Oscilloscopes Deliver Faster Update Rate, More Memory

Rohde & Schwarz's R&S MXO 4 series of oscilloscopes delivers a number of industry firsts according to the vendor, such as the world's fastest real-time update rate of over 4.5 million acquisitions per second. The 12-bit ADC in the MXO 4 series also has 16 times the resolution of traditional 8-bit oscilloscopes at all sample rates without any tradeoffs for more precise measurements. A standard acquisition memory of 400 Mpts on all four channels gives the instrument up to 100 times the standard memory of comparable instruments, says the company.

The MXO 4 oscilloscopes come in four-channel models with bandwidths of 200 MHz, 350 MHz, 500 MHz, 1 GHz, and 1.5 GHz with a starting price of $8,435. Targeted application areas for this series include power integrity, EMI debug, power analysis, protocol analysis, logic analysis and general-purpose measurement.

The term MXO refers to "neXt generation MSO (mixed signal oscilloscope)" which reflects the series' status as first in a new generation of scopes based on advanced software and hardware being implemented for the first time in the MXO 4 series. On the hardware side that includes a unique 200-Gbps processing ASIC, which enables the 4.5-M acquisitions-per-second update rate.

Greg McCaskill, product manager for oscilloscopes and value instruments at Rohde & Schwarz, notes that the scopes previously introduced by the company fell into one of two categories—cost optimized or performance optimized. "Now for the first time, we're combining these two groups in the MXO 4 series," says McCaskill.

The improved performance can be seen in comparisons of the MXO 4 series with the RTA4000, one of the cost-optimized series from Rohde & Schwarz that was introduced in January of 2017 (see the table). He also notes that similar performance is available from R&S's RTO & RTP series, which are in the performance optimized class, with prices starting at $24,680. However, those scopes do have features not available on the MXO 4 series including advanced math and compliance packages.

Andreas Werner, vice president Oscilloscopes at Rohde & Schwarz, explains, "The new hardware and software technology blocks and architecture allowed our development team to achieve a once-in-a-decade engineering breakthrough. Our customers will experience a whole new level of performance, and all at a price more affordable than has ever been seen on the market."

The MXO 4 series incorporates a 12-bit ADC that operates across all the instrument sample rates with an 18-bit vertical resolution architecture for greater resolution precision than any other oscilloscope, according to the vendor, which adds that the MXO 4 series also has the lowest noise and largest offset range (±5 V with a 500-µV/div scaling) in its class. This capability is useful for power rail analysis, offering an advantage versus the standard ±1-V offset range.

In addition to bandwidth and sample rate, memory depth is an important factor and determines whether an oscilloscope can handle a large range of troubleshooting tasks. More acquisition memory enables oscilloscopes to capture more time and retain rated bandwidth information for longer time base settings. With a simultaneous standard acquisition memory of 400 Mpts on all four channels, the MXO 4 series has up to 100 times the standard memory of its primary competition, according to the vendor. The additional memory also provides extra measurement capability when needed.

Once only available in higher performance oscilloscopes with higher price points, the digital trigger comes standard with all MXO 4 series oscilloscopes. The trigger sensitivity of 1/10,000 division can isolate difficult-to-find small physical layer anomalies in the presence of large signals. No competitive oscilloscope has this degree of trigger sensitivity for isolating small signals. The digital trigger complements the 18-bit vertical architecture, allowing users to fully utilize the precision of the MXO 4 series (Fig. 1).

In addition to time domain measurements, MXO 4 series oscilloscopes have superior RF spectrum measurement capabilities (Fig. 2). They are the first oscilloscopes to perform 45,000 FFTs (fast Fourier transforms) per second, while comparable oscilloscopes deliver fewer than 10 FFTs per second, according to R&S. For those involved in power supply design, a bode-frequency analysis mode will be offered as a software option in the MXO 4 series.

The MXO 4 series incorporates a 13.3-in. full-HD capacitive touchscreen and an intuitive user interface (Fig. 3). The instrument's small footprint, low audible noise, VESA mounting and a rackmount kit for installation in integrated environments make the MXO 4 oscilloscopes suitable for any engineering workspace.

When users have more demands, a number of upgrade options are available, including 16 integrated digital channels with a mixed signal oscilloscope (MSO) option, an integrated dual-channel 100-MHz arbitrary generator, protocol decode and triggering options for a variety of industry-standard buses and other options that expand the oscilloscope's capabilities.

The MXO 4 series oscilloscopes are now available from Rohde & Schwarz and selected distribution channel partners. For more information go to https://www.rohde-schwarz.com/product/MXO4.

Table. Comparing MXO 4 series oscilloscope features with those of the RTA4000.

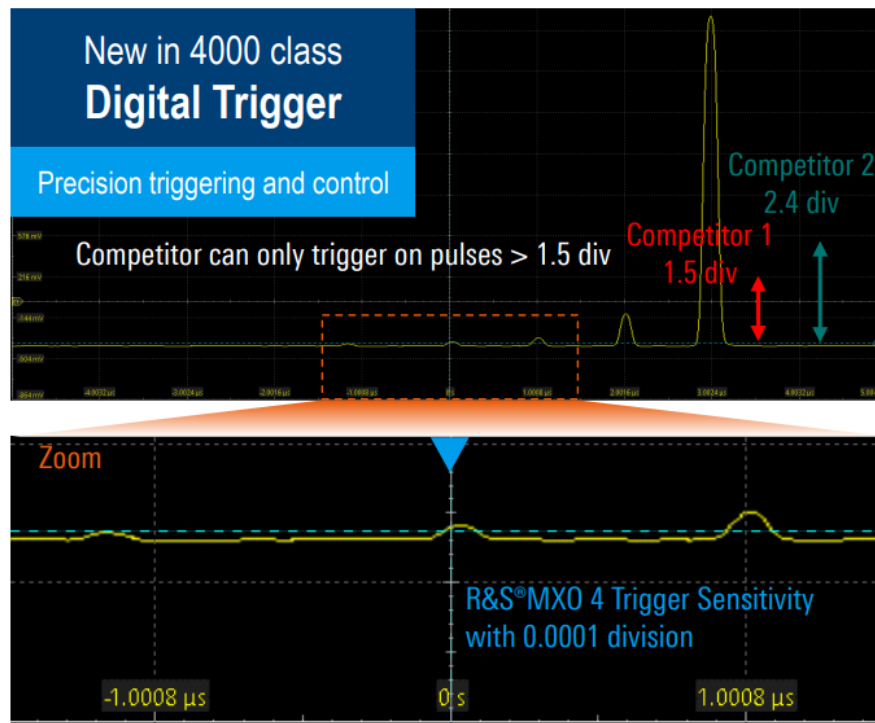|	R&S®RTA4000	R&S®MXO 4	Better
Max BW	1 GHz	1.5 GHz	50%
Max SR	5 GSa/s	5 GSa/s	-
Memory	100 Mpts	400 Mpts / 800 Mpts (opt.)	x 4
ADC	10-bit	12 bit, up to 18 bit	x 4
Update rate	20 Kwfs/s	4.5 Mwfs/s	x 200
Display	10.1"	13.3"	65%
Trigger	analog	digital	x 10k

Fig. 1. A unique digital trigger architecture enables the MXO 4 scopes to trigger on 18-bit signals from HD mode with sensitivity of 0.0001 division at all bandwidths.

Fig. 2. For spectrum analysis, the MXO 4 series offers independent span/RBW control vs time base and automatic peak list and max/min-hold measurement.

Fig. 3. The scopes incorporate several features that enhance their usability including box design for better touchability, a cursor that displays dynamic values, a search-in menu, a toolbar to make workflows quick and easy and R&S SmartGrid functionality.