TELEDYNE LECROY
Everywhereyoulook™

UNBELIEVABLY POWERFUL.
INSANELY EASY.



WaveRunner 8000

500 MHz – 4 GHz
Oscilloscopes

- Superior User Experience
- Powerful, Deep Toolbox
- Exceptional Serial Data Tools
- "M" Models for Maximum Sample Rate and Memory

The WaveRunner 8000 combines a **superior oscilloscope experience** with an **extensive toolbox** to deliver **faster time to insight.**

teledynelecroy.com/wr8000



UNBELIEVABLY POWERFUL.
INSANELY EASY.

WaveRunner 8000

MAUI®
with
OneTouch

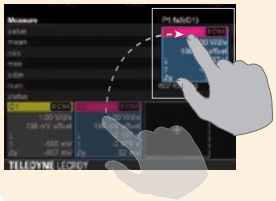
Designed for Touch

Built for Simplicity

MAUI

Made to Solve

OneTouch delivers a superior user experience by providing gesture control of common operations.



Deep Toolbox

OBSESSED WITH TOOLS

WaveRunner 8000 has the greatest breadth and depth of tools, ensuring quick resolution of the most complicated debug tasks.



The WaveRunner 8000 combines a **superior oscilloscope experience** with an **extensive toolbox** to deliver **faster time to insight.**

1. Superior User Experience
2. Powerful, Deep Toolbox
3. Exceptional Serial Data Tools
4. "M" Models for Maximum Sample Rate and Memory

Faster Time to Insight

Insight alone is not enough.

Markets and **technologies** change too rapidly.

The **timing** of **critical design decisions** is significant.

Time to insight is what matters.

TIME TO **INSIGHT**™

MAUI – SUPERIOR USER EXPERIENCE



MAUI – Most Advanced User Interface was developed to put all the power and capabilities of the modern oscilloscope right at your fingertips. Designed for touch; all important oscilloscope controls are accessed through the intuitive touch screen. Built for simplicity; time saving shortcuts and intuitive dialogs simplify setup. Made to solve; a deep set of debug and analysis tools helps identify problems and find solutions quickly.

Designed for Touch

MAUI is designed for touch. Operate the oscilloscope just like a phone or tablet with the most unique touch screen features on any oscilloscope. All important controls are always one touch away. Touch the waveform to position or zoom in for more details using intuitive actions.

Built for Simplicity

MAUI is built for simplicity. Basic waveform viewing and measurement tools as well as advanced math and analysis capabilities are seamlessly integrated in a single user interface. Time saving shortcuts and intuitive dialogs simplify setup and shorten debug time.

Made to Solve

MAUI is made to solve. A deep set of integrated debug and analysis tools help identify problems and find solutions quickly. Unsurpassed integration provides critical flexibility when debugging. Solve problems fast with powerful analysis tools.

MAUI with OneTouch

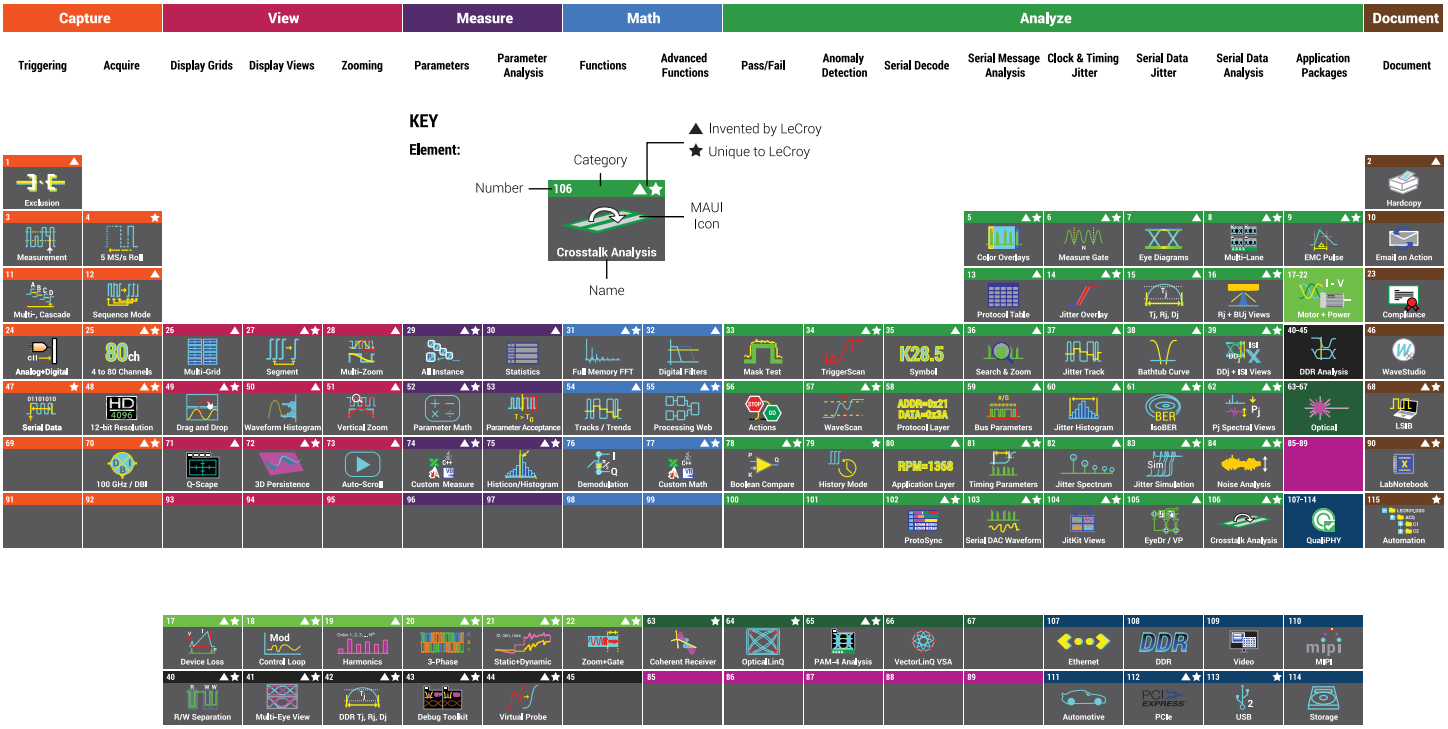
MAUI with OneTouch introduces a new paradigm for oscilloscope user experience. Dramatically reduce setup time with revolutionary drag and drop actions to copy and setup channels, math functions, and measurement parameters without lifting a finger. Use common gestures like drag, drop, and flick to instinctively interact with the oscilloscope. Quickly enable a new channel, math or measurement using the “Add New” button and simply turn off any trace or parameter with a flick of the finger. These OneTouch innovations provide unsurpassed efficiency in oscilloscope operation.



- **A** Channel, timebase, and trigger descriptors provide easy access to controls without navigating menus.
- **B** Configure parameters by touching measurement results.
- **C** Shortcuts to commonly used functions are displayed at the bottom of the channel, math and memory menus.
- **D** Use the “Add New” button for one-touch trace creation.
- **E** Drag to change source, copy setup, turn on new trace, or move waveform location.
- **F** Drag to copy measurement parameters to streamline setup process.
- **G** Drag to quickly position cursors on a trace.

MAUI *Unique to OneTouch*

POWERFUL, DEEP TOOLBOX



Our Heritage

Teledyne LeCroy's 50+ year heritage has its origins in the high-speed collection of data in the field of high-energy physics, and the processing of long records to extract meaningful insight. We didn't invent the oscilloscope, but we did invent the digital oscilloscope, which can take full advantage of advanced digital signal processing and waveshape analysis tools to provide unparalleled insight.

Our Obsession

Our developers are true to our heritage – they are more obsessed with making better and smarter tools than anybody else. Our tools and operating philosophy are standardized across much of our product line for a consistent user experience. Our mission is to help you use these tools to understand problems, including the ones you don't even know you have. Our deep toolbox inspires insight; and your moment of insight is our reward.

Our Invitation

Our Periodic Table of Oscilloscope Tools provides a framework to understand the toolsets that Teledyne LeCroy has created and deployed in our oscilloscopes. Visit our interactive website to learn more about what we offer and how we can help you develop and debug more efficiently.

teledynelecroy.com/tools

WAVERUNNER 8000 AT A GLANCE

The WaveRunner 8000 combines a superior oscilloscope experience with an extensive toolbox to shorten debug time. MAUI with OneTouch includes the most unique touch features on any oscilloscope providing unsurpassed efficiency in oscilloscope operation. Offering 500 MHz - 4 GHz of bandwidth, 40 GS/s sample rate, long memory, MAUI – Most Advanced User Interface, and a versatile toolset make the WaveRunner 8000 unbelievably powerful and insanely easy to use.

Key Features

500 MHz - 4 GHz bandwidths

Up to 40 GS/s sample rate

MAUI with OneTouch

- Designed for touch
- Built for simplicity
- Made to solve

Advanced Tools

- Jitter and Timing Analysis Capabilities
- WaveScan – Search and Find
- LabNotebook Documentation and Report Generation
- History Mode - Waveform Playback

Optional Software Packages

- Advanced Customization
- Digital Filtering
- Spectrum Analysis
- Device and Switching Power Supply Analysis
- Comprehensive set of serial data analysis, debug, validation and compliance tools

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



Superior User Experience

The WaveRunner 8000 with MAUI OneTouch sets the standard for oscilloscope user experience by providing the most unique touch features on any oscilloscope. Common gestures are used to instinctively interact with the oscilloscope and dramatically reduce setup time. Convenience and efficiency are optimized - all common operations can be performed with one touch and do not require opening and closing of pop-up dialogs or menus.

Exceptional Serial Data Tools

A wide a variety of application packages are available to meet all serial data test challenges, ranging from automated compliance packages to flexible debug toolkits. A suite of protocol specific measurement and eye diagram packages are available to complement the industry's most intuitive trigger and decode packages.

Powerful, Deep Toolbox

The standard collection of math, measurement, debug, and documentation tools provides unsurpassed analysis capabilities. Application-specific packages enable streamlined debugging for common design/validation scenarios. The advanced customization option (XDEV) enables user-defined parameters and math functions providing unique and limitless analysis capability.

"M" Models for Maximum Sample Rate and Memory

An industry leading 40 GS/s sample rate allows for a detailed edge reconstruction even for signals with the fastest rise times. Long memory allows for maximum sample rate to be maintained in longer timebases. Deep memory of 128 Mpts is ideal for debugging long term behavior on high speed serial data buses.



Key Attributes

1. 12.1" Widescreen (16 x 9) high resolution WXGA color touch screen display
2. MAUI with OneTouch optimized for convenience and efficiency
3. "Add New" button for fast waveform creation
4. Serial trigger captures signals up to 3 Gb/s
5. "Push" Knobs – All knobs have push functionality that provide shortcuts to common actions such as Set to Variable, Find Trigger Level, Zero Offset, and Zero Delay
6. Waveform Control Knobs – Control channel, zoom, math and memory traces with the multiplexed vertical and horizontal knobs
7. Dedicated Cursor Knob – Select type of cursor, position them on your signal, and read values without ever opening Ava menu
8. Dedicated buttons to quickly access popular debug tools.
9. Mixed Signal Capability - Debug complex embedded designs with integrated 16 channel mixed signal capability
10. Reference Clock Input/Output connectors for connecting to other equipment
11. Easy connectivity with four USB 3.1 ports and three USB 2.0 ports
12. USBTMC (Test and Measurement Class) over USB 3.1 for fast data offload

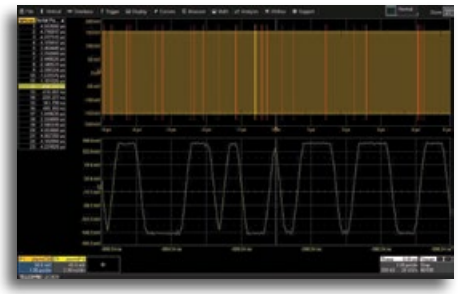


ADVANCED TOOLS FOR WAVEFORM ANALYSIS

Serial Trigger, Decode, Measure/Graph, and Eye Diagrams

Isolate events using the serial bus trigger and view color-coded protocol information on top of analog or digital waveforms. Timing and bus measurements allow quick and easy characterization of a serial data system. Serial (digital) data can be extracted and graphed to monitor system performance over time. Identify physical layer anomalies with eye diagram mask testing and mask failure locator.





WaveScan Advanced Search and Find Tool

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



Jitter and Timing Analysis

Understand system jitter performance of clock and data signals. Enable histograms, tracks, and spectrum plots to visualize the data.



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.

POWERFUL MIXED SIGNAL CAPABILITIES

Teledyne LeCroy's WaveRunner 8000-MS mixed signal oscilloscope combines the high-performance analog channels of the WaveRunner 8000 with the flexibility of 16 digital inputs. In addition, the many triggering and decoding options turn the WaveRunner 8000-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.

Advanced Digital Debug Tools

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

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

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

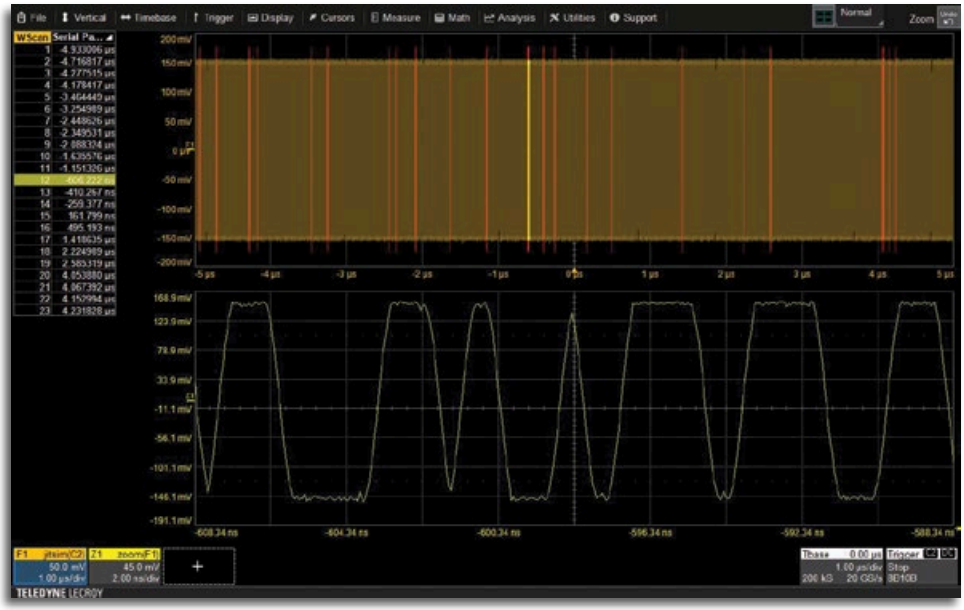
Simulate complete digital designs using logic gate emulation. When used with the web editor, many logic gates can be combined together in one math function to simulate complex logic designs. Choose from AND, OR, NAND, NOR, XOR, NOT and D Flip Flop gates.

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.



STANDARD TOOLS FOR ADVANCED ANALYSIS



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.

Additionally, digital lines can be used as inputs into WaveScan to isolate and analyze patterns using the powerful parallel pattern search capability. Identified patterns are presented in a table with timestamp information and enables quick searching for each pattern occurrence.

Advanced Waveform Capture with Sequence Mode

Use Sequence mode to store up to 15,000 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.

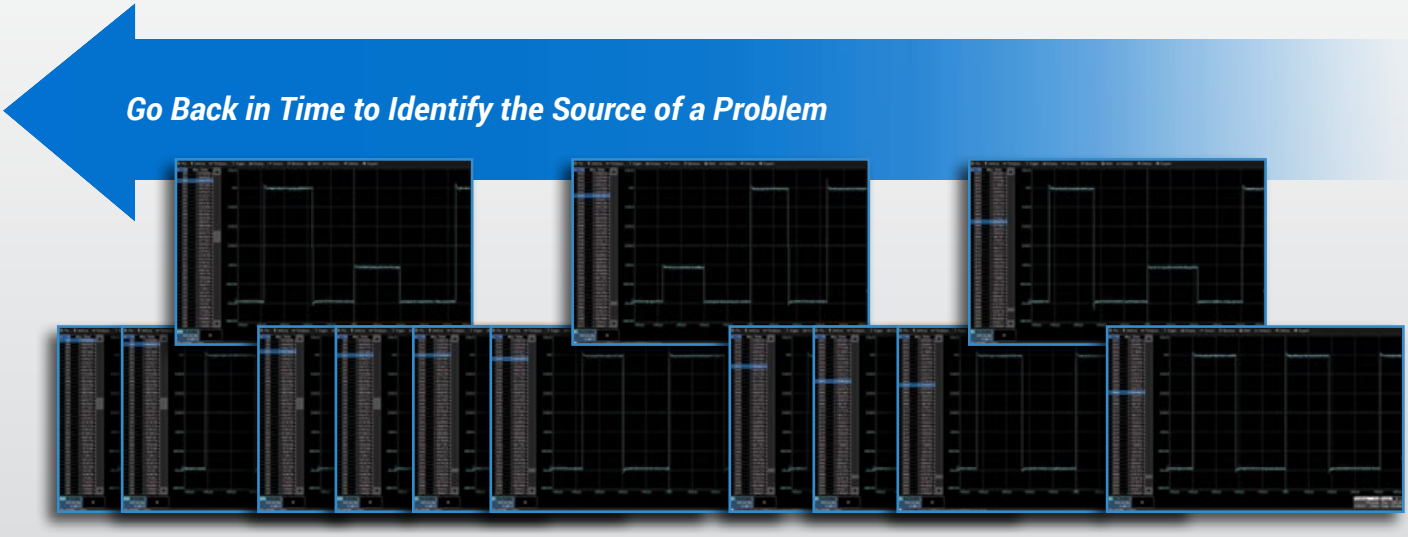
Advanced Math and Measure

With many math functions and measurement parameters available, the WaveRunner 8000 can measure and analyze every aspect of analog and digital waveforms. Beyond just measuring waveforms, the WaveRunner 8000 provides statistics, histicons, tracks and trends to show how waveforms change over time. Measurements and math functions can be quickly copy and setup using MAUI with OneTouch.



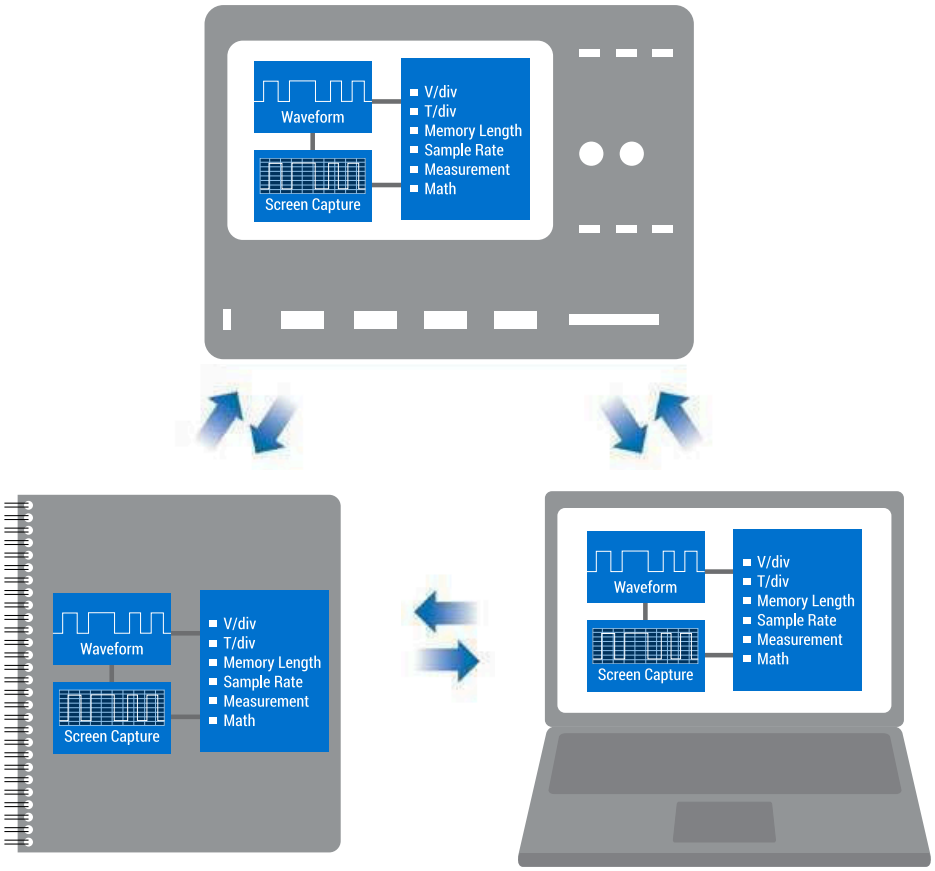
History Mode Waveform Playback

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 WaveRunner 8000 is the ideal documentation tool. LabNotebook automatically saves all displayed waveforms, oscilloscope setup file, and a screen with a single button press, eliminating the need to navigate multiple menus to save all these files independently. Report files can be annotated and shared with colleagues to fully document all results. Easily recreate experiments and compare tests results amongst colleagues across the world by recalling LabNotebook files back onto the oscilloscope or view on a PC using WaveStudio.



MOST COMPLETE SERIAL DATA DEBUG AND VALIDATION

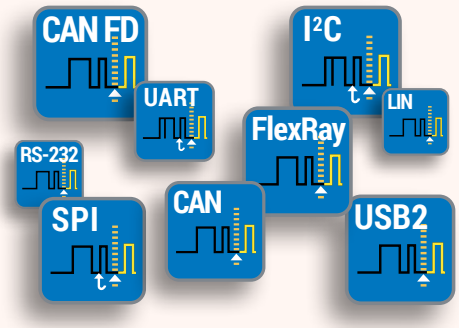
The WaveRunner 8000 features the widest range and most complete serial data debug and validation solutions.

- Triggering
- Decoding
- Measurement and Graphing
- Eye Diagram and Physical Layer Analysis

Various compliance test, synchronized protocol decode views, and other advanced jitter analysis tools are also available.

Solutions address the following markets and applications:

- Embedded Computing
- Automotive
- Industrial
- Military and Avionics
- Peripherals
- Memory
- Handset/Mobile/Cellular
- High Speed Computing
- Data Storage
- Serial Digital Audio





Trigger

Powerful, flexible triggers designed by people who know the standards, with the unique capabilities you want to isolate unusual events. Conditional data triggering permits maximum flexibility and highly adaptable error frame triggering is available to isolate error conditions. Frame definition allows grouping of UART or SPI packets into message frames for customization.

Decode

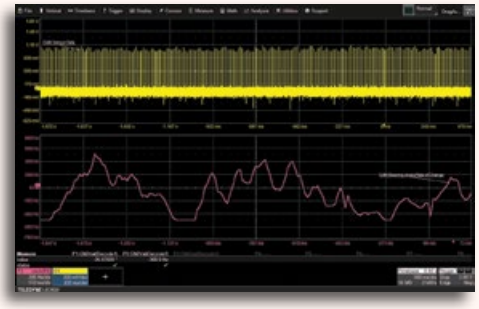
Decoded protocol information is color-coded to specific portions of the serial data waveform and transparently overlaid for an intuitive, easy-to-understand visual record. All decoded protocols are displayed in a single time-interleaved table. Touch a row in the interactive table to quickly zoom to a packet of interest and easily search through long records for specific protocol events using the built-in search feature.

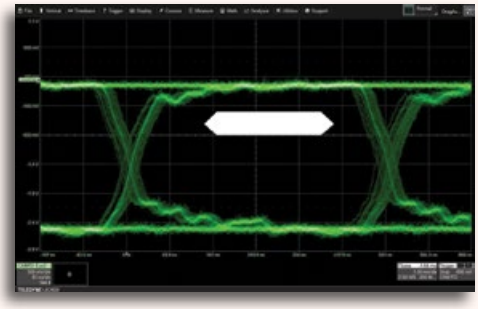


ProtoSync

ProtoSync combines the oscilloscope view with a simultaneous view of data link layer decodes on the same instrument. This combination makes ProtoSync very effective in debugging protocol-specific negotiation rates.

Compatible with PCI Express, USB 2.0, USB2-HSIC, SAS, SATA, and Fibre Channel.





Measure/Graph

Quickly validate cause and effect with automated timing measurements to or from an analog signal or another serial message. Make multiple measurements in a single long acquisition to quickly acquire statistics during corner-case testing. Serial (digital) data can be extracted to an analog value and graphed to monitor system performance over time, as if it was probed directly. Complete validation faster and gain better insight.

Eye Diagram

Rapidly display an eye diagram of your packetized low-speed serial data signal without additional setup time. Use eye parameters to quantify system performance and apply a standard or custom mask to identify anomalies. Mask failures can be indicated and can force the scope into Stop mode.

SDAII or DDR Debug (optional) create eye diagrams of streaming NRZ serial data or DDR signals, and measure and analyze jitter breakdown.

QualiPHY / Compliance

Compliance testing is a critical part of the design cycle in order to ensure that requirements are met. The QualiPHY framework provides an automated and easy-to-use compliance testing platform for a number of serial data standards.



QualiPHY™

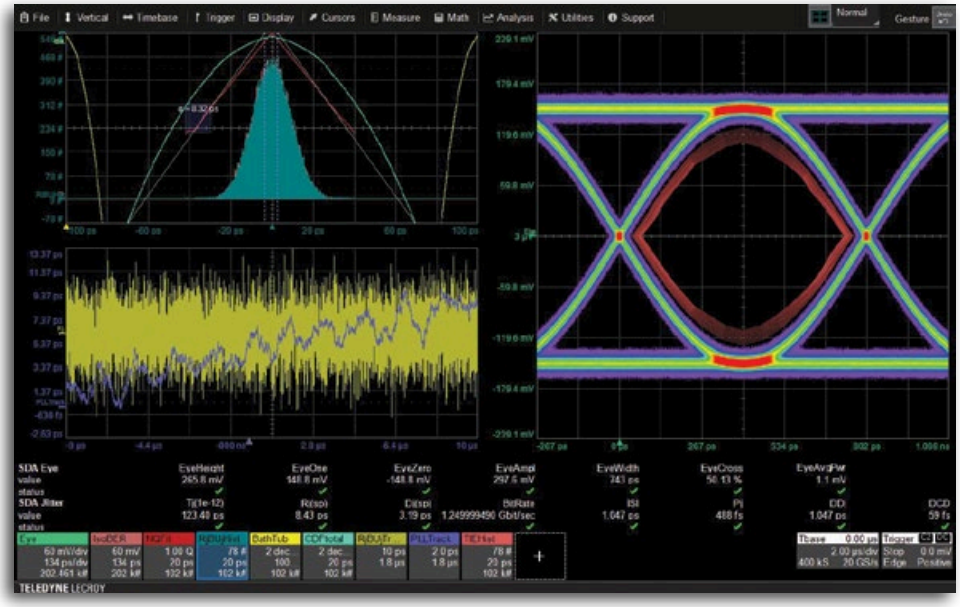
WaveRunner 8000 Serial Data Protocol Support

		Trigger	Decode	Measure/Graph	Eye Diagram	Protosync	QualiPHY
Embedded Computing	I^2C	•	•	•	•		
	SPI	•	•	•	•		
	UART-RS232	•	•	•	•		
	USB2-HSIC		•				
Automotive + Industrial	CAN	•	•	•	•		
	CAN FD	•	•	•	•		
	FlexRay	•	•	•	•		
	LIN	•	•	•	•		
	SENT		•				
	MOST50/150						•
	BroadR-Reach						•
Avionics	ARINC429		•	•	•		
	MIL-STD-1553	•	•	•	•		
	SPACEWIRE		•				
High Speed Computing, Storage +Peripherals	Ethernet (10/100Base-T)		•				•
	Ethernet (1000Base-T)						•
	USB 2.0	•	•	•	•	•	•
	8b/10b	•	•		•		
	Fibre Channel		•				
	SATA (1.5 & 3 Gb/s)	•	•			•	
	SAS (1.5 & 3 Gb/s)		•			•	
	PCI Express (Gen1)		•			•	
Memory	LPDDR2				•		•
	DDR2				•		•
	DDR3				•		•
MIPI	D-PHY/CSI-2/DSI		•		•		•
	DigRF3G		•	•			
	DigRFv4		•	•			
	UniPro		•				
	M-PHY		•		•		
Other	Audio (I^2S, LJ, RJ, TDM)	•	•	•			
	Manchester		•				
	NRZ	•	•		•		

MOST COMPLETE SERIAL DATA DEBUG AND VALIDATION

SDA II – Advanced Tools to Isolate and Analyze (WR8K-SDAII)

Unleash the power of serial data analysis for understanding and characterizing a design, proving compliance, and understanding why a device or host fails compliance. The SDAII architecture provides fast updates and eye diagram creation. Combined with up to 128 Mpts record lengths and more complete jitter decomposition tools, SDA II provides a fast and complete understanding of why serial data fails a compliance test. Whether debugging eye pattern or other compliance test failures, the WaveRunner 8000 Oscilloscopes rapidly isolate the source of the problem.



Advanced jitter decomposition methodologies and tools provide more information about root cause. Tj Analysis, RjBUj Analysis and DDj Analysis are made simple with the deepest toolset dedicated to providing the highest level of insight into your serial data signals.

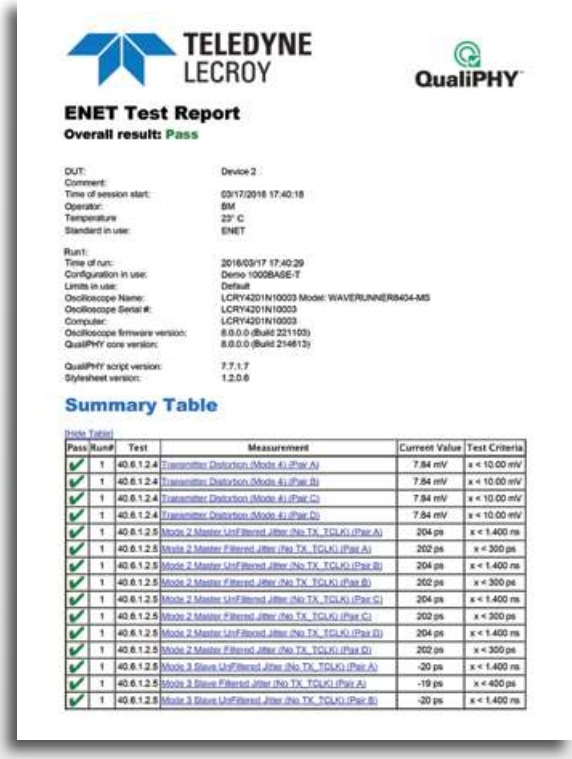
QualiPHY

QualiPHY is designed to reduce the time, effort, and specialized knowledge needed to perform compliance testing on high-speed serial buses.

- Guides the user through each test setup
- Performs each measurement in accordance with the relevant test procedure
- Compares each measured value with the applicable specification limits
- Fully documents all results
- QualiPHY helps the user perform testing the right way — every time

Supported Standards:

— ENET
— USB
— DDR2, DDR3, LPDDR2
— MIPI-DPHY
— BroadR-Reach
— MOST50, MOST150



TELEDYNE LECROY

QualiPHY

ENET Test Report

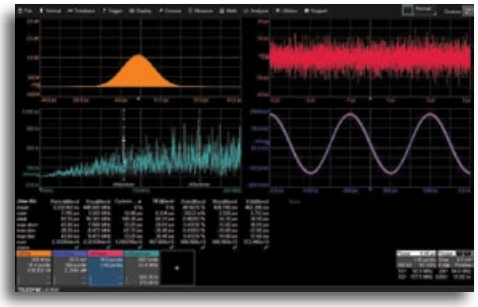
Overall result: Pass

DUT:	Device 2
Comment:	
Time of session start:	03/17/2016 17:40:18
Operator:	BM
Temperature	23° C
Standard in use:	ENET
Run1:	
Time of run:	2016/03/17 17:40:29
Configuration in use:	Demo 1000BASE-T
Limits in use:	Default
Oscilloscope Name:	LCRY4201N10003 Model: WAVERUNNER8404-MS
Oscilloscope Serial #:	LCRY4201N10003
Computer:	LCRY4201N10003
Oscilloscope firmware version:	8.0.0.0 (Build 221103)
QualiPHY core version:	8.0.0.0 (Build 214613)
QualiPHY script version:	7.7.1.7
Stylesheet version:	1.2.0.6

Summary Table

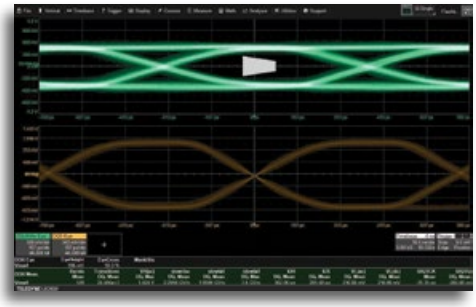
Pass	Run#	Test	Measurement	Current Value	Test Criteria
✔	1	40.6.1.2.4	Transmitter Distortion (Mode 4) (Pair A)	7.84 mV	x < 10.00 mV
✔	1	40.6.1.2.4	Transmitter Distortion (Mode 4) (Pair B)	7.84 mV	x < 10.00 mV
✔	1	40.6.1.2.4	Transmitter Distortion (Mode 4) (Pair C)	7.84 mV	x < 10.00 mV
✔	1	40.6.1.2.4	Transmitter Distortion (Mode 4) (Pair D)	7.84 mV	x < 10.00 mV
✔	1	40.6.1.2.5	Mode 2 Master UnFiltered Jitter (No TX_TCLK) (Pair A)	204 ps	x < 1.400 ns
✔	1	40.6.1.2.5	Mode 2 Master Filtered Jitter (No TX_TCLK) (Pair A)	202 ps	x < 300 ps
✔	1	40.6.1.2.5	Mode 2 Master UnFiltered Jitter (No TX_TCLK) (Pair B)	204 ps	x < 1.400 ns
✔	1	40.6.1.2.5	Mode 2 Master Filtered Jitter (No TX_TCLK) (Pair B)	202 ps	x < 300 ps
✔	1	40.6.1.2.5	Mode 2 Master UnFiltered Jitter (No TX_TCLK) (Pair C)	204 ps	x < 1.400 ns
✔	1	40.6.1.2.5	Mode 2 Master Filtered Jitter (No TX_TCLK) (Pair C)	202 ps	x < 300 ps
✔	1	40.6.1.2.5	Mode 2 Master UnFiltered Jitter (No TX_TCLK) (Pair D)	204 ps	x < 1.400 ns
✔	1	40.6.1.2.5	Mode 2 Master Filtered Jitter (No TX_TCLK) (Pair D)	202 ps	x < 300 ps
✔	1	40.6.1.2.5	Mode 3 Slave UnFiltered Jitter (No TX_TCLK) (Pair A)	-20 ps	x < 1.400 ns
✔	1	40.6.1.2.5	Mode 3 Slave Filtered Jitter (No TX_TCLK) (Pair A)	-19 ps	x < 400 ps
✔	1	40.6.1.2.5	Mode 3 Slave UnFiltered Jitter (No TX_TCLK) (Pair B)	-20 ps	x < 1.400 ns

Compliance Reports contain all of the tested values, the specific test limits and screen captures. Compliance Reports can be created as HTML, PDF or XML.



Jitter and Timing Analysis Option (WR8K-JITKIT)

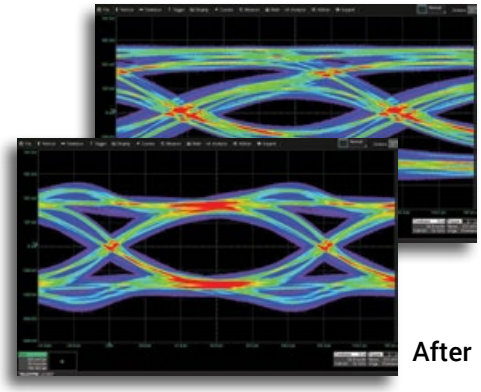
JITKIT makes it simple and easy to understand the basic system jitter performance of clock signals and clock-data activities, including period, half period, cycle-cycle, skew, amplitude, differential voltage crossing, slew rate, and a wide variety of other common jitter measurements.



DDR Debug Toolkit (WR8K-DDR3-Toolkit)

The DDR Debug Toolkit provides test, debug and analysis tools for the entire DDR design cycle. The unique DDR analysis capabilities provide automatic Read and Write burst separation, bursted data jitter analysis and DDR-specific measurement parameters. The WaveRunner 8000 supports both standard and custom speed grades of DDR2 and DDR3.

Before



After

Eye Doctor II (WR8K-EYEDRII)

The Eye Doctor II advanced signal integrity toolkit enables a complete set of channel emulation, de-embedding, and receiver equalization simulation tools. It provides capability to emulate a serial data link, de-embed or embed a fixture, cable or serial data channel, add or remove emphasis, and perform CTLE, FFE, or DFE equalization.



Q-Scape Multi-tab Display Architecture (WR8K-Q-SCAPE)

Unique Q-Scape multitab display architecture speeds up your understanding of your design with 4x the display area. Acquired or calculated waveforms can be located on any of four different "tabbed" oscilloscope grid displays, with individually selectable grid styles available for each tab. Quickly move waveforms to different tabs through drag-and-drop.

Advanced Probe Interface

The advanced active probe interface gives tremendous flexibility for measuring high voltages, high frequencies, currents, or differential signals.

High Impedance Active Probes



High Bandwidth Differential Probes



High Voltage Differential Probes



High Voltage Passive Probes



Current Probes



ADDITIONAL APPLICATIONS AND CUSTOMIZATION



Use two independent input settings and frequency ranges for advanced spectrum analysis.

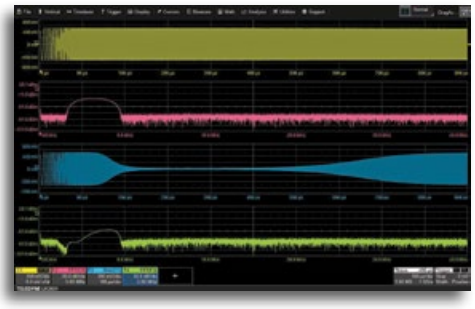
Spectrum Analyzer Option (WR8K-SPECTRUM)

The Spectrum Analyzer 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 in the desired units and the unique peak search automatically labels spectral components and presents frequency and level in an interactive table. To monitor how the spectrum changes over time, view the spectrogram which can display a 2D or 3D history of the frequency content.



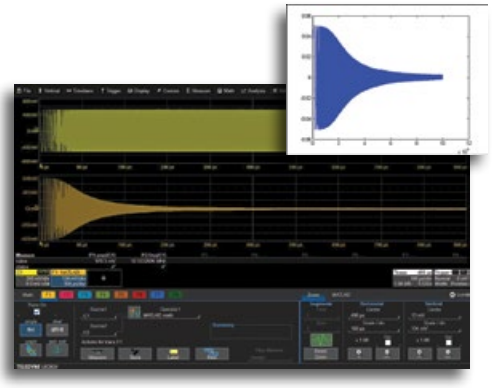
Power Analyzer Software Option (WR8K-PWR)

Quickly measure and analyze operating characteristics of power conversion circuits. Make automatic switching device measurements and identify areas of loss and conduction with color-coded overlay. Control loop modulation analysis and line power harmonic testing are all simplified with a dedicated user interface.



Digital Filter Software Option (WR8K-DFP2)

DFP2 lets you implement Finite Impulse Response (FIR) or Infinite Impulse Response (IIR) filters to eliminate undesired spectral components, such as noise, and enhances your ability to examine important signal components. You can choose from a standard set of FIR or IIR filters or you can also design your own custom filters. Create and apply a variety of FIR and IIR digital filters to your capture waveforms or processed traces.



XDEV Advanced Customization Option (WR8K-XDEV)

With the XDEV option, third party programs can be completely integrated into the oscilloscope's processing stream. Create customized math functions and parameters using C/C++, MATLAB, Excel, JScript or Visual Basic without ever leaving the oscilloscope application - and view the results directly on the oscilloscope, in real-time.

WAVERUNNER 8000-R LOW-PROFILE OSCILLOSCOPE

Key Features

Low-profile design - <2U (3.5")

1, 2.5, and 4 GHz bandwidths

Up to 40 GS/s sample rate

Deep Memory - up to 128 Mpts

Fully software-compatible with the WaveRunner 8000

Remote connectivity via LXI, USBTMC, and LAN

Rackmount kit and removable SSD standard

Same powerful, deep toolbox of WaveRunner 8000 oscilloscopes

Support for ProBus active probes



WaveRunner 8000-R oscilloscopes utilize the WaveRunner 8000 acquisition system to provide a high-performance, 4 GHz oscilloscope in a convenient, low-profile form factor.

Low-Profile Form Factor

The WaveRunner 8000-R models provide a convenient form factor for a 4 GHz oscilloscope. The compact design has a height of less than 2U (3.5", 8.89 cm) and includes a standard rackmount kit, easily lending itself to be installed in an automated test environment.

Powerful, Deep Toolbox

Unlike most digitizing systems the WaveRunner 8000-R provides the powerful, deep toolbox that is expected in a Teledyne LeCroy oscilloscope. The full range of the WaveRunner 8000's analysis capability is available; including an array of serial protocol analysis packages and application specific packages.

Easily Transition Test Programs

The WaveRunner 8000-R models are fully software-compatible with their WaveRunner 8000 counterparts. Development can be conducted with the assistance of the front panel and display of the WaveRunner 8000 and then seamlessly transitioned to automated testing.

Flexible Connectivity Options

A variety of remote connectivity options (LXI, USBTMC, and LAN) offer flexibility when connecting to the WaveRunner 8000-R. Teledyne LeCroy's free WaveStudio software is a fast and easy way to analyze acquired waveforms off-line, or remotely control an oscilloscope from your desktop.

SPECIFICATIONS

	WaveRunner 8054	WaveRunner 8104/ 8104-R	WaveRunner 8254/ 8254M/8254M-R	WaveRunner 8404/ 8404M/8404M-R
Vertical System				
Analog Bandwidth @ 50 Ω (-3 dB)	500 MHz (≥ 2 mV/div)	1 GHz (≥ 2 mV/div)	2.5 GHz (≥ 5 mV/div)	4 GHz (≥ 5 mV/div)
Analog Bandwidth @ 1 MΩ (-3 dB)	500 MHz (typical)	500 MHz (typical)	500 MHz (typical)	500 MHz (typical)
Rise Time (10–90%, 50 Ω)	700 ps (typical)	415 ps (typical)	160 ps (typical)	100 ps (typical)
Rise Time (20–80%, 50 Ω)	480 ps (typical)	290 ps (typical)	120 ps (typical)	75 ps (typical)
Input Channels	4			
Bandwidth Limiters	20 MHz, 200 MHz	20 MHz, 200 MHz	20 MHz, 200 MHz, 1 GHz	20 MHz, 200 MHz, 1 GHz
Input Impedance	50 Ω ±2% or 1 MΩ || 17pF, 10 MΩ || 9.5 pF with supplied Probe			
Input Coupling	1 MΩ: AC, DC, GND; 50 Ω: DC, GND			
Maximum Input Voltage	**50 Ω**: 5 V_{rms} ±10 V peak; **1 MΩ**: 400 V max. (DC + peak AC < 10 kHz)			
Channel-Channel Isolation	> 100:1 up to rated BW (typical)		DC -2.5 GHz: >100:1; 2.5 GHz to rated BW: >30:1 (typical)	
Vertical Resolution	8-bits; up to 11-bits with enhanced resolution (ERES)			
Sensitivity	**50 Ω**: 1 mV/div–1 V/div, fully variable; **1 MΩ**: 1 mV/div–10 V/div, fully variable			
DC Vertical Gain Accuracy (Gain Component of DC Accuracy)	±1% F.S. (typical), offset at 0 V			
Offset Range	**50 Ω:** ±1.6 V @ 1 mV– 4.95 mV/div, ±4 V @ 5 mV–9.9 mV/div, ±8 V @ 10 mV–19.8 mV/div, ±10 V @ 20 mV–1 V/div **1 MΩ:** ±1.6 V @ 1 mV–4.95 mV/div, ±4 V @ 5 mV–9.9 mV/div, ±8 V @ 10 mV–19.8 mV/div, ±16 V @ 20 mV–100 mV/div, ±80 V @ 102 mV–1.0 V/div, ±160 V @ 1.02 V–10 V/div		**50 Ω:** **BWL ≤ 1 GHz** ±1.6 V @ 1 mV–4.95 mV/div, ±4 V @ 5 mV–9.9 mV/div, ±8 V @ 10 mV–19.8 mV/div, ±10 V @ 20 mV–1 V/div **BWL > 1 GHz** ±1.4 V @ 5 mV–100 mV/div, ±10 V @ 102 mV–1 V/div **1 MΩ:** ±1.6 V @ 1 mV–4.95 mV/div, ±4 V @ 5 mV–9.9 mV/div, ±8 V @ 10 mV–19.8 mV/div, ±16 V @ 20 mV–140 mV/div, ±80 V @ 142 mV–1.4 V/div, ±160 V @ 1.42 V–10 V/div	
DC Vertical Offset Accuracy	±(1.5% of offset setting +1% of full scale + 1 mV) (test limit)			
Horizontal System				
Timebases	Internal timebase common to 4 input channels; an external clock may be applied at the EXT input			
Time/Division Range	20 ps/div - 1.6 ks/div with standard memory **M Models:** 20 ps/div - 6.4 ks/div with standard memory RIS available at ≤ 10 ns/div; Roll Mode available at ≥ 100 ms/div and ≤ 5 MS/s			
Clock Accuracy	≤ 1.5 ppm +(aging of 0.5 ppm/yr from last calibration)			
Trigger and Interpolator Jitter	≤ 4 ps_{rms} (typical) < 0.1 ps_{rms} (typical, software assisted)	≤ 3.5 ps_{rms} (typical) < 0.1 ps_{rms} (typical, software assisted)	≤ 2.5 ps_{rms} (typical) < 0.1 ps_{rms} (typical, software assisted)	≤ 2 ps_{rms} (typical) < 0.1 ps_{rms} (typical, software assisted)
Channel-Channel Deskew Range	±9 x time/div. setting, each channel			
External Timebase Reference (Input)	10 MHz ±25 ppm			
External Timebase Reference (Output)	10 MHz 3.5 dBm ±1 dBm, synchronized to reference being used by user (internal or external reference)			
External Clock	DC to 100 MHz; (50 Ω/1 MΩ), Ext. BNC input, Minimum rise time and amplitude requirements apply at low frequencies			
Acquisition System				
Single-Shot Sample Rate/Ch	10 GS/s on 4 Ch; 20 GS/s on 2 Ch		10 GS/s on 4 Ch; 20 GS/s on 2 Ch **M Models:** 20 GS/s on 4 Ch; 40 GS/s on 2 Ch	
Random Interleaved Sampling (RIS)	200 GS/s for repetitive signals (20 ps/div to 10 ns/div)			
Maximum Trigger Rate	1,000,000 waveforms/second (in Sequence Mode, up to 4 channels)			
Intersegment Time	1 µs			
Standard Memory (4 Ch / 2 Ch / 1 Ch) (Number of Segments)	16M / 32M / 32M (5,000)		16M / 32M / 32M (5,000) **M Models:** 64M / 128M / 128M (15,000)	
Acquisition Processing				
Averaging	Summed averaging to 1 million sweeps; continuous averaging to 1 million sweeps			
Enhanced Resolution (ERES)	From 8.5- to 11-bits vertical resolution			
Envelope (Extrema)	Envelope, floor, or roof for up to 1 million sweeps			
Interpolation	Linear or Sin x/x (2 pt and 5 pt)			
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	±30V Peak			
Threshold Accuracy	±(3% of threshold setting + 100mV)			

SPECIFICATIONS

	WaveRunner 8054	WaveRunner 8104/ 8104-R	WaveRunner 8254/ 8254M/8254M-R	WaveRunner 8404/ 8404M/8404M-R
Digital - Vertical and Acquisition (-MS Models Only) - Cont'd				
Input Dynamic Range	± 20V			
Minimum Input Voltage Swing	400mV			
Input Impedance (Flying Leads)	100 kΩ || 5 pF			
Maximum Input Frequency	250 MHz			
Sample Rate	1.25 GS/s			
Record Length	32MS - 16 Channels		32MS - 16 Channels **M Models:** 128MS - 16 Channels	
Minimum Detectable Pulse Width	2 ns			
Channel-to-Channel Skew	350 ps			
User Defined Threshold Range	±10 V in 20 mV steps			
User Defined Hysteresis Range	100 mV to 1.4 V in 100 mV steps			
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 trigger)			
Coupling Mode	DC, AC, HFRej, LFRej			
Pre-trigger Delay	0 - 100% of memory size (adjustable in 1% increments or 100 ns)			
Post-trigger Delay	0 - 10,000 divisions in real time mode, limited at slower time/div settings or in roll mode			
Hold-off by Time or Events	From 2 ns up to 20 s or from 1 to 99,999,999 events			
Internal Trigger Range	±4.1 div from center (typical)			
Trigger Sensitivity with Edge Trigger (Ch 1–4)	2 div @ < 500 MHz 1.5 div @ < 250 MHz 1 div @ < 200 MHz 0.9 div @ < 10 MHz (DC, AC, and LFRej coupling)	2 div @ < 1 GHz 1.5 div @ < 500 MHz 1 div @ < 200 MHz 0.9 div @ < 10 MHz (DC, AC, and LFRej coupling)	2 div @ < 2.5 GHz 1.5 div @ < 1.25 GHz 1 div @ < 200 MHz 0.9 div @ < 10 MHz (DC, AC, and LFRej coupling)	2 div @ < 4 GHz 1.5 div @ < 2 GHz 1 div @ < 200 MHz 0.9 div @ < 10 MHz (DC, AC, and LFRej coupling)
External Trigger Sensitivity, (Edge Trigger)	2 div @ 1 GHz 1.5 div @ < 500 MHz 1 div @ < 200 MHz 0.9 div @ < 10 MHz (DC, AC, and LFRej coupling)			
Max. Trigger Frequency, SMART Trigger	500 MHz @ ≥ 10 mV/div 1.2 ns (minimum triggerable width 1.2 ns)	1.0 GHz @ ≥ 10 mV/div (minimum triggerable width 750 ps)	2.0 GHz @ ≥ 10 mV/div (minimum triggerable width 300 ps)	2.0 GHz @ ≥ 10 mV/div (minimum triggerable width 200 ps)
External Trigger Input Range	Ext (±0.4 V); Ext/10 (±4 V)			
Basic Triggers				
Edge	Triggers when signal meets slope (positive, negative, or either) and level condition			
Window	Triggers when signal exits a window defined by adjustable thresholds			
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				
State or Edge 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			
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			
Dropout	Triggers if signal drops out for longer than selected time between 1 ns and 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			
SMART Triggers with Exclusion Technology				
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			
Width (Signal or Pattern)	Triggers on positive or negative glitches with widths selectable as low as 500 ps (depending on oscilloscope bandwidth) to 20 s, or on intermittent faults			
Interval (Signal or Pattern)	Triggers on intervals selectable between 1 ns and 20 s			
Timeout (State/Edge Qualified)	Triggers on any source if a given state (or transition edge) has occurred on another source. Delay between sources is 1 ns to 20 s, or 1 to 99,999,999 events			
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			
Exclusion Triggering	Trigger on intermittent faults by specifying the expected behavior and triggering when that condition is not met			
Measurement Trigger				
	Trigger on measurement values, Edge, Serial Pattern, Bus Pattern, Non-monotonic			

SPECIFICATIONS

	WaveRunner 8054	WaveRunner 8104/ 8104-R	WaveRunner 8254/ 8254M/8254M-R	WaveRunner 8404/ 8404M/8404M-R
Cascade (Sequence) Triggering				
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.			
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). Cascade A then B then C then D: Edge, Window, Pattern (Logic), or Measurement. Measurement can be on Stage D only			
Holdoff	Holdoff between A and B, B and C, C and D is selectable by time (1ns to 20s) 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.			
Optional High-speed Serial Protocol Triggering (WR8K-80B-8B10B TD)				
Data Rates	150 Mb/s–3.125 Gb/s			
Pattern Length	80-bits, NRZ or 8b/10b			
Clock Recovery Jitter	1 ps_{rms} + 0.3% Unit Interval RMS for PRBS data patterns with 50% transition density			
Hardware Clock Recovery Loop BW	PLL Loop BW = Fbaud/5500, 100 Mb/s to 2.488 Gb/s (typical)			
Color Waveform Display				
Type	Color 12.1" widescreen flat panel TFT-Active Matrix with high resolution touch screen (not included on R Models)			
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, Quatro, Twelve, Sixteen			
Waveform Representation	Sample dots joined, or sample dots only			
Processor/CPU				
Type	Intel® i5-3610 Dual Core, 2.7 GHz (or better), **R Models:** Intel® Celeron, 1.4 GHz (or better)			
Processor Memory	8 GB standard, up to 16 GB optional **M Models:** 16 GB standard, **R Models:** 8 GB maximum			
Operating System	Microsoft Windows® 7 Professional for Embedded Systems, 64-bit; **R Models:** Microsoft Windows® 7 Professional Edition (64-bit)			
Real Time Clock	Date and time displayed with waveform in hardcopy files. SNTP support to synchronize to precision internal clocks			
Interface				
Remote Control	Via Windows Automation, or via Teledyne LeCroy Remote Command Set			
Network Communication Standard	VXI-11 or VICP, LXI Class C (v1.2) Compliant			
GPIB Port (Optional)	Supports IEEE—488.2 (External)			
Ethernet Port	Supports 10/100/1000Base-T Ethernet interface (RJ45 port), **R Models:** includes 2 ports			
USB	4 side USB 3.1 Gen1 ports, 2 side USB 2.0 ports, and 1 front USB 2.0 port support Windows compatible devices R Models: 2 rear USB 3.1 Gen1 ports, 2 rear USB 2.0 ports and 1 front 1 USB 2.0 port			
USB Device Port	1 port - USBTMC over USB 3.1 Gen1, **R Models:** USBMTMC over USB 2.0			
External Monitor Port	2 full-size Display Port connectors and 1 DVI-D. **R Models:** 1 full-size Display Port connectors and 1 VGA Includes support for extended desktop operation with WXGA resolution on second monitor			
Power Requirements				
Voltage	100–240 VAC ±10% at 50/60 Hz ±5%; 100–120 VAC ±10% at 400 Hz ±5%; Automatic AC Voltage Selection			
Power Consumption (Nominal)	285 W / 285 VA, **M Models:** 415 W / 415 VA, **R Models:** 240 W / 240 VA, **M-R Models:** 340 W / 340 VA			
Max Power Consumption	375 W / 375 VA, **M Models:** 500 W / 500 VA, **R Models:** 320 W / 320 VA, **M-R Models:** 420 W / 420 VA with all PC peripherals, active probes connected to 4 channels, and MSO active			
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 3,000 m at or below +30 °C			
Random Vibration (Operating)	0.31 g_{rms} 5 Hz to 500 Hz, 15 minutes in each of three orthogonal axes			
Random Vibration (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				
Dimensions (HWD)	12.44" H x 16.42" W x 9.37" D (316 x 417 x 238 mm), **R Models:** 3.41" x 17.52" x 17.52" (86.5 x 445 x 445 mm)			
Weight	22.8 lbs. (10.3 kg), **R Models:** 16.4 lbs. (7.4 kg)			
Certifications				
	CE Compliant, UL and cUL listed; Conforms to UL 61010-1 (3rd Edition), UL 61010-2-030 (1st Edition) CAN/CSA C22.2 No. 61010-1-12, **R Models:** CE Compliant			
Warranty and Service				
	3-year warranty; calibration recommended annually. Optional service programs include extended warranty, upgrades, and calibration services			

SPECIFICATIONS

Standard

Math Tools

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.

absolute value
average (summed)
average (continuous)
correlation (two waveforms)
derivative
deskew (resample)
difference (–)
enhanced resolution (to 11 bits vertical)
envelope
exp (base e)
exp (base 10)
fft (power spectrum, power average, magnitude, phase, up to 128 Mpts)
floor
integral
interpolate (cubic, quadratic, sinx/x)
invert (negate)
log (base e)
log (base 10)
product (x)
reciprocal
rescale (with units)
roof
(sinx)/x
sparse
square
square root
sum (+)
zoom (identity)

Measure Tools

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.

amplitude
area
base
bit rate
cycles
delay
Δ delay
duty cycle
duration
falltime (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
phase
time @ minimum (min.)
time @ maximum (max.)
Δ time @ level
Δ time @ level from trigger
x @ max.
x @ min.

Pass/Fail Testing

Simultaneously test multiple parameters against selectable parameter limits or pre-defined masks. Pass or fail conditions can initiate actions including document to local or networked files, e-mail the image of the failure, save waveforms, send a pulse out at the front panel auxiliary BNC output, or (with the GPIB option) send a GPIB SRQ.

Standard (cont'd)

Basic Jitter and Timing Analysis

This package provides jitter timing and analysis using time, frequency, and statistical views for common timing parameters, and also includes other useful tools. Includes:

- "Track" graphs of all parameters, no limitation of number
  - N-Cycle
  - Edge to Edge
  - Frequency @ level
  - Period @ level
  - Half Period
  - Width @ level
  - Time Interval Error @ level
  - Setup
  - Hold
  - Skew
  - Duty Cycle @ level
  - Duty Cycle Error
- Edge @ lv parameter (counts edges)
- Histograms expanded with 19 histogram parameters and up to 2 billion events
- Trend (datalog) of up to 1 million events
- Persistence histogram, persistence trace (mean, range, sigma)

Software Options

Advanced Customization (WR8K-XDEV)

Provides capability to create a math function or measurement parameter in MATLAB, Excel, C++, JavaScript, or Visual Basic Script (VBS) format and insert it into the oscilloscope's processing stream. All results are processed and displayed on the oscilloscope grid, and are available for further processing. Also permits the creation of customized plug-ins that can be inserted into the scope user interface, control of the scope via Visual Basic scripts embedded in customized functions, and use of Teledyne LeCroy's Custom DSO capabilities.

SDA II Serial Data Analysis Option (WR8K-SDAII)

Total Jitter

A complete toolset is provided to measure total jitter. Eye Diagrams with millions of UI are quickly calculated from up to 128 Mpts records, and advanced tools may be used on the Eye Diagram to aid analysis. Complete TIE and Total Jitter (Tj) parameters and analysis functions are provided.

- Time Interval Error (TIE) Measurement Parameter, Histogram, Spectrum and Jitter Track
- Total Jitter (Tj) Measurement Parameter, Histogram, Spectrum
- Eye Diagram Display (sliced)
- Eye Diagram IsoBER (lines of constant Bit Error Rate)
- Eye Diagram Mask Violation Locator
- Eye Diagram Measurement Parameters
  - Eye Height
  - One Level
  - Zero Level
  - Eye Amplitude
  - Eye Width
  - Eye Crossing
  - Avg. Power
  - Extinction Ratio
  - Mask hits
  - Mask out
  - Bit Error Rate
  - Slice Width (setting)
- Q-Fit Tail Representation
- Bathtub Curve
- Cumulative Density Function (CDF)
- PLL Track

Software Options (cont'd)

SDA II Serial Data Analysis Option (WR8K-SDAII) - *continued*

Jitter Decomposition Models
Two jitter decomposition methods are provided and simultaneously calculated to provide maximum measurement confidence. Q-Scale, CDF, Bathtub Curve, and all jitter decomposition measurement parameters can be displayed using either method.

- Spectral Method
- NQ-Scale Method

Random Jitter (Rj) and Non-Data Dependent Jitter (Rj+BUj)
- Random Jitter (Rj) Measurement Parameter
- Rj+BUj Histogram
- Rj+BUj Spectrum
- Rj+BUj Track

Deterministic Jitter (Dj)
- Deterministic Jitter (Dj) Measurement Parameter

Data Dependent Jitter (DDj)
- Data Dependent Jitter (DDj) Measurement Parameter
- DDj Histogram
- DDj Plot (by Pattern or N-bit Sequence)

Eye Doctor II Advanced Signal Integrity Tools (WR8K-EYEDRII)

Complete set of channel emulation, de-embedding and receiver equalization simulation tools. Provides capability to emulate a serial data link, de-embed or embed a fixture, cable or serial data channel, add or remove emphasis, and perform CTLE, FFE, or DFE equalization.

Power Analyzer Option (WR8K-PWR)

Power switching device measurements, control loop modulation analysis, and line power harmonic testing are all simplified with a dedicated user interface and automatic measurements.

Device Analysis
- Losses – Automatic measurement of turn-on, turn-off, and conduction loses as well as off-state power, total losses and switching frequency
- Safe Operating Area
- B-H-Hysteresis Curve
- Dynamic On-Resistance
- Dv/dt and di/vt

Control Loop Analysis
- Closed loop time-domain – Duty cycle, width, period or frequency

Line Power Analysis
- Power – Vrms, Irms, real-power, apparent power, power factor, crest factor
- Harmonics – EN61000-3-2 pre-compliance, Total Harmonic Distortion

Measurement Setup
- Controls for Deskew, DC fine adjust, probe integration, device zone identification

Cable De-embedding Option (WR8K-CBL-DE-EMBED)

Removes cable effects from your measurements. Simply enter the S-parameters or attenuation data of the cable(s) then all of the functionality of the WR8K can be utilized with cable effects de-embedded.

8b/10b Decode and 80-bit High Speed Serial Trigger Option (WR8K-80B-8B10B TD)

Intuitive, color-coded serial trigger decode with powerful search capability enables captured waveforms to be searched for user-defined sequences of symbols. Multi-lane analysis decodes up to four simultaneously captured lanes. Includes 150 Mb/s to 3.125 Gb/s High-speed 80-bit Serial Pattern Trigger Option

Software Options (cont'd)

Serial Data Mask Option (WR8K-SDM)

Create eye diagrams using a comprehensive list of standard eye pattern masks, or create a user-defined mask. Mask violations are clearly marked on the display for easy analysis.

Electrical Telecom Pulse Mask Test Option (WR8K-ET-PMT)

Performs automated compliance mask tests on a wide range of electrical telecom standards.

Spectrum Analyzer Option (WR8K-SPECTRUM)

Spectrum analyzer style user interface and advanced FFT capabilities.
- Automatic oscilloscope setup when selecting start/stop frequency or center frequency and span
- Resolution bandwidth automatically or manually controlled
- FFT Reference and vertical scale in dBm, dBV, dBmV, dBuV, Vrms or Arms
- Spectrogram provides 2D or 3D spectral history display
- Up to 100 automatic peak markers
- Up to 20 markers, either manually controlled or automatic which mark fundamental frequency and harmonics
- Math waveform analysis, additional output types:
  - Power density
  - Real
  - Imaginary
  - Magnitude squared

Disk Drive Measurements Option (WR8K-DDM2)

This package provides disk drive parameter measurements and related mathematical functions for performing disk drive WaveShape Analysis.
- Disk Drive Parameters are as follows:

- amplitude asymetry
- local base
- local baseline separation
- local maximum
- local minimum
- local number
- local peak-peak
- local time between events
- local time between peaks
- local time between troughs
- local time at minimum
- local time at maximum
- local time peak-trough
- local time over threshold
- local time trough-peak
- local time under threshold
- narrow band phase
- narrow band power
- overwrite
- pulse width 50
- pulse width 50 –
- pulse width 50 +
- resolution
- track average amplitude
- track average amplitude –
- track average amplitude +
- auto-correlation s/n
- non-linear transition shift

ORDERING INFORMATION

Product Description	Product Code
WaveRunner 8000 Oscilloscopes	
500 MHz, 10 GS/s, 4ch, 16 Mpts/Ch Oscilloscope with 12.1"" WXGA Color Display. 32 Mpts/Ch in interleaved mode.	WaveRunner 8054
1 GHz, 10 GS/s, 4ch, 16 Mpts/Ch Oscilloscope with 12.1"" WXGA Color Display. 32 Mpts/Ch in interleaved mode.	WaveRunner 8104
2.5 GHz, 10 GS/s, 4ch, 16 Mpts/Ch Oscilloscope with 12.1"" WXGA Color Display. 32 Mpts/Ch in interleaved mode.	WaveRunner 8254
4 GHz, 10 GS/s, 4ch, 16 Mpts/Ch Oscilloscope with 12.1" WXGA Color Display. 32 Mpts/Ch in interleaved mode.	WaveRunner 8404
2.5 GHz, 20 GS/s, 4ch, 64 Mpts/Ch Oscilloscope with 12.1" WXGA Color Display. 128 Mpts/Ch in interleaved mode.	WaveRunner 8254M
4 GHz, 20 GS/s, 4ch, 64 Mpts/Ch Oscilloscope with 12.1" WXGA Color Display. 128 Mpts/Ch in interleaved mode.	WaveRunner 8404M
500 MHz, 10 GS/s, 4ch, 16 Mpts/Ch Mixed Signal Oscilloscope with 12.1" WXGA Color Display. 32 Mpts/Ch in interleaved mode.	WaveRunner 8054-MS
1 GHz, 10 GS/s, 4ch, 16 Mpts/Ch Mixed Signal Oscilloscope with 12.1" WXGA Color Display. 32 Mpts/Ch in interleaved mode.	WaveRunner 8104-MS
2.5 GHz, 10 GS/s, 4ch, 16 Mpts/Ch Mixed Signal Oscilloscope with 12.1" WXGA Color Display. 32 Mpts/Ch in interleaved mode	WaveRunner 8254-MS
4 GHz, 10 GS/s, 4ch, 16 Mpts/Ch Mixed Signal Oscilloscope with 12.1" WXGA Color Display. 32 Mpts/Ch in interleaved mode.	WaveRunner 8404-MS
2.5 GHz, 20 GS/s, 4ch, 64 Mpts/Ch Mixed Signal Oscilloscope with 12.1" WXGA Color Display. 128 Mpts/Ch in interleaved mode.	WaveRunner 8254M-MS
4 GHz, 20 GS/s, 4ch, 64 Mpts/Ch Mixed Signal Oscilloscope with 12.1" WXGA Color Display. 128 Mpts/Ch in interleaved mode.	WaveRunner 8404M-MS

Included with Standard Configurations (WaveRunner 8000 and WaveRunner 8000-MS)

÷10, 500 MHz Passive Probe (Qty. 4), Protective Cover, Getting Started Guide, Anti-virus Software (Trial Version), Microsoft Windows® 7 for Embedded Systems 64-bit License, Commercial NIST Traceable Calibration with Certificate, Power Cable for the Destination Country, 3-year Warranty

Included with WaveRunner 8000-MS

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

Computer Upgrade

256 GB Removable Solid State Drive Option	WR8K-256GB-RSSD
Additional 256 GB Solid State Drive for use with RSSD option. Includes Windows 7 Pro for Embedded Systems OS, LeCroy Oscilloscope Software and Critical Scope Operational File Duplicates.	WR8K-256GB-RSD-02
Upgrade from 8 GB RAM to 16 GB RAM	WR8K-UPG-16GBRAM

Product Description	Product Code
WaveRunner 8000-R Oscilloscopes	
1 GHz, 10 GS/s, 4ch, 16 Mpts/Ch, 2U form factor Oscilloscope. 20 GS/s, 32 Mpts/Ch in interleaved mode.	WaveRunner 8104-R
2.5 GHz, 20 GS/s, 4ch, 64 Mpts/Ch, 2U form factor Oscilloscope. 40 GS/s, 128 Mpts/Ch in interleaved mode.	WaveRunner 8254M-R
4 GHz, 20 GS/s, 4ch, 64 Mpts/Ch, 2U form factor Oscilloscope. 40 GS/s, 128 Mpts/Ch in interleaved mode.	WaveRunner 8404M-R

Included with Standard Configurations

÷10, 500 MHz Passive Probe (Qty. 4), Getting Started Guide, Rackmount kit, Removable SSD, Anti-virus Software (Trial Version), Microsoft Microsoft Windows® 7 Professional Edition (64-bit), Commercial NIST Traceable Calibration with Certificate, Power Cable for the Destination Country, 3-year Warranty

ORDERING INFORMATION

Product Description	Product Code
Serial Trigger and Decode	
MIL-STD-1553 Trigger and Decode Option	WR8K-1553 TD
MIL-STD-1553 Trigger, Decode, Measure/ Graph, and Eye Diagram Option	WR8K-1553 TDME
8b10b Decode Option- Includes 80 bit 3.125 Gb/s serial trigger	WR8K-80B-8b10b TD
AudioBus Trigger and Decode Option	WR8K-Audiobus TD
AudioBus trigger, decode, and graph Option	WR8K-Audiobus TDG
ARINC 429 Bus Symbolic Decode Option	WR8K-ARINC429BUS DSYMBOLIC
ARINC 429 Bus Symbolic Decode, Measure/Graph, and Eye Diagram Option	WR8K-ARINC429BUS DME SYMBOLIC
CAN FD Trigger and Decode Option	WR8K-CAN FDBUS TD
CAN FD Trigger, Decode, Measure/ Graph, and Eye Diagram Option	WR8K-CAN FDBUS TDME
CAN FD Symbolic Trigger, Decode, and Measure/Graph, and Eye Diagram Option	WR8K-CAN FDBUS TDME SYMBOLIC
CAN Trigger & Decode Option	WR8K-CANBUS TD
CAN Trigger, Decode, Measure/Graph, and Eye Diagram Option	WR8K-CANBUS TDME
CAN Symbolic Trigger, Decode, and Measure/Graph, and Eye Diagram Option	WR8K-CANBUS TDME SYMBOLIC
DigRF 3G Bus Decode Option	WR8K-DigRF3Gbus D
DigRF V4 Bus Decode Option	WR8K-DigRFV4bus D
MIPI D-PHY CSI-2, DSI Bus Decode Option	WR8K-DPHYbus D
MIPI D-PHY CSI-2, DSI Bus Decode and Physical Layer Test Option	WR8K-DPHYbus DP
ENET Bus Decode Option	WR8K-ENETbus D
Bundle: Includes I2C, SPI, UART-RS232 Trigger and Decode Option	WR8K-EMB TD
Bundle: Incl. I2C, SPI, UART-RS232 Trigger, Decode, Measure/Graph, and Eye Diagram Option	WR8K-EMB TDME
FibreChannel decode annotation Option	WR8K-FCbus D
FlexRay Trigger and Decode Option	WR8K-FLEXRAYBUS TD
FlexRay Trigger, Decode, Measure/ Graph and Physical Layer Option	WR8K-FLEXRAYBUS TDMP
I2C Trigger and Decode Option	WR8K-I2CBUS TD
I2C Trigger, Decode, Measure/Graph, and Eye Diagram Option	WR8K-I2CBUS TDME
LIN Trigger and Decode Option	WR8K-LINBUS TD
LIN Trigger, Decode, Measure/Graph, and Eye Diagram Option	WR8K-LINBUS TDME
Manchester Bus Decode Option	WR8K-MANCHESTERbus D
MIPI M-PHY Bus Decode Option	WR8K-MPHYbus D
MIPI M-PHY Bus Decode and Physical Layer Test Option	WR8K-MPHYbus DP
NRZ Bus Decode Option	WR8K-NRZbus D
PCIe Gen 1 Decode Option	WR8K-PCIebus D
Serial Debug Toolkit - Measure Analyze Graph Option	WR8K-PROTOBUS MAG
Decode Annotation and Protocol Analyzer Synchronization Option	WR8K-ProtoSync
Decode Annotation and Protocol Analyzer+Bit Tracer Synchronization Option	WR8K-ProtoSync-BT
SAS Decode annotation Option	WR8K-SASbus D
SATA Trigger and Decode Option	WR8K-SATAbus TD
SENT Bus Decode Option	WR8K-SENTbus D
SpaceWire Decode Option	WR8K-SPACEWIREbus D
SPI Trigger and Decode Option	WR8K-SPIBUS TD
SPI Trigger, Decode, Measure/Graph, and Eye Diagram Option	WR8K-SPIBUS TDME
UART-RS232 Trigger and Decode Option	WR8K-UART-RS232BUS TD
UART-RS232 Trigger, Decode, Measure/Graph, and Eye Diagram Option	WR8K-UART-RS232BUS TDME

Product Description	Product Code
Serial Trigger and Decode	
MIPI UniPro Protocol Decoder Software Option	WR8K-UNIPRObus D
MPHY to UniPro Decoder Software Upgrade MPHY REQUIRED	WR8K-UPG-MPHY-UNIPRObus D
USB 2.0 HSIC Decode Option	WR8K-USB2-HSICbus D
USB2 Trigger and Decode Option	WR8K-USB2bus TD
USB 2.0 Trigger and Decode Option	WR8K-USB2BUS TD
USB 2.0 Trigger, Decode, Measure/ Graph, and Eye Diagram Option	WR8K-USB2BUS TDME
Serial Data Compliance	
QualiPHY Enabled BroadR-Reach Software Option	QPHY-BroadR-Reach
QualiPHY Enabled Ethernet 10/100/1000BT Software Option	QPHY-ENET*
QualiPHY Enabled DDR2 Software Option	QPHY-DDR2
QualiPHY Enabled DDR3 Software Option	QPHY-DDR3
QualiPHY Enabled LPDDR2 Software Option	QPHY-LPDDR2
QualiPHY Enabled MIPI D-PHY Software Option	QPHY-MIPI-DPHY
QualiPHY Enabled MOST150Software Option	QPHY-MOST150
QualiPHY Enabled MOST50 Software Option	QPHY-MOST50
QualiPHY Enabled USB 2.0 Software Option	QPHY-USB ‡
10/100/1000Base-T Ethernet Test Fixture	TF-ENET-B**
USB 2.0 Compliance Test Fixture	TF-USB-B

* TF-ENET-B required. ‡ TF-USB-B required.

** Includes ENET-2CAB-SMA018 and ENET-2ADA-BNCSMA.

Serial Data Analysis	
Cable De-Embedding Option	WR8K-CBL-DE-EMBED
Eye Doctor (Virtual Probe and Equalizer Emulation Bundle)	WR8K-EYEDRII
Serial Data Mask Software Option	WR8K-SDM
SDAII Serial Data Analysis Option	WR8K-SDAII
DDR Debug Toolkits	
DDR2 and LPDDR2 Debug Toolkit	WR8K-DDR2-TOOLKIT
DDR3, DDR3L, LPDDR3, DDR2, and LPDDR2 Debug Toolkit	WR8K-DDR3-TOOLKIT
DDR3, DDR3L, LPDDR3, DDR2, and LPDDR2 Debug Toolkit Upgrade	WR8K-UPG-DDR3-TOOLKIT
Data Storage Software	
Advanced Optical Recording Measurement Package	WR8K-AORM
Disk Drive Measurements Software Package	WR8K-DDM2
Disk Drive Analyzer Software Package	WR8K-DDA
Power Analysis Software	
Power Analyzer Software Option	WR8K-PWR
Jitter Analysis Software	
Clock, Clock-Data Jitter Analysis And Views Of Time, Statistical, Spectral, and Jitter Overlay	WR8K-JITKIT
Other Software Options	
Advanced Customization Option	WR8K-XDEV
EMC Pulse Parameter Software Option	WR8K-EMC
Electrical Telecom Mask Test Software Option	WR8K-ET-PMT
Q-Scape Multi-tab Display Option	WR8K-Q-SCAPE
Spectrum Analyzer and Advanced FFT Option	WR8K-SPECTRUM
Digital Filtering Software	
Digital Filter Software Option	WR8K-DFP2

ORDERING INFORMATION

Product Description	Product Code
Remote Control/Network Options	
External USB2 to GPIB Adaptor	USB2-GPIB
General Accessories	
Oscilloscope Cart with Additional Shelf and Drawer	OC1024
Oscilloscope Cart	OC1021
Rackmount, 8U Adaptor Kit	WR8K-RACK
Keyboard, USB	KYBD-1
Soft Carrying Case	WR8K-SOFTCASE
Probes	
High Voltage Fiber Optic Probe, 60 MHz (requires accessory tip)	HVFO103
±1V (1x) Tip Accessory for HVFO103	HVFO100-1X-TIP
±5V (5x) Tip Accessory for HVFO103	HVFO100-5X-TIP
±20V (20x) Tip Accessory for HVFO103	HVFO100-20X-TIP
Power/Voltage Rail Probe. 4 GHz bandwidth, 1.2x attenuation, ±30V offset, ±800mV	RP4030
Browser for use with RP4030	RP4000-BROWSER
500 MHz Passive Probe, 2.5mm, 10:1, 10 MΩ	PP022
500 MHz Passive Probe, 5mm, 10:1, 10 MΩ	PP024
1 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe	ZS1000
Set of 4 ZS1000, 1 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe	ZS1000-QUADPAK
1.5 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe	ZS1500
Set of 4 ZS1500, 1.5 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe	ZS1500-QUADPAK
2.5 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe	ZS2500
Set of 4 ZS2500, 2.5 GHz, 0.9 pF, 1 MΩ High Impedance Active Probe	ZS2500-QUADPAK
500 MHz, 3.1pf, 1 MΩ Active Differential Probe, ±40 V, with 10X Gain, 42V common-mode 200 MHz,	AP033
4 GHz, 0.6 pF, 1 MΩ High Impedance Active Probe	ZS4000
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 Active Differential Probe, ±8 V	ZD1000
1.5 GHz, 1.0 pF Active Differential Probe, ±8 V	ZD1500
WaveLink 4 GHz, 2.5 Vp-p Differential Probe System	D410-A-PS
WaveLink 4 GHz, 5 Vp-p Differential Probe System	D420-A-PS
WaveLink 6 GHz, 2.5 Vp-p Differential Probe System	D610-A-PS
WaveLink 6 GHz, 5 Vp-p Differential Probe System	D620-A-PS
WaveLink 4 GHz Differential Amplifier Module with Adjustable Tip	D400A-AT*
WaveLink 6 GHz Differential Amplifier Module with Adjustable Tip	D600A-AT*
WaveLink ProBus Platform/Cable Assembly (4 GHz)	WL-PBus-CASE

Product Description	Product Code
Probes (cont'd)	
1 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A
DA1855A with Rackmount	DA1855A-RM
2 Ch, 100 MHz Differential Amplifier with Precision Voltage Source	DA1855A-PR2
DA1855A with Rackmount (must be ordered at time of purchase, no retrofit)	DA1855A-PR2-RM
30 A; 50 MHz Current Probe – AC/DC; 30 Arms; 50 Apeak Pulse	CP030
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 Arms; 50 Apeak Pulse	CP031
30A, 100 MHz High Sensitivity Current Probe - AC/DC, 30 A rms, 50 A Peak Pulse, 1.5 meter cable	CP031A
150 A; 10 MHz Current Probe – AC/DC; 150 Arms; 500 Apeak Pulse	CP150
500 A; 2 MHz Current Probe – AC/DC; 500 Arms; 700 Apeak Pulse	CP500
Deskew Calibration Source for CP030, CP030A, CP031, CP031A, AP015, CP150, CP500	DCS025
Programmable Current Sensor to ProBus Adapter for use with third party current sensors	CA10
Set of 4 CA10 Programmable Current Sensor to ProBus Adapters for third-party current sensors	CA10-QUADPAK
100:1 400 MHz 50 MΩ 1 kV High-voltage 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 5 MΩ / 50 MΩ 6 kV High-Voltage Probe	PPE6KV
TekProbe to ProBus Probe Adapter	TPA10
Set of 4 TPA10 TekProbe to ProBus Probe Adapters. Includes soft carrying case	TPA10-QUADPAK
Optical-to-Electrical Converter, 500-870 nm ProBus BNC Connector	OE425
Optical-to-Electrical Converter, 950-1630 nm ProBus BNC Connector	OE455
1kV, 25 MHz High Voltage Differential Probe	HVD3102
1kV, 25 MHz High Voltage Differential Probe without tip Accessories	HVD3102-NOACC
1kV, 120 MHz High Voltage Differential Probe	HVD3106
1kV, 120 MHz High Voltage Differential Probe without tip Accessories	HVD3106-NOACC
2kV, 120 MHz High Voltage Differential Probe	HVD3206
2kV, 80 MHz High Voltage Differential Probe with 6m cable	HVD3206-6M
6kV, 100 MHz High Voltage Differential Probe	HVD3605
700 V, 15 MHz High-Voltage Differential Probe (÷10, ÷100)	AP031

TELEDYNE LECROY
Everywhereyoulook™

1-800-5-LeCroy
teledynelecroy.com

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

© 2017 by Teledyne LeCroy, Inc. All rights reserved. Specifications, prices, availability, and delivery subject to change without notice.
Product or brand names are trademarks or requested trademarks of their respective holders.

PCI Express® is a registered trademark and/or service mark of PCI-SIG.

MATLAB® is a registered trademark of The MathWorks, Inc. All other product or brand names are trademarks or requested trademarks of their respective holders.

waverunner8000-ds-02oct17