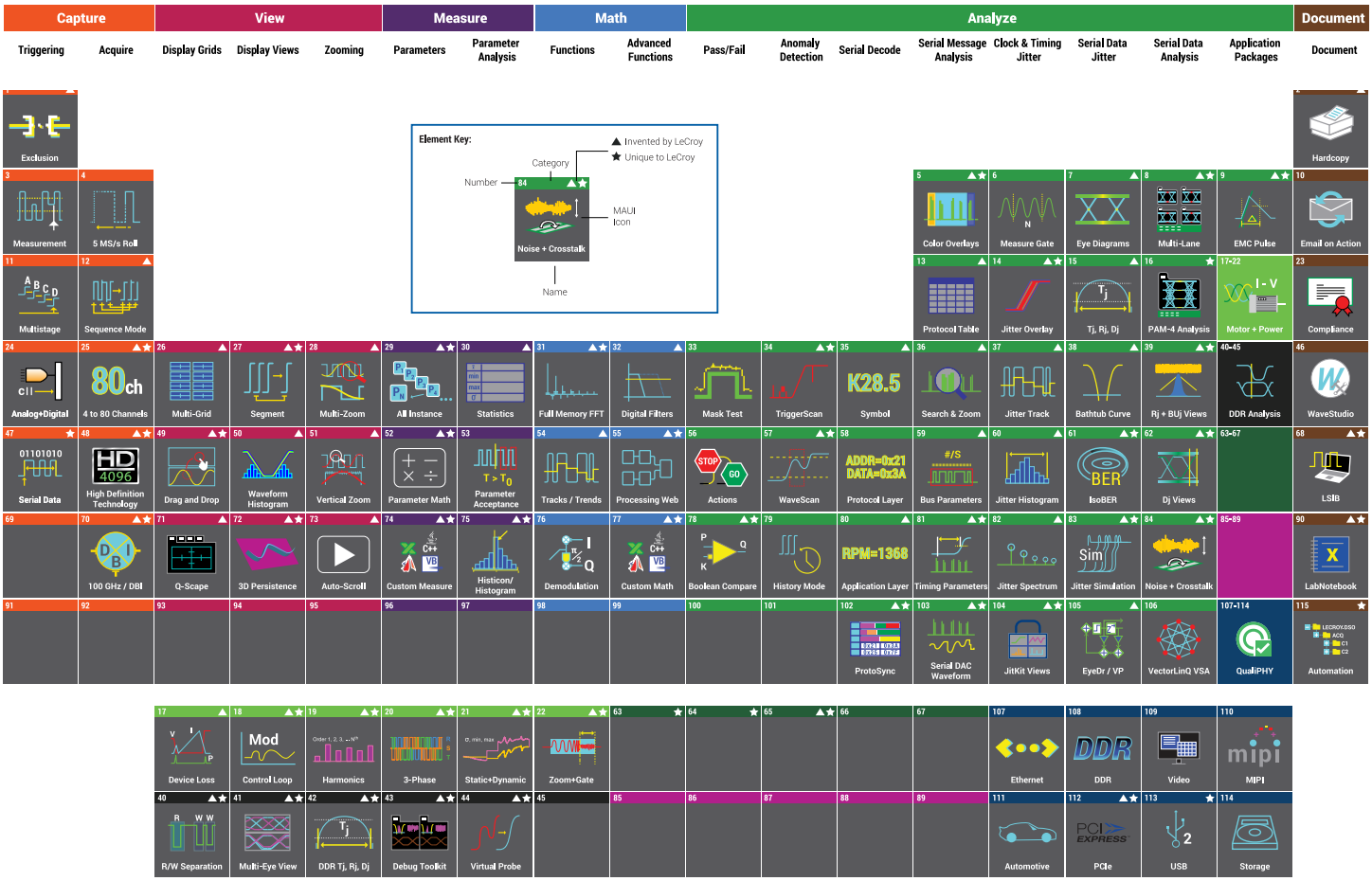
HDO6000B OSCILLOSCOPES AT A GLANCE

Key Attributes

1. 15.6" 1920 x 1080 capacitive touchscreen display
2. 4 analog input channels
3. ProBus input supports every Teledyne LeCroy probe
4. MAUI with OneTouch user interface for intuitive and efficient operation
5. Q-Scape multi-tab display architecture
6. Up to 250 Mpts of acquisition memory
7. HD4096 technology - 12 bits all the time
8. Buttons/indicators color-coded to associated waveform on display
9. Use cursors and adjust settings without opening a menu
10. Mixed Signal capability with 16 integrated digital channels
11. 6 USB 3.1 ports (2 front, 4 side)
12. HDMI and DisplayPort - supports 4K (4096 x 2304) external monitor
13. Removable SSD (standard)
14. Reference Clock Input/Output for connecting to other equipment
15. USBTMC over USB 2.0 for data offload
16. WaveSource Arbitrary Function Generator

POWERFUL, DEEP TOOLBOX



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

Teledyne LeCroy offers an extensive range of probes to meet virtually every probing need.

60 V Common Mode Differential Probes DL05-HCM, DL10-HCM		The 60 V Common Mode Differential Probes are the ideal probes for lower voltage GaN power conversion measurement with the highest accuracy, best CMRR, and lowest noise.
ZS Series High Impedance Active Probes ZS1000, ZS1500		High input impedance (1 MΩ), low 0.9 pF input capacitance and an extensive set of probe tips and ground accessories make these low-cost, single-ended probes ideal for a wide range of applications. The ZS Series is available up to 4 GHz bandwidth.
Differential Probes (200 MHz – 1.5 GHz) ZD200, ZD500, ZD1000, ZD1500 AP033		High bandwidth, excellent common-mode rejection ratio (CMRR) and low noise make these active differential probes ideal for applications such as automotive electronics and data communications. AP033 provides 10x gain for high-sensitivity measurement of series/shunt resistor voltages.
Active Voltage/Power Rail Probe RP4030		Specifically designed to probe a low impedance power/voltage rail. The RP4030 has 30 V built-in offset adjust, low attenuation (noise), and high DC input impedance with 4 GHz of bandwidth. Featuring a wide assortment of tips and leads, including solder-in and U.FL receptacle connections.
High Voltage Fiber Optically isolated Probe HVFO108		The HVFO108 is a compact, simple, affordable probe for measurement of small signals (gate drives, sensors, etc.) floating on an HV bus in power electronics designs, or for EMC, EFT, ESD and RF immunity testing sensor monitoring. Suitable for up to 35 kV common-mode. 140 dB CMRR.
HVD Series High Voltage Differential Probes HVD3102A, HVD3106A (1 kV) HVD3206A, HVD3220 (2 kV) HVD3605A (6 kV)		Available with 1, 2 or 6 kV common-mode ratings. Excellent CMRR (65 dB @ 1 MHz) at high frequencies is combined with low inherent noise, wide differential voltage range, high offset voltage capabilities, and up to 0.35% gain accuracy. The ideal probe for power conversion system test.
High Voltage Passive Probes HVP120, PPE4KV, PPE5KV, PPE6KV		The HVP and PPE series includes four fixed-attenuation probes covering a range from 1 kV to 6 kV. These probes are ideal for lightning/surge or EFT testing, or for probing in-circuit beyond the range of an LV-rated passive probe.
Current Probes CP030, CP030-3M, CP030A CP031, CP031A CP150, CP150-6M CP500, DCS025		Available in bandwidths up to 100 MHz with peak currents of 700 A and sensitivities to 1 mA/div. Extra-long cables (3 or 6 meters) available on some models. Ideal for component or power conversion system input/output measurements. DCS015 deskew calibration source also available.
Probe and Current Sensor Adapters TPA10, CA10		TPA10 adapts supported Tektronix TekProbe-compatible probes to the Teledyne LeCroy ProBus interface. CA10 is a programmable adapter for third-party current sensors that have voltage or current outputs proportional to measured current.

SPECIFICATIONS

HD 4096

	HDO6034B	HDO6054B, HDO6054B-MS	HDO6104B, HDO6014B-MS
Vertical - Analog Channels			
Analog Bandwidth @ 50 Ω (-3 dB)	350 MHz	500 MHz	1 GHz
Analog Bandwidth @ 1 MΩ (-3 dB)	350 MHz	500 MHz	500 MHz
Rise Time (10–90%, 50 Ω)	1 ns	700 ps	450 ps
Rise Time (20–80%, 50 Ω)	700 ps	500 ps	300 ps
Input Channels	4		
Vertical Resolution	12 bits; up to 15 bits with enhanced resolution (ERES)		
Effective Number of Bits (ENOB)	8.7 bits	8.6 bits	8.4 bits
Vertical Noise Floor (rms, 50 Ω)			
1 mV/div	85 µV	100 µV	145 µV
2 mV/div	85 µV	100 µV	145 µV
5 mV/div	90 µV	105 µV	150 µV
10 mV/div	95 µV	110 µV	155 µV
20 mV/div	110 µV	130 µV	185 µV
50 mV/div	210 µV	265 µV	275 µV
100 mV/div	360 µV	450 µV	500 µV
200 mV/div	1.10 mV	1.25 mV	1.75 mV
500 mV/div	2.10 mV	2.60 mV	2.75 mV
1 V/div	3.70 mV	4.50 mV	4.90 mV
Sensitivity	**50 Ω**: 1 mV–1 V/div, fully variable; **1 MΩ**: 1 mV–10 V/div, fully variable		
DC Vertical Gain Accuracy (Gain Component of DC Accuracy)	±(0.5%) FS, offset at 0 V		
Channel-Channel Isolation	60 dB up to 200 MHz 50 dB up to 350 MHz	60 dB up to 200 MHz 50 dB up to 500 MHz	60 dB up to 200 MHz 50 dB up to 500 MHz 40 dB up to 1 GHz
Offset Range	**50 Ω:** 1 mV to 4.95 mV: ±1.6 V, 5 mV to 9.9 mV: ±4 V 10 mV to 19.8 mV: ±8 V, 20 mV to 1 V: ±10 V **1 MΩ:** 1 mV to 4.95 mV: ±1.6 V, 5 mV to 9.9 mV: ±4 V 10 mV to 19.8 mV: ±8 V, 20 mV to 100 mV: ±16 V 102 mV to 198 mV: ±80 V, 200 mV to 1 V: ±160 V 1.02 V to 10 V: ±400 V		
DC Vertical Offset Accuracy	±(1.0% of offset setting + 0.5%FS + 0.02% of max offset + 1mV)		
Maximum Input Voltage	**50 Ω:** 5 Vrms, ± 10 V Peak **1 MΩ:** 400 V max. (DC + Peak AC ≤ 10 kHz)		
Input Coupling	50 Ω: DC, GND; 1 MΩ: AC, DC, GND		
Input Impedance	50 Ω ± 2.0%;1 MΩ ± 2.0% || 15 pF		
Bandwidth Limiters	20 MHz, 200 MHz		
Rescaling	Length: meters, inches, feet, yards, miles; Mass: grams, slugs; Temperature: Celsius, Fahrenheit, Kelvin; Angle: radian, arcdegr, arcmin, arcsec, cycles, revolutions, turns; Velocity: m/s, in/s, ft/s, yd/s, miles/s; Acceleration: m/s2, in/s2, ft/s2, g0; Volume: liters, cubic meters, cubic inches, cubic feet, cubic yards; Force (Weight): Newton, grain, ounce, pound; Pressure: Pascal, bar, atmosphere (technical), atmosphere (standard), torr, psi; Electrical: Volts, Amps, Watts, Volt-Amperes, Volt-Amperes reactive, Farad, Coulomb, Ohm, Siemen, Volt/meter, Coulomb/m2, Farad/meter, Siemen/meter, power factor; Magnetic: Weber, Tesla, Henry, Amp/meter, Henry/meter; Energy: Joule, BTU, calorie; Rotating Machine: radian/second, frequency, revolution/second, revolution/minute, N·m, lb-ft, lb-in, oz-in, Watt, horsepower; Other: %		
Horizontal - Analog Channels			
Timebases	Internal timebase common to 4 input channels		
Time/Division 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 ≤ 10 ns/div; Roll Mode available at ≥ 100 ms/div and ≤ 5 MS/s		
Clock Accuracy	±2.5 ppm + 1.0ppm/year from calibration		
Sample Clock Jitter	Up to 10 ms acquired time range: 280 fsrms (internal timebase reference)		
Delta Time Measurement Accuracy	$\sqrt{2} * \sqrt{\left(\frac{Noise}{SlewRate}\right)^2 + (Sample\ Clock\ Jitter)^2}$ (RMS) + (clock accuracy * reading) (seconds)		
Jitter Measurement Floor	$\sqrt{\left(\frac{Noise}{SlewRate}\right)^2 + (Sample\ Clock\ Jitter)^2}$ (RMS, seconds, TIE)		
Jitter Between Channels	Analog Channels: 2 psrms (TIE, typical) Digital Channels: 350 ps (maximum) between any two channels Analog-Digital Channels: <5ns (maximum) between any analog and any digital channel		
Channel-Channel Deskew Range	±9 x time/div. setting, 100 ms max., each channel		
External Timebase Reference (Input)	10 MHz ±25 ppm at 0 to 10 dBm into 50 Ohms		
External Timebase Reference (Output)	10 MHz, 2.0 dBm ±1.5 dBm, sinewave synchronized to reference being used (internal or external reference)		

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SPECIFICATIONS

HD 4096

	HDO6034B	HDO6054B, HDO6054B-MS	HDO6104B, HDO6014B-MS
Acquisition - Analog Channels			
Sample Rate (Single-Shot)	10 GS/s on all 4 Channels with Enhanced Sample Rate		
Sample Rate (Repetitive)	125 GS/s, user selectable for repetitive signals (20 ps/div to 10 ns/div)		
Memory Length (Number of Segments in Sequence Acquisition Mode)	**Standard:** 50 Mpts/ch for all channels (30,000 segments) **Option - L:** 100 Mpts/ch for all channels (60,000 segments) **Option -XL:** 250 Mpts/ch for all channels (65,000 segments)		
Intersegment Time	1.25 µs		
Averaging	Summed averaging to 1 million sweeps; continuous averaging to 1 million sweeps		
Interpolation	Linear or Sin x/x (2 pt and 4 pt); 5 or 10 GS/s Enhanced Sample Rate defaults to 2 pt or 4 pt Sin x/x respectively		
Vertical, Horizontal, Acquisition - Digital Channels (-MS Models only)			
Maximum Input Frequency	250 MHz		
Minimum Detectable Pulse Width	1 ns		
Input Dynamic Range	±20 V		
Input Impedance (Flying Leads)	100 kΩ || 5 pF		
Input Channels	16 Digital Channels		
Maximum Input Voltage	±30V Peak		
Minimum Input Voltage Swing	400 mV		
Threshold Groupings	Pod 2: D15 to D8, Pod 1: D7 to D0		
Threshold Selections	TTL, ECL, CMOS (2.5 V, 3.3 V, 5 V), PECL, LVDS or User Defined		
Threshold Accuracy	±(3% of threshold setting + 100 mV)		
User Defined Threshold Range	±10 V in 20 mV steps		
User Defined Hysteresis Range	100 mV to 1.4 V in 100 mV steps		
Sample Rate	1.25 GS/s		
Record Length	**Standard:** 50 MS **Optional -L:** 100 MS **Optional -XL:** 125 MS		
Channel-to-Channel Skew	350 ps		
Triggering System			
Modes	Normal, Auto, Single, and Stop		
Sources	Any input channel, Ext, Ext/10, or Line; slope and level unique to each source (except Line)		
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		
Trigger and Interpolator Jitter	≤ 4.0 ps rms (typical) <0.1 ps rms (typical, software assisted)	≤ 3.5 ps rms (typical) <0.1 ps rms (typical, software assisted)	≤ 3.5 ps rms (typical) <0.1 ps rms (typical, software assisted)
Internal Trigger Level Range	±4.1 div from center (typical)		
External Trigger Level Range	Ext (±400 mV); Ext/10 (±4 V)		
Maximum Trigger Rate	800,000 waveforms/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, SMART Trigger	350 MHz	500 MHz	1 GHz

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	HDO6034B	HDO6054B, HDO6054B-MS	HDO6104B, HDO6104B-MS
Trigger Types			
Edge	Triggers when signal meets slope (positive, negative, or either) and level condition.		
Width	Triggers on positive or negative glitches with selectable widths. Minimum width: 1.5 ns, maximum width: 20 s		
Glitch	Triggers on positive or negative glitches with selectable widths. Minimum width: 1.5 ns, maximum width: 20 s		
Window	Triggers when signal exits a window defined by adjustable thresholds.		
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 pattern.		
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.		
Interval	Triggers on intervals selectable between 1 ns and 20 s.		
Dropout	Triggers if signal drops out for longer than selected time between 1 ns and 20 s.		
Measurement	Select from a large number of measurement parameters to trigger on a measurement value with qualified limits.		
Multi-stage: 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).		
Multi-stage: 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).		
Multi-Stage: Cascade (Sequence) Trigger, 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		
Multi-Stage: Cascade (Sequence) Trigger, Types	Cascade A then B: Edge, Window, Pattern (Logic) Width, Glitch, Interval, Dropout, or Measurement. Measurement can be on Stage B only. Cascade A then B then C (Measurement): Edge, Window, Pattern (Logic), Width, Glitch, Interval, Dropout, or Measurement. Measurement can be on Stage C only. Cascade A then B then C: Edge, Window, Pattern (Logic)		
Multi-Stage: Cascade (Sequence) Trigger, Holdoff	Holdoff between A and B or B and C is selectable by time or number of events. Measurement trigger selection as the last stage in a Cascade precludes a holdoff setting between the prior stage and the last stage.		
Low Speed Serial Protocol Triggering (Optional)			
	Please refer to the Oscilloscope Features, Options, and Accessories Catalog for the latest offerings on all our instruments		
Measurement Tools			
Measurement Functionality	Display up to 8 measurement parameters together with statistics including mean, minimum, maximum, standard deviation, and total number. Each occurrence of each parameter is measured and added to the statistics table. Histicons provide a fast, dynamic view of parameters and waveshape characteristics. Parameter math allows addition, subtraction, multiplication, or division of two different parameters. Parameter gates define the location for measurement on the source waveform. Parameter accept criteria define allowable values based on range setting or waveform state.		
Measurement Parameters - Horizontal and Jitter	Cycles (number of), Delay (from trigger, 50%), Δ Delay (50%), Duty Cycle (50%, @level), Edges (number of, @ level), Fall Time (90-10, @levels), Frequency (50%, @level), Half Period (@level), Hold Time (@level), N Cycle Jitter (peakpeak), Number of Points, Period (50%, @level), Δ Period (@level), Phase (@level), Rise Time (10-90, @levels), Setup (@levels), Skew (@levels), Slew Rate (@levels), Time Interval Error (@level), Time (@level), Δ Time (@level), Width (50%, @level), Δ Width (@level), X(value)@max, X(value)@min		
Measurement Parameters - Vertical	Amplitude, Base, Level@X, Maximum, Mean, Median, Minimum, Peak-to-Peak, RMS, Std. Deviation, Top		
Measurement Parameters - Pulse	Area, Base, Fall Time (90-10, 80-20, @levels), Overshoot (positive, negative), Rise Time (10-90, 80-20, @levels), Top, Width (50%)		
Measurement Parameters - Statistical (on Histograms)	Full Width (@HalfMax, @%), Amplitude, Base, Peak@MaxPopulation, Maximum, Mean, Median, Minimum, Mode, Range, RMS, Std. Deviation, Top, X(value)@Peak, Peaks (number of), Percentile, Population (@bin, total)		
Math Tools			
Math Functionality	Display up to 8 math functions 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 - Basic Math	Average (summed), Average (continuous), Difference (–), Envelope, Floor, Invert (negate), Product (x), Ratio (/), Reciprocal, Rescale (with units), Roof, Sum (+)		
Math Operators - Digital (incl. with -MS Models)	Digital AND, Digital DFlipFlop, Digital NAND, Digital NOR, Digital NOT, Digital OR, Digital XOR		
Math Operators - Filters	Enhanced Resolution (ERes) to 15 bits vertical, Interpolate (cubic, quadratic, sinx/x)		
Math Operators - Frequency Analysis	FFT (power spectrum, magnitude, phase, power density, real, imaginary, magnitude squared) up to full analysis memory length. Select from Rectangular, VonHann, Hamming, FlatTop and Blackman Harris windows.		
Math Operators - Functions	Absolute value, Correlation (two waveforms), Derivative, Deskew (resample), Exp (base e), Exp (base 10), Integral, Invert (negate), Log (base e), Log (base 10), Reciprocal, Rescale (with units), Square, Square Root, Zoom (identity)		
Math Operators - Other	Segment, Sparse		
Measurement and Math Integration			
	Histogram of statistical distributions of up to 2 billion measurements. Trend (datalog) of up to 1 million measurements. Track (measurement vs. time, time-correlated to acquisitions) of any parameter. Persistence histogram and persistence trace (mean, range, sigma).		

SPECIFICATIONS

HD 4096

	HDO6034B	HDO6054B, HDO6054B-MS	HDO6104B, HDO6104B-MS

Pass/Fail Testing

	Display up to 8 Pass/Fail queries using a Single or Dual Parameter Comparison (compare All values, or Any value <, ≤, =, >, ≥, within limit ±Δ value or %) or Mask Test (pre-defined or user-defined mask, waveform All In, All Out, Any In, or Any Out conditions). Combine queries into a boolean expression to Pass or Fail IF "All True", "All False", "Any True", "Any False", or groups of "All" or "Any", with following THEN Save (waveforms), Stop (test), (sound) Alarm, (send) Pulse, (save) LabNotebook or other User(-defined) Action.

Display System

Size	Color 15.6" widescreen capacitive touch screen
Resolution	Full HD (1920 x 1080 pixels)
Number of Traces	Display a maximum of 16 traces. Simultaneously display channel, zoom, memory and math traces.
Grid Styles	Auto, Single, Dual, Triplex, Quad, Octal, Tandem, Triad, Quattro, Twelve, Sixteen, Twenty, X-Y, Single+X-Y, Dual+X-Y. Supports Normal Display Mode (1 grid style, selectable) or Q-Scape Display Mode (4 different tabs, each with individually selectable grid styles). Q-Scape tabbed displays may be viewed in Single, Dual, or Mosaic mode.
Waveform Representation	Sample dots joined, or sample dots only

Processor/CPU

Type	Intel® Core i5-6500 Quad Core, 3.2 GHz (or better)
Processor Memory	16 GB standard
Operating System	Microsoft Windows® 10
Real Time Clock	Date and time displayed with waveform in hardcopy files. SNTP support to synchronize to precision internal clocks.

Connectivity

Ethernet Port	2 x 10/100/1000BaseT Ethernet interface (RJ45 port)
USB Host Ports	4 side USB 3.1 Gen1 ports, 2 front USB 3.1 Gen1 ports
USB Device Port	1 USBTMC over USB 2.0 port
GPIB Port (Optional)	Supports IEEE—488.2 (External)
External Monitor Port	1 x DisplayPort, supports up to 4096x2304 @ 24 Hz 1 x HDMI, supports up to 4096x2304 @ 60 Hz
Remote Control	Microsoft COM Automation or LeCroy Remote Command Set
Network Communication Standard	VICP or VXI-11, LXI Compatible

Power Requirements

Voltage	100-240 VAC (±10%) at 50/60/400 Hz (±5%)
Nominal Power Consumption	220 W / 220 VA
Max Power Consumption	320 W / 320 VA

Environmental

Temperature (Operating)	+5 °C to +40 °C
Temperature (Non-Operating)	–20 °C to +60 °C
Humidity (Operating)	5% to 90% relative humidity (non-condensing) up to +31 °C Upper limit derates to 50% relative humidity (non-condensing) at +40 °C
Humidity (Non-Operating)	5% to 95% relative humidity (non-condensing) as tested per MIL-PRF-28800F
Altitude (Operating)	Up to 10,000 ft (3048 m) at or below +30 °C
Altitude (Non-Operating)	Up to 40,000 ft (12,192 m)
Random Vibration (Operating)	0.31 grms 5 Hz to 500 Hz, 20 minutes in each of three orthogonal axes
Random Vibration (Non-Operating)	2.4 grms 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes
Functional Shock	30 g peak, half sine, 11 ms pulse, 3 shocks (positive and negative) in each of three orthogonal axes, 18 shocks total

Size and Weight

Dimensions (HWD)	13.8" H x 17.5" W x 6.7" D (352 mm x 445 mm x 170 mm)
Weight	21 lbs (9.8 kg)

Certifications

CE Certification	CE compliant, UL and cUL listed; conforms to UL 61010-1 (3rd Edition), UL 61010-2-030 (1st Edition)
UL and cUL Listing	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.

WaveSource Arbitrary Waveform Generator (all models)

General

Max Frequency	25 MHz
Sample Rate	125 MS/s
Arbitrary Waveform Length	16 kpts
Output Amplitude	4 mVpp - 6 Vpp (HiZ); 2 mVpp - 3 Vpp (50 Ω)
Waveform Types	Sine, Square, Pulse, Triangle, DC, Noise, Arbitrary Waveform

Frequency Specification

Sine	1 µHz - 25 MHz
Square/Pulse	1 µHz - 10 MHz
Triangular	1 µHz - 300 KHz
DC Output	±3 V (HiZ); ±1.5 V (50 Ω)
Noise	25 MHz (-3 dB)
Arbitrary Waveform	1 µHz - 3 MHz

ORDERING INFORMATION

HD 4096

Product Description	Product Code
HDO6000B Oscilloscopes	
350 MHz, 4 Ch, 12 Bits, 10 GS/s, 50 Mpts/Ch High Definition Oscilloscope with 15.6" 1920x1080 capacitive touch screen and 4K extended desktop	HDO6034B
500 MHz, 4 Ch, 12 Bits, 10 GS/s, 50 Mpts/Ch High Definition Oscilloscope with 15.6" 1920x1080 capacitive touch screen and 4K extended desktop	HDO6054B
1 GHz, 4 Ch, 12 Bits, 10 GS/s, 50 Mpts/Ch High Definition Oscilloscope with 15.6" 1920x1080 capacitive touch screen and 4K extended desktop	HDO6104B
HDO6000B-MS Mixed Signal Oscilloscopes	
500 MHz, 4 Ch, 12 Bits, 10 GS/s, 50 Mpts/Ch High Definition Mixed Signal Oscilloscope with 15.6" 1920x1080 capacitive touch screen and 4K extended desktop	HDO6054B-MS
1 GHz, 4 Ch, 12 Bits, 10 GS/s, 50 Mpts/Ch High Definition Mixed Signal Oscilloscope with 15.6" 1920x1080 capacitive touch screen and 4K extended desktop	HDO6104B-MS
Included with Standard Configurations (HDO6000B and HDO6000B-MS)	
÷10 Passive Probe (Qty. 4), Getting Started Guide, Anti-virus Software (Trial Version), Microsoft Windows® 10, Removable Solid State Drive, Commercial NIST Traceable Calibration with Certificate, Power Cable for the Destination Country, Protective Front Cover, 3-year Warranty	
Included with HDO6000B-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	HDO6KB-L
250 Mpts/ch Memory Option	HDO6KB-XL
CPU, Computer, and Other Hardware Options	
Additional Removable Solid State Drive	HDO6KB-SSD-02
WaveSource Arbitrary Function Generator	HDO6KB-AFG
Serial Trigger and Decode Options	
100Base-T1 Trigger & Decode	HDO6K-100Base-T1bus TD
100Base-T1 Trigger, Decode , Measure/Graph, and Eye Diagram	HDO6K-100Base-T1bus TDME
MIL-STD-1553 Trigger & Decode	HDO6K-1553 TD
MIL-STD-1553 Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-1553 TDME
ARINC 429 Bus Symbolic Decode, Measure/Graph, and Eye Diagram	HDO6k-ARINC429BUS DME SYMBOLIC
ARINC 429 Symbolic Decode	HDO6K-ARINC429bus DSymbolic
Audiobus Trigger and Decode	HDO6K-Audiobus TD
Audiobus Trigger, Decode, And Graph	HDO6K-Audiobus TDG
CAN FD Trigger & Decode	HDO6K-CAN FDbus TD
CAN FD Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-CAN FDBUS TDME
CAN FD Symbolic Trigger, Decode, and Measure/Graph, and Eye Diagram	HDO6K-CAN FDBUS TDME SYMBOLIC
CAN Trigger and Decode Option	HDO6K-CANbus TD
CAN Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-CANBUS TDME
CAN Symbolic Trigger, Decode, and Measure/Graph, and Eye Diagram	HDO6K-CANBUS TDME SYMBOLIC
DigRF 3G Decode	HDO6K-DigRF3Gbus D
DigRF v4 Decode	HDO6K-DigRFv4bus D

Product Description	Product Code
Serial Trigger and Decode Options (cont'd)	
D-PHY Decode	HDO6K-DPHYbus D
I²C, SPI and UART-RS232 Trigger & Decode	HDO6K-EMB TD
I²C, SPI, UART-RS232 Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-EMB TDME
ENET Decode	HDO6K-ENETbus D
FlexRay Trigger & Decode	HDO6K-FlexRaybus TD
FlexRay Trigger, Decode, Measure/Graph and Physical Layer	HDO6K-FLEXRAYBUS TDMP
I²C Bus Trigger & Decode	HDO6K-I2Cbus TD
I²C Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-I2CBUS TDME
I³C Bus Trigger & Decode	HDO6K-I3Cbus TD
I³C Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-I3Cbus TDME
LIN Trigger & Decode	HDO6K-LINbus TD
LIN Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-LINBUS TDME
Manchester Decode	HDO6K-Manchesterbus D
MDIO Decode	HDO6K-MDIObus D
NRZ Decode	HDO6K-NRZbus D
PMBus Trigger & Decode	HDO6K-PMBUS TD
PMBus Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-PMBUS TDME
SENT Trigger & Decode	HDO6K-SENTbus TD
SENT Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-SENTbus TDME
SpaceWire Decode	HDO6K-SpaceWirebus D
SPI Bus Trigger and Decode	HDO6K-SPIbus TD
SPI Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-SPIBUS TDME
SMBus Trigger & Decode	HDO6K-SMBUS TD
SMBus Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-SMBUS TDME
UART and RS-232 Trigger & Decode	HDO6K-UART-RS232bus TD
UART-RS232 Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-UART-RS232BUS TDME
USB2-HSIC Decode	HDO6K-USB2-HSICbus D
USB 2.0 Trigger and Decode	HDO6K-USB2bus TD
USB 2.0 Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6k-USB2BUS TDME
USB Power Delivery Trigger & Decode	HDO6K-USBPD TD
USB Power Delivery Trigger, Decode, Measure/Graph, and Eye Diagram	HDO6K-USBPD TDME
Serial Data Compliance Test Options	
QualiPHY 10Base-T1L Compliance Software	QPHY-10Base-T1L
QualiPHY 10Base-T1S Compliance Software	QPHY-10Base-T1S
QualiPHY 100Base-T1 Compliance Software	QPHY-100Base-T1
QualiPHY Ethernet 10/100/1000BT Software	QPHY-ENET
QualiPHY MOST50 ePHY Compliance Software	QPHY-MOST50
QualiPHY USB 2.0 Compliance Software for Low Speed and Full Speed data rates	QPHY-USB
Serial Data Analysis Options	
Serial Data Mask Option	HDO6K-SDM
Power Analysis Options	
Power Analyzer Software	HDO6K-PWR
Digital Power Management Analysis Software	HDO6k-DIG-PWR-MGMT
3-Phase Power Analysis Software	HDO6K-THREEPHASEPOWER
3-Phase Power Harmonics Calculation Software (requires HDO6K-THREEPHASEPOWER)	HDO6K-THREEPHASEHARMONICS
3-Phase Power Vector Display	HDO6K-THREEPHASEVECTOR
Jitter Analysis Options	
Clock and Clock-Data Timing Jitter Analysis Package	HDO6K-JITKIT

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ORDERING INFORMATION

Product Description	Product Code
Digital Filtering Options	
DFP2 Digital Filter Option	HDO6K-DFP2
Other Software Options	
Spectrum Analysis Option (1 Trace)	HDO6K-SPECTRUM-1
Spectrum Analysis Option (2 Traces + Reference)	HDO6K-SPECTRUM-PRO-2R
Advanced Customization Option	HDO6K-XDEV
EMC Pulse Parameter Software Package	HDO6K-EMC
Remote Control/Network Options	
External GPIB Accessory	USB2-GPIB
General Accessories	
Carrying Case	WPHD-CARRYCASE
HDO6000B Rackmount Kit	HDO6KB-RACKMOUNT
Probes	
500 MHz Passive Probe, 2.5mm, 10:1, 10 MΩ	PP023-1
500 MHz Passive Probe, 5mm, 10:1, 10 MΩ	PP026-1
High Voltage Fiber Optic Probe, 150 MHz	HVFO108
TekProbe to ProBus Probe Adapter	TPA10
Power/Voltage Rail Probe. 4 GHz bandwidth, 1.2x attenuation, ±30V offset, ±800mV	RP4030
1 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe	ZS1000
1.5 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe	ZS1500
30 A; 50 MHz Current Probe – AC/DC; 30 A_{rms}; 50 A_{peak} Pulse	CP030
30 A, 10 MHz Current Probe - AC/DC, 30 A rms, 50 A Peak Pulse, 3 meter cable	CP030-3M
30A, 50 MHz High Sensitivity Current Probe - AC/DC, 30 A_{rms}, 50 A_{peak} Pulse, 1.5 meter cable	CP030A
30 A; 100 MHz Current Probe – AC/DC; 30 A_{rms}; 50 A_{peak} Pulse	CP031
30A, 100 MHz High Sensitivity Current Probe - AC/DC, 30 A_{rms}, 50 A_{peak} Pulse, 1.5 meter cable	CP031A

Product Description	Product Code
Probes (cont'd)	
150 A; 10 MHz Current Probe – AC/DC; 150 A_{rms}; 500 A_{peak} Pulse	CP150
150 A, 5 MHz Current Probe - AC/DC, 150 A rms, 500 A Peak Pulse, 6 meter cable	CP150-6M
500 A; 2 MHz Current Probe – AC/DC; 500 A_{rms}; 700 A_{peak} Pulse	CP500
Deskew Calibration Source	DCS025
Programmable Current Sensor to ProBus Adapter (for third-party current sensors)	CA10
500 MHz, Active Differential Probe (÷1, ÷10, ÷100)	AP033
500 MHz 60 V Common Mode Differential Probe	DL05-HCM
1 GHz 60 V Common Mode Differential Probe	DL10-HCM
200 MHz, 3.5 pF, 1 MΩ Active Differential Probe, ±20 V	ZD200
500 MHz, 1.0 pF Active Differential Probe, ±8 V	ZD500
1 GHz, 1.0 pF, 1 MΩ Active Differential Probe, ±8 V	ZD1000
1.5 GHz, 1.0 pF Active Differential Probe, ±8 V	ZD1500
1,500 V, 25 MHz High-Voltage Differential Probe	HVD3102A
1kV, 25 MHz High Voltage Differential Probe without tip Accessories)	HVD3102A-NOACC
1,500 V, 120 MHz High-Voltage Differential Probe	HVD3106A
1kV, 120 MHz High Voltage Differential Probe without tip Accessories	HVD3106A-NOACC
1kV, 80 MHz High Voltage Differential Probe with 6m cable	HVD3106A-6M
2kV, 120 MHz High Voltage Differential Probe	HVD3206A
2kV, 80 MHz High Voltage Differential Probe with 6m cable	HVD3206A-6M
6kV, 100 MHz High Voltage Differential Probe	HVD3605A
700 V, 25 MHz High Voltage Differential Probe (÷10, ÷100)	AP031
400 MHz, 1kV Vrms High-Voltage Passive Probe	HVP120
100:1 400 MHz 50 MΩ 4 kV High-voltage Probe	PPE4KV
1000:1 400 MHz 50 MΩ 5 kV High-voltage Probe	PPE5KV
1000:1 400 MHz 50 MΩ 6 kV High-voltage Probe	PPE6KV

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