LeCroy

WaveRunner® 104MXi

WaveRunner 104MXi

Leading Features

- **1 GHz Analog Bandwidth**
- **5 GS/s per Channel (10 GS/s Max.)**
- **Long Capture Time with 12.5 Mpts/Ch memory**
- **WaveScan™ Advanced Search Feature**
- **LabNotebook™ Report Generation Tool**
- **Advanced Math and Measurement Capabilities**
- **Jitter and Timing Analysis**
- **Customized Math and Measurements**
- **Powerful SMART Triggers™**
- **HDTV Trigger**
- **Large 10.4" Touch Screen**
- **Small 6" Deep Footprint**
- **Mixed Signal Options**
- **I²C, SPI, UART and RS-232 Trigger and Decode**
- **CAN, LIN and FlexRay Trigger and Decode**

Performance Reimagined

The LeCroy WaveRunner® Xi with its advanced triggers, fast viewing modes, measurement parameters, and serial decodes makes validation and debug simple and easy. Advanced debug, multi-domain analysis, and waveshape analysis are possible with tools unique to WaveRunner Xi, Building on the features and capabilities of the WaveRunner Xi the WaveRunner 104MXi provides a higher level of analysis, measurement and customization tools, making it the most powerful and capable oscilloscope in its class.

The collection of tools, features an functions packed into this small 6" deep instrument with large 10.4" touch screen make the WaveRunner 104MXi a truly unique oscilloscope. With a maximum sampling rate of 10 GS/s (5 GS/s per channel) you can be confident in all your measurements knowing that even the fastest signals in your device are being captured. High sample rate is important for fast signals and edges but without long memory this rate cannot be maintained for long captures. The

25 Mpts (12.5 Mpts/Ch) fast memory guarantees maximum sample rate for 2.5 ms.

Debug, Analyze, Document

Beyond the impressive specifications, the WaveRunner 104MXi provides a set of tools like no other oscilloscope. Use WaveScan to search through a single capture for a rare event, or scan through live data acquisitions. The LabNotebook report generator lets you quickly share findings with others and even allows you to make hand written notes directly on top of the signals. With the advanced math and measure tools you can look at every aspect of your waveforms and understand the distribution of measurements with histograms of up to 2 billion events, trends of up to 1 million measurements and a track function that shows variations in signals over time. Adding to the flexibility of th WaveRunner 104MXi is the ability to create your very own customer or proprietary measurements, math functions, filters or scripts and run them directly in the oscilloscope having results displayed in real time.

Outstanding Capabilities

The WaveRunner 104MXi not only provides the performance and tools required to debug and validate your signals, it goes deeper into your testing to help you understand the causes of complex problems. The high 10 GS/s maximum sampling rate and extremely long 25 Mpts memory guarantee you are capturing all of the details in your signals. The built-in search and scan functions (WaveScan) and report generator (LabNotebook) simplfy how you find and document problems. With the wide range of analytical, statistical and cusotmization tools, understanding and fixing those probeblems is quick and easy.

WaveRunner 104MXi Fast Memory Architecture

LeCroy's proprietary method of data transfer and processing permits wave shapes to be captured and processed 10–100x faster than other oscilloscopes. The result is better capability to perform advanced Waveshape Analysis, and faster debug.

With WaveRunner 104MXi, you'll notice the difference when capturing long records and making measurements, calculating math or FFTs, or performing non-time domain analysis using statistically-based Histograms or parameter-based Tracks.

For instance, in a long 12.5 Mpts capture where it is desired to measure the periodicity of a signal, WaveRunner 104MXi will quickly capture and display thousands of signal periods, measure each period, calculate statistics, and display a Histogram of the measurement values. Other oscilloscopes struggle to calculate a single period value (instead of thousands) and cannot provide a Histogram view of the statistical data.

Similar speed is achieved during simple operations, such as subtracting two channels (when a differential probe isn't available), or computing FFTs with high-frequency resolution (and, hence, long memory).

WaveScan™ Advanced Search and Analysis Finds Problems that Triggers Won't Find.

The best trigger won't find all unusual events—a more powerful capability is sometimes needed. WaveScan provides the ability to locate unusual events in a single capture (i.e., capture and search), or "scan" for an event in many acquisitions over a long period of time. Select from more than 20 search modes (frequency, rise time, runt, duty cycle, etc.), apply a search condition and begin scanning. 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 "frequency" to be quickly "scanned" for. 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 LeCroy strength of fast processing of data. A LeCroy X-Stream oscilloscope will quickly "scan" millions of events, looking for unusual occurrences, and do it much faster and more efficiently than other oscilloscopes can.

WaveScan in WaveRunner 104MXi also contains ScanHisto and ScanOverlay capability. Found events can be overlaid in a ScanOverlay view to provide a quick and simple comparison of events. In addition, measurement-based scanning modes (like the frequency example given above), permit ScanHistograms to show the statistical distribution of the found events. These analysis tools simplify understanding and enable faster debug.

LabNotebook™ – A Unique Tool for Documentation and Report Generation

The LabNotebook feature provides a report generation tool to save and document all your work. Saving all displayed waveforms, relevant settings, and screen images is all done with a single button press, eliminating the need to navigate multiple menus to save all these files independently.
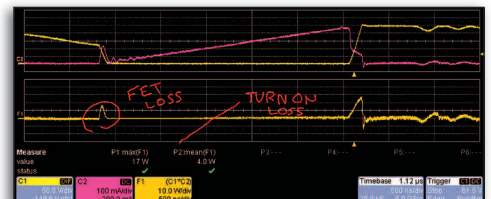
Easy report generation helps you share your findings and communicate important results. All screen images saved can be annotated with freehand notes using the stylus and touch screen, and then included in your report. Reports can be saved to the hard drive for later use, saved to a USB memory device or even emailed directly from the oscilloscope to you inbox. With the built in Flashback functionality LabNotebook lets you recall your settings from any report and use them to reproduce previous measurements.

Advanced Math Characterization

Most oscilloscopes contain only a few simple math functions to subtract waveforms or to perform coarse resolution FFTs on short record length acquisitions. Or, they provide long memory, but limited ability to process the memory and perform WaveShape Analysis that leads to detailed understanding and faster debug.

WaveRunner 104MXi oscilloscopes contain dozens of standard math functions, and powerful capabilities, such as long memory FFTs, Trending, Tracking (optional), Sparsing, Interpolation selection, a variety of Persistence Views, user customized math and measurements (MATLAB,® Mathcad,® or Visual Basic formats), and numerous other specialized capabilities (optional Application Packages). The toolset is rich and deep, and sure to solve any complex problem.

SMART Triggers Isolate Events

The WaveRunner 104MXi oscilloscope provides a multitude of basic and advanced (SMART) Triggers to meet any need. Advanced triggers isolate specific events of interest, and (when combined with long memory) provide a complete view of the signal activity

around that event. WaveRunner 104MXi excels in this regard.

Trigger on what you expect (widths, glitches, video, logic patterns, etc.) and also trigger on unusual signals (dropouts, intervals, runts, slew rates). LeCroy's exclusion triggering can exclude normal signals and capture only the abnormal ones, speeding up the debug of your circuits and systems. Trigger on signals down to 1 ns in width (500 ps for width and glitch trigger), or use an "A" condition to qualify a "B" trigger.
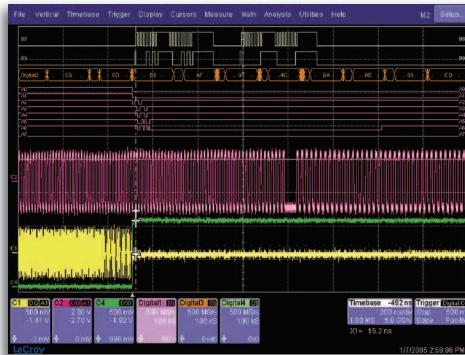

Mixed Signal Testing (MS Series Options)

Add high-performance mixed signal capability to any WaveRunner 104MXi with the MS-500 or MS-250. These solutions can capture digital signals with speeds up to 500 MHz. Available in 18 or 36 digital channel models and with long 50 Mpts/Ch memory the MS Series are the ideal tools for efficient testing 16 bit embedded systems where all 16 ADDR and DATA lines can be viewed simultaneously.

I²C, SPI, UART, RS-232, LIN, FlexRay, and CAN Trigger & Decode (optional)

Complete I²C, SPI, UART, RS-232, LIN, FlexRay, and CAN serial triggering, including powerful conditional data triggering, allows quick and easy isolation of
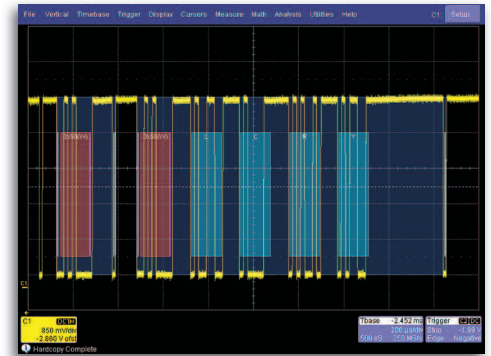
specific events on your embedded controller. Trigger on DATA in specific locations of long I²C EEPROM reads, or trigger on sensor values outside of a certain range. Intuitive, color-coded decode overlay helps you understand your serial data signals quickly. Search for data patterns, or view the protocol data in a table. Export table data to Excel. (Capabilities are optional).

ZS Series High Impedance Active Probes (Accessories)

LeCroy's ZS Series of high impedance active probes provide full bandwidth at the probe tip, and the high impedance (0.9 pF, 1 MΩ) you want.
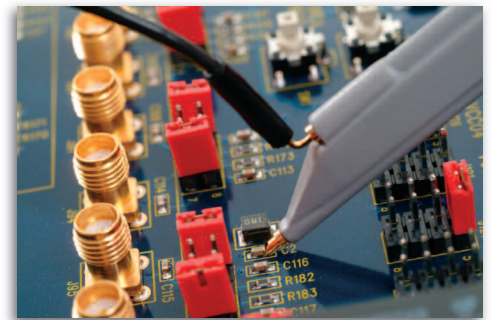
A variety of standard and available probe tip and grounding accessories are offered to meet any requirement. What's more, ZS Series probes are available for a very affordable price. The ZS1500, 1.5 GHz probe gives full 1 GHz system bandwidth at the probe tip when used with the WaveRunner 104MXi.

Specifications and Ordering Information

WaveRunner 104MXi Specfications

Bandwidth (@ 50 Ω)	1 GHz
Rise Time	400 ps
Input Channels	4
Display	10.4" Color flat-panel TFT-LCD, 800 x 600 SVGA, touch screen
Waveform Grids	1, 2, 4, 8 user defined
Sample Rate (single-shot)	5 GS/s (10 GS/s interleaved)
Sample Rate (RIS mode)	200 GS/s
Standard Record Length	12.5 Mpts/Ch (25 Mpts interleaved)
Standard Capture Time	up to 2.5 ms at full sample rate on all four channels
Vertical Resolution	8 bits
BW Limit	20 MHz, 200 MHz
Input Coupling	AC, DC, GND (DC and GND for 50 Ω)
Input Impedance	1 MΩ ‖ 20 pF, or 50 Ω
Probing System	BNC or ProBus
Probes	One PP007 (2.5 mm) per channel (standard)
Timebase Range	Real Time: 200 ps/div–100 s/div, RIS: 200 ps/div to 10 ns/div, Roll mode: up to 1000 s/div
Trigger Coupling	DC, AC, HFRej, LFRej
Triggering	Edge, Glitch, Width, Logic (Pattern), Video (NTSC, PAL, SECAM, HDTV - 720p, 1080i, 1080p, Runt, Slew Rate, Interval (signal or Pattern), Dropout, Qualified (State or Edge)

For more detailed specifications go to www.lecroy.com

Standard Software Tools

Advanced Math and Measure

- Parameter math – add, subtract, multiply, or divide two different parameters. Invert a parameter and rescale parameter values
- Histograms with 19 histogram parameters
- Track graphs of any measurement parameter
- Narrow-band power measurements
- Auto-correlation function
- Sparse function
- Cubic interpolation function

Customization Software

- Creation of your own measurement parameter or math function, using third-party software packages, and display of the result in the scope. Supported third-party software packages include:
  - VBScript – MATLAB – Excel – Mathcad
- CustomDSO – create your own user interface in a scope dialog box.
- Addition of macro keys to run VBScript files
- Support for plug-ins

Jitter and Timing Analysis Software

- Jitter and timing parameters, with "Track" graphs of

– Cycle-Cycle Jitter	– Period	– Hold
– N-Cycle	– Half Period	– Skew
– N-Cycle with start selection	– Width	– Duty Cycle
– Frequency	– Time Interval Error	– Duty Cycle Error
	– Setup	

- Edge@lv parameter (counts edges)
- Persistence histogram, persistence trace (mean, range, sigma)

Standard

Math Tools

Display up to four math function traces (F1-F4). 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 valueaverage (summed)	floor
average (continuous)	histogram of 2 billion events
custom (MATLAB, Mathcad, VBScript) – limited points	integral
derivative	invert (negate)
deskew (resample)	log (base e)
difference (–)	log (base 10)
enhanced resolution (to 11 bits vertical)	product (x)
	ratio (/)
envelope	reciprocal
exp (base e)	rescale (with units)
exp (base 10)	roof
FFT with power averaging, power density, real and imaginary components, frequency domain parameters, and FFT on up to 25 Mpts.	(sinx)/x
	square
	square root
	sum (+)
	trend (datalog) of 1 million events
	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 waveshape characteristics.

amplitude	frequency	risetime (10–90%, 20–80%, @ level)
area	last	
base	level @ x	rms
cycles	maximum	std. deviation
custom (MATLAB, Mathcad, VBScript) - limited points	mean	time @ level
	median	top
delay	minimum	Δ time @ level
Δ delay	number of points	Δ time @ level from trigger
duration	+overshoot	
duty cycle	–overshoot	width (positive + negative)
falltime (90–10%, 80–20%, @ level)	peak-to-peak	x@ max.
	period	x@ min.
first	phase	

Ordering Information

Product Description	Product Code
WaveRunner 104MXi Digital Oscilloscopes	
1 GHz, 4 Ch, 5 GS/s, 12.5 Mpts/Ch (10 GS/s, 25 Mpts/Ch in interleaved mode) with 10.4" Color Touch Screen Display	WaveRunner 104MXi

Customer Service

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

This warranty includes: • No charge for return shipping
• Long-term 7-year support • Upgrade to latest software at no charge

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