Highest Resolution

More Capability

Comprehensive Probe Support
WaveSurfer 4000HD extends Teledyne LeCroy's leadership in High Definition Oscilloscopes with a bright, 12.1” touch screen display, performance without compromise, and price points that fit your budget.

12 bits all the time.
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 and oscilloscope bandwidth ratings up to 1 GHz, while 5 GS/s sample rate 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.
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.
Protocol Analysis with Serial Trigger and Decode

- Intuitive, color-coded overlays make it easy to understand serial data information
- Powerful, conditional data triggering capabilities
- Interactive decode table summarizes results of two different protocol decodes
- Touch a row in the table to automatically zoom and display the selected packet
- Search and conditional filtering

Logic Analysis with 16-channel Mixed Signal Capability

- Simultaneously view, measure, and analyze 4 analog and 16 digital channels
- Dedicated digital logic port does not consume analog channels
- Analog and digital channels can be incorporated into a single pattern trigger
- Find anomalies in digital waveforms using WaveScan, trends, statistics, and histicons

MAUI with OneTouch

- Most unique touch screen features on any oscilloscope
- Drag-and-drop to dramatically reduce setup time
- All common operations can be performed with one touch
**Spectrum Analyzer**

- Spectrum analyzer style controls
- Logarithmic scales
- Pop up Peaks and Markers table

**Built-in Waveform Generator**

- Frequencies of up to 25 MHz
- Wide variety of waveform sources available
- Saved waveforms can be uploaded to oscilloscope to generate arbitrary waveforms

**DVM and Frequency Counter**

- 4-digit digital voltmeter, 5-digit frequency counter
- Works with any channel; measurements update even when system is not triggering
- Set voltage readings to DC, DC RMS, or AC RMS

The DVM license key can be downloaded at no charge from [teledynelecroy.com/ws4000hd/redeemdvm](http://teledynelecroy.com/ws4000hd/redeemdvm)

**LabNotebook**

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

To learn more about the capabilities of the WaveSurfer 4000HD, see the Oscilloscope Features, Options, and Accessories catalog [cdn.teledynelecroy.com/files/pdf/lbw-scopes-options-catalog.pdf](http://cdn.teledynelecroy.com/files/pdf/lbw-scopes-options-catalog.pdf)
COMPREHENSIVE PROBE SUPPORT

Over 30 probes in 9 categories

Active Power Rail Probe
- RP2060
- RP4060
- Large (60 V) built-in offset, low noise
- Perfect for low impedance power rails
- Solder-in & U.FL connections

Active Voltage Probes
- ZS1000
- ZS1500
- Low 0.9 pF input capacitance
- High input impedance (1 MΩ)
- Low cost

Current Probes
- CP030B, CP030-3M,
- CP031, CP031A
- CP150B, CP150-6M
- CP500, DCS025
- Peak currents up to 700 A
- Sensitivities to 1 mA/div
- Bandwidth up to 100 MHz
<table>
<thead>
<tr>
<th>Differential Probes</th>
<th>High Voltage Differential Probes</th>
<th>High Voltage Passive Probes</th>
</tr>
</thead>
<tbody>
<tr>
<td>ZD1500, ZD1000, ZD500, ZD200, AP033</td>
<td>HVD3102A, HVD3106A (1 kV) HVD3206A, HVD3220 (2 kV) HVD3605A (6 kV)</td>
<td>HVP120 PPE6KV-A</td>
</tr>
<tr>
<td>• High CMRR, high bandwidth, low noise</td>
<td>• 1, 2, or 6 kV common-mode ratings</td>
<td>• 1 kV to 6 kV ratings</td>
</tr>
<tr>
<td>• 1 pF capacitance, wide dynamic range</td>
<td>• Excellent CMRR (65 dB at 1 MHz)</td>
<td>• Safe and easy probing accessories</td>
</tr>
<tr>
<td>• Series/shunt voltage measurement</td>
<td>• 1% gain accuracy</td>
<td>• Sense pin for automatic scaling</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>High Voltage Fiber Optically-isolated Probes</th>
<th>Passive Probes</th>
<th>Probe Adapters</th>
</tr>
</thead>
<tbody>
<tr>
<td>HVFO108</td>
<td>PP019, PP026</td>
<td>TPA10</td>
</tr>
<tr>
<td>• 35 kV common-mode rating</td>
<td>• Rated for 500 V</td>
<td>• Supports TekProbe interface level II</td>
</tr>
<tr>
<td>• Highest possible CMRR (140 dB)</td>
<td>• Sense pin for automatic scaling</td>
<td>• Configure power and offset control</td>
</tr>
<tr>
<td>• Ideal for gate-drive measurements</td>
<td>• High input impedance of 10 MΩ</td>
<td>• Supports wide variety of Tek probes</td>
</tr>
</tbody>
</table>
Clock Analysis

- Capture long records to build statistics faster
- All-instance measurements measure every clock edge in any acquisition length
- Trend values over time
- Histicons show statistical distribution
Power Rail Analysis

- 12-bit resolution and low noise clearly shows small signal details in power rails
- FFT or Spectrum Analyzer determines root cause of high noise events
- Built-in high offset capability permits native probing of power rails

Protocol Analysis

- Trigger on protocol elements or specific DATA patterns using powerful conditional DATA triggering
- Highly adaptable ERROR frame triggering isolates protocol errors
- Combine UART/SPI bytes into single “message frame” to trigger on proprietary protocols
- Use Search and Zoom to correlate protocol events to other embedded signals

Power Analysis

- Measure and analyze operating characteristics of power conversion circuits
- Identify turn-on and turn-off transitions using color-coded overlays
- Automatically calculate switching device measurements
- Measure input/output power and input harmonics
Key Attributes

1. 12.1” 1280 x 800 capacitive touch screen display
2. Buttons/indicators color-coded to associated waveform on display
3. MAUI with OneTouch user interface for intuitive and efficient operation
4. HD4096 Technology - 12 bits all the time
5. Use cursors and adjust settings without opening a menu
6. ProBus input supports over 30 probes in 9 product categories
7. Mixed Signal capability with 16 channel dedicated digital logic port
8. USB 3.1 ports for easy connectivity
9. WaveSource Arbitrary Waveform Generator
10. HDMI output
11. USB TMC over USB 2.0 for data offload
### Vertical - Analog Channels

<table>
<thead>
<tr>
<th></th>
<th>WaveSurfer 4024HD</th>
<th>WaveSurfer 4034HD</th>
<th>WaveSurfer 4054HD</th>
<th>WaveSurfer 4104HD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Analog Bandwidth @ 50 Ω (-3 dB)</td>
<td>200 MHz</td>
<td>350 MHz</td>
<td>500 MHz</td>
<td>1 GHz</td>
</tr>
<tr>
<td>Rise Time (10–90%)</td>
<td>1.75 ns</td>
<td>1 ns</td>
<td>700 ps</td>
<td>450 ps</td>
</tr>
<tr>
<td>Input Channels</td>
<td>4</td>
<td>4</td>
<td>4</td>
<td>4</td>
</tr>
<tr>
<td>Vertical Resolution</td>
<td>12 bits</td>
<td>12 bits</td>
<td>12 bits</td>
<td>12 bits</td>
</tr>
<tr>
<td>Vertical No. of Bits (ENOB)</td>
<td>8.7</td>
<td>8.6</td>
<td>8.5</td>
<td>8.3</td>
</tr>
<tr>
<td>Vertical Noise Floor (rms, 50 Ω)</td>
<td>1 mV/div</td>
<td>65 μV</td>
<td>70 μV</td>
<td>90 μV</td>
</tr>
<tr>
<td></td>
<td>2 mV/div</td>
<td>65 μV</td>
<td>70 μV</td>
<td>90 μV</td>
</tr>
<tr>
<td></td>
<td>5 mV/div</td>
<td>65 μV</td>
<td>70 μV</td>
<td>90 μV</td>
</tr>
<tr>
<td></td>
<td>10 mV/div</td>
<td>70 μV</td>
<td>75 μV</td>
<td>95 μV</td>
</tr>
<tr>
<td></td>
<td>20 mV/div</td>
<td>95 μV</td>
<td>95 μV</td>
<td>115 μV</td>
</tr>
<tr>
<td></td>
<td>50 mV/div</td>
<td>160 μV</td>
<td>175 μV</td>
<td>210 μV</td>
</tr>
<tr>
<td></td>
<td>100 mV/div</td>
<td>270 μV</td>
<td>290 μV</td>
<td>350 μV</td>
</tr>
<tr>
<td></td>
<td>200 mV/div</td>
<td>960 μV</td>
<td>925 μV</td>
<td>110 mV</td>
</tr>
<tr>
<td></td>
<td>500 mV/div</td>
<td>1.60 mV</td>
<td>1.75 mV</td>
<td>2.10 mV</td>
</tr>
<tr>
<td></td>
<td>1 V/div</td>
<td>2.70 mV</td>
<td>2.90 mV</td>
<td>3.50 mV</td>
</tr>
<tr>
<td>Sensitivity</td>
<td>50 Ω: 1 mV–1 V/div, fully variable; 1 MΩ: 1 mV–10 V/div, fully variable</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC Vertical Gain Accuracy</td>
<td>±0.5% FS, offset at 0 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channel-Channel Isolation</td>
<td>60 dB</td>
<td>60 dB up to 200 MHz</td>
<td>60 dB up to 200 MHz</td>
<td>60 dB up to 200 MHz</td>
</tr>
<tr>
<td></td>
<td>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</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td></td>
<td>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</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>DC Vertical Offset Accuracy</td>
<td>±(1.0% of offset setting + 0.5% FS + 0.02% of max offset + 1 mV)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Input Voltage</td>
<td>50 Ω: 5 Vrms, 1 MΩ: 400 V max (DC + Peak AC ≤ 10 kHz)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Coupling</td>
<td>1 MΩ: AC, DC, GND; 50 Ω: DC, GND</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Impedance</td>
<td>50 Ω: ±2.0%; 1 MΩ: ±2.0%</td>
<td></td>
<td>15 pF</td>
<td></td>
</tr>
<tr>
<td>Bandwidth Limiters</td>
<td>20 MHz</td>
<td>20 MHz, 200 MHz</td>
<td>20 MHz, 200 MHz</td>
<td>20 MHz, 200 MHz</td>
</tr>
<tr>
<td>Rescaling</td>
<td>Electrical: Volts, Amps</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Horizontal - Analog Channels

<table>
<thead>
<tr>
<th></th>
<th>WaveSurfer 4024HD</th>
<th>WaveSurfer 4034HD</th>
<th>WaveSurfer 4054HD</th>
<th>WaveSurfer 4104HD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acquisition Modes</td>
<td>Real-time, Roll, Average, Sequence (Segmented Memory up to 1000 segments with 1 μs min. intersegment time)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Timebases</td>
<td>Internal timebase common to 4 input channels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time/Division Range</td>
<td>2 ns/div to 50 s/div</td>
<td>2 ns/div to 50 s/div</td>
<td>1 ns/div to 50 s/div</td>
<td>500 ps/div to 100 s/div</td>
</tr>
<tr>
<td>Clock Accuracy</td>
<td>±2.5 ppm + 1.0 ppm/year from calibration</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Acquisition - Analog Channels

<table>
<thead>
<tr>
<th></th>
<th>WaveSurfer 4024HD</th>
<th>WaveSurfer 4034HD</th>
<th>WaveSurfer 4054HD</th>
<th>WaveSurfer 4104HD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sample Rate (Single-Shot)</td>
<td>2.5 GS/s on 4 Ch, 5 GS/s on 2 Ch</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Standard Memory (4 Ch / 2 Ch)</td>
<td>12.5 Mpts / 25 Mpts</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Averaging</td>
<td>Summed averaging to 1024 sweeps</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Vertical, Horizontal, Acquisition - Digital Channels (WS4KHD-MSO option only)

<table>
<thead>
<tr>
<th></th>
<th>WaveSurfer 4024HD</th>
<th>WaveSurfer 4034HD</th>
<th>WaveSurfer 4054HD</th>
<th>WaveSurfer 4104HD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Input Channels</td>
<td>16 Digital Channels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threshold Groupings</td>
<td>Pod 2: D15 to D8, Pod 1: D7 to D0</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threshold Selections</td>
<td>TTL (+1.4 V), 5 V CMOS (+2.5 V), ECL (-1.3 V) or User Defined</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Maximum Input Voltage</td>
<td>±30 V Peak</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Threshold Accuracy</td>
<td>±3% of threshold setting + 100 mV</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Dynamic Range</td>
<td>±20 V</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Input Voltage Swing</td>
<td>500 mV/pp</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Input Impedance (Flying Leads)</td>
<td>100 kΩ</td>
<td></td>
<td>5 pF</td>
<td></td>
</tr>
<tr>
<td>Maximum Input Frequency</td>
<td>125 MHz</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sample Rate</td>
<td>500 MS/s</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Record Length</td>
<td>12.5 Mpts - 16 Channels</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Minimum Detectable Pulse Width</td>
<td>4 ns</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Channel-to-Channel Skew</td>
<td>±(1 digital sample interval)</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>User-defined Threshold Range</td>
<td>±10 V in 20 mV steps</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
## SPECIFICATIONS

### Triggering System

<table>
<thead>
<tr>
<th>WaveSurfer 4024HD</th>
<th>WaveSurfer 4034HD</th>
<th>WaveSurfer 4054HD</th>
<th>WaveSurfer 4104HD</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sources</td>
<td>Any input channel, Ext, Ext/5, or Line; slope and level unique to each source (except Line trigger)</td>
<td>Any input channel, Ext, Ext/5, or Line; slope and level unique to each source (except Line trigger)</td>
<td>Any input channel, Ext, Ext/5, or Line; slope and level unique to each source (except Line trigger)</td>
</tr>
<tr>
<td>Coupling</td>
<td>DC, AC, HFRej, LFRej</td>
<td>DC, AC, HFRej, LFRej</td>
<td>DC, AC, HFRej, LFRej</td>
</tr>
<tr>
<td>Hold-off</td>
<td>From 10 ns up to 20 s or from 1 to 100,000,000 events</td>
<td>From 10 ns up to 20 s or from 1 to 100,000,000 events</td>
<td>From 10 ns up to 20 s or from 1 to 100,000,000 events</td>
</tr>
<tr>
<td>Pre-trigger Delay</td>
<td>0 to 100% of full scale</td>
<td>0 to 100% of full scale</td>
<td>0 to 100% of full scale</td>
</tr>
<tr>
<td>Post-trigger Delay</td>
<td>0 to 10,000 divisions</td>
<td>0 to 10,000 divisions</td>
<td>0 to 10,000 divisions</td>
</tr>
<tr>
<td>Internal Trigger Level Range</td>
<td>±4.1 div from center (typical)</td>
<td>±4.1 div from center (typical)</td>
<td>±4.1 div from center (typical)</td>
</tr>
<tr>
<td>External Trigger Level Range</td>
<td>Ext (±0.610 mV); Ext/5 (±3.05 V)</td>
<td>Ext (±0.610 mV); Ext/5 (±3.05 V)</td>
<td>Ext (±0.610 mV); Ext/5 (±3.05 V)</td>
</tr>
<tr>
<td>Maximum Trigger Rate</td>
<td>175,000 waveforms/second</td>
<td>175,000 waveforms/second</td>
<td>175,000 waveforms/second</td>
</tr>
<tr>
<td>Trigger Sensitivity with Edge Trigger</td>
<td>0.9 division @ 10 MHz</td>
<td>0.9 division @ 10 MHz</td>
<td>0.9 division @ 10 MHz</td>
</tr>
<tr>
<td>(Ch 1–4)</td>
<td>1.0 division @ 200 MHz</td>
<td>1.0 division @ 350 MHz</td>
<td>1.0 division @ 500 MHz</td>
</tr>
<tr>
<td>Trigger Types</td>
<td>Edge, Width, Logic (Pattern), TV (NTSC, PAL, SECAM, HDTV - 720p, 1080i, 1080p), Run, Slope Rate, Interval (Signal or Pattern), Dropout, Qualified (State or Edge). External input supports Edge trigger only.</td>
<td>Edge, Width, Logic (Pattern), TV (NTSC, PAL, SECAM, HDTV - 720p, 1080i, 1080p), Run, Slope Rate, Interval (Signal or Pattern), Dropout, Qualified (State or Edge). External input supports Edge trigger only.</td>
<td>Edge, Width, Logic (Pattern), TV (NTSC, PAL, SECAM, HDTV - 720p, 1080i, 1080p), Run, Slope Rate, Interval (Signal or Pattern), Dropout, Qualified (State or Edge). External input supports Edge trigger only.</td>
</tr>
</tbody>
</table>

### Low Speed Serial Protocol Triggering (Optional)

- I2C, SPI (SPI, SSPI, SIOP), UART-RS232, CAN1.1, CAN2.0, CAN FD, LIN, FlexRay

### Measure, Zoom, and Math Tools

- **Measurement Parameters**: Up to 6 parameters can be calculated at one time on any waveforms, selected from the following list of measurements: Amplitude, Area, Base, Delay, Duty Cycle (50%, (level)), Edge (floor), Fall Time (90%–10%), Rise Time (90%–10%), Frequency (50%, (level)), Maximum, Minimum, Overshoot+, Overshoot-, Peak-Peak, Period (50%, (level)), Phase, Rise Time (10%–90%), Rise Time (20%–80%), RMS, Skew, Standard Deviation, Standard Error, Top, Width+, Width-, Statistics and histicons can be added to measurements. Measurements can be gated.

- **Zooming**: Use front panel QuickZoom button, or Rectangle-Zoom using touch screen or mouse.

- **Math Functions**: Up to 2 math functions can be calculated at one time on any waveforms, selected from the following list of operations: Sum, Difference, Product, Ratio, Absolute Value, Average, Derivative, Enhanced Resolution, Envelope, Floor, Integral, Invert, Reciprocal, Rescale, Roof, SinX/x, Square, Square Root, Trend, Zoom and FFT (with Power Spectrum output, Rectangular, VonHann and FlatTop windows).

### Display System

- **Size**: 12.1" widescreen capacitive touch screen
- **Resolution**: 1280 x 800 pixels

### Probes

- **Standard Probes**: PP019 (5 mm), 1 per channel
- **Probing System**: BNC and Teledyne LeCroy ProBus for active voltage, current, and differential probes

### Connectivity

- **Ethernet Port**: 1 x 10/100BaseT Ethernet interface (RJ45 port)
- **Removable Storage**: 1 Micro SD port, 16 GB Micro SD card installed standard
- **USB Host Ports**: 2 front USB 3.1 Gen1 ports, 2 back USB 2.0 ports
- **USB Device Port**: 1 USBTMC over USB 2.0 port
- **External Monitor Port**: 1 HDMI port, supports up to 1280 x 800 pixels
- **Remote Control**: Microsoft COM Automation or LeCroy Remote Command Set

### Power Requirements

- **Voltage**: 100 to 240 VAC ±10% @ 50 to 60 Hz ±10%; 100 to 120 VAC ±10% @ 400 Hz ±5%; automatic AC voltage selection
- **Nominal Power Consumption**: 90 W / 90 VA
- **Max Power Consumption**: 150 W / 150 VA

### Environmental

- **Temperature**: Operating: 0 °C to +50 °C; Non-operating: –30 °C to +70 °C
- **Humidity**: Operating: 5% to 90% RH (non-condensing) at ≤30 °C, upper limit derates to 50% RH (non-condensing) at +50 °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 ≤ 25 °C; Non-operating: up to 12,192 meters (40,000 ft)

### Size and Weight

- **Dimensions (HWD)**: 10.7" H x 14.9" W x 6.3" D (273 mm x 380 mm x 160 mm)
- **Weight**: 11.7 lbs (5.3 kg)

### Certifications

- **CE Certification**: CE compliant, UL and cUL listed; conforms to UL 61010-1 (3rd Edition), UL 61010-2-030 (1st Edition), and 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.
**Digital Voltmeter** *(Optional, available no charge at teledynelecroy.com/ws4000hd/redeemvdm)*

<table>
<thead>
<tr>
<th>Functions</th>
<th>AC&lt;sub&gt;rms&lt;/sub&gt;, DC, DC&lt;sub&gt;rms&lt;/sub&gt;, Frequency</th>
</tr>
</thead>
<tbody>
<tr>
<td>Resolution</td>
<td>ACV/DCV: 4 digits, Frequency: 5 digits</td>
</tr>
<tr>
<td>Measurement Rate</td>
<td>100 times/second, measurements update on the display 5 times/second</td>
</tr>
<tr>
<td>Vertical Settings</td>
<td>Autorange: Automatic adjustment of vertical settings to maximize the dynamic range of measurements</td>
</tr>
</tbody>
</table>

**WaveSource Arbitrary Waveform Generator** *(WS4KHD-FG option only)*

### General
- **Max Frequency**: 25 MHz
- **Channels**: 1
- **Sample Rate**: 125 MS/s
- **Arbitrary Waveform Length**: 16 kpts
- **Frequency Resolution**: 1 µHz
- **Vertical Resolution**: 14 bits
- **Vertical Range**: ±3 V (HiZ); ±1.5 V (50 Ω)
- **Waveform Types**: Sine, Square, Triangle, Pulse, DC, Noise, ARB, Exponential Fall, Exponential Rise, Ramp, Gaussian, Lorentz, Cardiac, Haversine

### Frequency Specification
- **Sine/Haversine**: 1 µHz - 25 MHz
- **Square/Pulse**: 1 µHz - 10 MHz
- **Ramp/Triangular**: 1 µHz - 300 KHz
- **Exponential Fall/Rise**: 1 µHz - 1 MHz
- **Gaussian, Lorentz, Cardiac**: 1 µHz - 5 MHz
- **Noise**: 25 MHz (-3 dB)
- **Resolution**: 1 µHz
- **Accuracy**: ±50 ppm, over temperature
- **Aging**: ±3 ppm/year, first year

### Output Specification
- **Amplitude**: 4 mVpp - 6 Vpp (HiZ); 2 mVpp - 3 Vpp (50 Ω)
- **Vertical Accuracy**: ±(0.3 dB + 1 mV)
- **Amplitude Flatness**: ±0.5 dB

### DC Offset
- **Range (DC)**: ±3 V (HiZ); ±1.5 V (50 Ω)
- **Offset Accuracy**: ±(1% of offset value + 3 mV)

### Waveform Output
- **Impedance**: 50 Ω ±2%
- **Protection**: Short-circuit protection

### Sine Spectrum Purity
- **SFDR (Non Harmonic) @1.265 Vpp**
  - DC - 1 MHz: -60 dBc
  - 1 MHz - 5 MHz: -55 dBc
  - 5 MHz - 25 MHz: -50 dBc
- **Harmonic Distortion @1.265 Vpp**
  - DC - 5 MHz: -50 dBc
  - 5 MHz - 25 MHz: -45 dBc

### Square/Pulse
- **Rise/Fall time**: 24 ns (10% - 90%)
- **Overshoot**: 3% (typical - 1 kHz, 1 Vpp)
- **Pulse Width**: 50 ns minimum
- **Jitter**: 500 ps + 10 ppm of period (RMS cycle to cycle)

### Ramp/Triangle
- **Linearity**: 0.1% of Peak value output (typical - 1 kHz, 1 Vpp, 100% symmetric)
- **Symmetry**: 0% to 100%
PRODUCT DESCRIPTION | PRODUCT CODE
---|---
**WaveSurfer 4000HD Oscilloscopes**
200 MHz, 2.5 GS/s, 4 Ch, 12.5 Mpts/Ch | WaveSurfer 4024HD-MSO
High Definition Oscilloscope with 12.1” capacitive touch screen | 
350 MHz, 2.5 GS/s, 4 Ch, 12.5 Mpts/Ch | WaveSurfer 4034HD-MSO
High Definition Oscilloscope with 12.1” capacitive touch screen | 
500 MHz, 2.5 GS/s, 4 Ch, 12.5 Mpts/Ch | WaveSurfer 4054HD-MSO
High Definition Oscilloscope with 12.1” capacitive touch screen | 
1 GHz, 2.5 GS/s, 4 Ch, 12.5 Mpts/Ch | WaveSurfer 4104HD-MSO
High Definition Oscilloscope with 12.1” capacitive touch screen | 

**Included with Standard Configurations**
+10 passive probes (Qty. 4), Micro SD card (installed), Micro SD card adapter, protective cover, Getting Started Guide, commercial NIST traceable calibration with certificate, power cable for the destination country, 3-year warranty | 

**Multi-Instrument Options**
Mixed-Signal Oscilloscope (incl. 16-channel digital leadset, 22 extra large gripper probes, 20 ground extenders, 5 flexible ground leads and license) | WS4KHD-MSO

**Spectrum Analyzer for WaveSurfer 4000HD** | WS4KHD-SPECTRUM-1

**WaveSource Arbitrary Waveform Generator** | WS4KHD-FG

**Serial Trigger and Decode Options**
AudioBus Trigger and Decode | WS4KHD-AUDIO TD
Automotive Bundle: CAN, CAN FD, LIN, FlexRay Trigger and Decode | WS4KHD-AUTO TD
Embedded Bundle: I2C, SPI, UART/RS232 Trigger and Decode | WS4KHD-EMB TD

**Power Analysis Options**
Power Analysis | WS4KHD-PWR

**General Accessories**
Softcase | WS4KHD-SOFTCASE
Rackmount Kit | WS4KHD-RACK

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**Probes**
250 MHz Passive Probe – 5 mm, 10:1, 10 MΩ | PP019
500 MHz Passive Probe – 5 mm, 10:1, 10 MΩ | PP026
250 MHz 60 V Common Mode Differential Probe | DL02-HCM
500 MHz 60 V Common Mode Differential Probe | DL05-HCM
1 GHz 60 V Common Mode Differential Probe | DL10-HCM
Power/Voltage Rail Probe. 2 GHz bandwidth, 1.2x attenuation, +/-60V offset, +/-800mV | RP2030
Power/Voltage Rail Probe. 4 GHz bandwidth, 1.2x attenuation, +/-60V offset, +/-800mV | RP4060
RP4030 Browser Tip Accessory | RP4000-BROWSER
30 A, 10 MHz Current Probe – AC/DC, 30 Arms, 50 A peak pulse, 3-meter cable | CP030-3M
30 A, 50 MHz High Sensitivity Current Probe – AC/DC, 30 Arms, 50 A peak pulse, 1.5-meter cable | CP030B
30 A, 100 MHz Current Probe – AC/DC, 30 Arms, 50 A peak pulse, 1.5-meter cable | CP031
30A, 100 MHz High Sensitivity Current Probe – AC/DC, 30 Arms, 50 A peak pulse, 1.5-meter cable | CP031A
150 A, 10 MHz Current Probe – AC/DC, 150 Arms, 500 A peak pulse, 2-meter cable | CP150B
150 A, 5 MHz Current Probe – AC/DC, 150 Arms, 500 A peak pulse, 6-meter cable | CP150M6
500 A, 2 MHz Current Probe – AC/DC, 30 Arms, 50 A peak pulse, 6-meter cable | CP500
Deskew Calibration Source | DC025
700 V, 25 MHz High Voltage Differential Probe (+10, +100) | AP031
1 kV, 25 MHz High Voltage Differential Probe | HVD3102A
1 kV, 25 MHz High Voltage Differential Probe (without tip accessories) | HVD3102A-NOACC
1 kV, 120 MHz High Voltage Differential Probe | HVD3106A
1 kV, 80 MHz High Voltage Differential Probe with 6-meter Cable | HVD3106A-M6
1 kV, 120 MHz High Voltage Differential Probe (without tip accessories) | HVD3106A-NOACC
2 kV, 120 MHz High Voltage Differential Probe | HVD3206A
2 kV, 80 MHz High Voltage Differential Probe with 6-meter Cable | HVD3206A-M6
2kV, 400 MHz High Voltage Differential Probe | HVD3220
6 kV, 100 MHz High Voltage Differential Probe | HVD3605A
High Voltage Fiber Optic Probe. 150 MHz bandwidth | HVF0106
HVF010 Universal ±1 V Tip Accessory | HVFO100-1X-TIP-U
HVF010 Universal ±5 V Tip Accessory | HVFO100-5X-TIP-U
HVF010 Universal ±10 V Tip Accessory | HVFO100-10X-TIP-U
HVF010 Universal ±20 V Tip Accessory | HVFO100-20X-TIP-U
HVF010 Universal ±40 V Tip Accessory | HVFO100-40X-TIP-U
100:1 400 MHz 50 MΩ 1 kV High Voltage Probe | HVF120
2 kV HV Probe, 6 kV overvoltage capability | PPE6KV-A
500 MHz, 60 V Common Mode Differential Probe. Includes standard set of leads and tips | DL05-HCM
1 GHz, 60 V Common Mode Differential Probe. Includes standard set of leads and tips | 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
500 MHz Active Differential Probe (+1, +10, +100) | AP033
1 GHz, 1.0 pF Active Differential Probe. ±8 V | ZD1000
1.5 GHz, 1.0 pF Active Differential Probe | ZD1500
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

**Probe Adapters**
Tek Probe to ProBus Probe Adapter | TPA10

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**Bandwidth upgrades can be made at any time. Contact your local Teledyne LeCroy sales office.**