R&S®ESSENTIALS

MXO 4 Series OSCILLOSCOPE

Next generation oscilloscope for accelerated insight

Product Brochure
Version 11.00

Oscilloscope innovation. Measurement confidence.

ROHDE&SCHWARZ
Make ideas real

NEXT GENERATION TECHNOLOGY

MXO 4 Series OSCILLOSCOPE

The MXO 4 series is the first of a new generation of oscilloscopes that excels in both performance and value. The instruments deliver a once-in-a-decade engineering breakthrough for accelerated insight.

A touch above other oscilloscopes in its class, the MXO 4 series oscilloscope sports an impressive 13.3" Full HD capacitive touchscreen and an intuitive user interface with a learning curve of less than 15 minutes.

WHY ENGINEERS CONTINUE TO UPGRADE TO ROHDE&SCHWARZ OSCILLOSCOPES?

- Trusted, global company committed to highest quality standards, long-term customer relationships and technological innovation
- Industry's newest oscilloscope portfolio from 60 MHz to 16 GHz
- ASIC investments enable world's most responsive oscilloscope
- Frontend technology developments offer pristine signal integrity
- 16-bit and 18-bit architectures with HD mode provide highest resolution
- Digital triggering delivers world's most sensitive event isolation
- Superior user interface and front panel experience

WHY USE THE MXO 4?

- World's first oscilloscope with update rate exceeding 4.5 million waveforms per second
- Industry leading 12-bit ADC at all sample rates
- Industry best 18-bit architecture
- Fastest and most accurate spectrum analysis in its class
- Industry's deepest standard memory of 400 Mpoints per channel
- Industry's fastest trigger rearm time of 21 ns
- First in class to incorporate new digital triggering technology
- Industry's most sensitive trigger of 0.0001 div
- Best in class trigger jitter of < 1 ps
- First oscilloscope with dual-path protocol analysis
- First in class with R&S®SmartGrid user interface

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FEATURES AND BENEFITS

APPLICATIONS

PROBES AND ACCESSORIES

- 200 MHz to 1.5 GHz bandwidth
- Up to 5 Gsample/s sample rate
- 400 Mpoints per channel standard memory
- 12-bit ADC at all sample rates
- 18-bit architecture with HD mode
- Precise digital trigger

CUTTING-EDGE TECHNOLOGY BLOCKS

THAT HELP GIVE YOU ACCELERATED INSIGHT

The MXO 4 series oscilloscopes utilize advanced technologies to achieve fast and accurate results. Custom technology and innovative features in our oscilloscopes quickly boost your understanding of circuit behaviors.

MXO-EP processing ASIC

See more of your signals, faster.

At the heart of each MXO 4 series oscilloscope is a Rohde&Schwarz developed application-specific integrated circuit (ASIC): MXO-EP (extreme performance). MXO-EP processes 200 Gbit/s to deliver the world's fastest update rate of up to > 4.5 million acquisitions/s. See and capture more of your signals, faster. Find rare signal anomalies quickly. Experience the most responsive oscilloscope in the industry.

12-bit ADC, 18-bit vertical architecture

Measure your signals accurately.

Measurement accuracy is highly dependent on the components in the signal path, e.g. amplifiers, samplers and A/D converters. The workhorse of the MXO 4 series is an extremely low-noise signal path including a 12-bit ADC. High-definition (HD) mode increases vertical resolution to industry best 18-bit architecture. The ultra-low noise and high precision provides up to 10 effective number of bits (ENOB). Get accurate measurements all the time.

Responsive deep memory

Capture more of your signals.

MXO 4 series oscilloscopes come equipped with the industry's deepest standard acquisition memory of 400 Mpoints per channel. Capture up to 80 ms of power up or power down sequences with the highest time resolution of 200 ps. The memory controller in the MXO-EP ASIC ensures the oscilloscope stays responsive with deep memory.

Advanced digital triggering system

Easily isolate subtle signal variations.

The MXO-EP ASIC incorporates advanced digital triggering that evaluates the ADC samples in the acquisition path in real time. Trigger on small events of less than 0.0001 vertical division that no other oscilloscope can isolate. Choose your own trigger hysteresis. Apply digital filters to suppress noise to get the most precise triggering available. The implemented zone trigger retains ultra fast acquisition speed and versatility and can work across channel waveforms, spectra and math signals.

FIND SIGNAL ANOMALIES QUICKLY

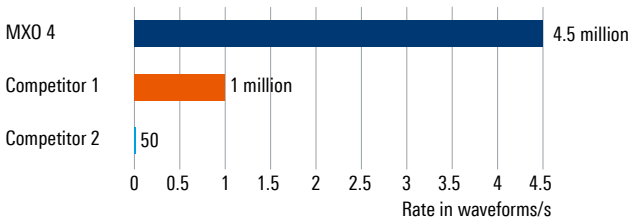
WITH UNPARALLELED UPDATE RATES

- **World's fastest acquisition rate of up to > 4.5 million waveforms/s reveals infrequent anomalies instantly**
- **Up to 90 % real-time signal capture and display ensures instant display of all signal details**
- **Signal processing based on MXO-EP ASIC ensures responsive deep memory**

World's fastest update rate

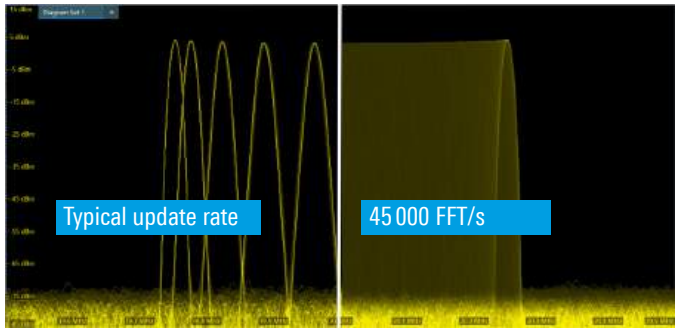
The MXO 4 oscilloscope processing path contains a dedicated ASIC: the MXO-EP (extreme performance). Thanks to optimized signal processing, the MXO 4 oscilloscope reaches an exceptional update rate. Its unique architecture allows the MXO 4 to acquire, process and display up to > 4.5 million waveforms/s.

Real-time acquisition rate



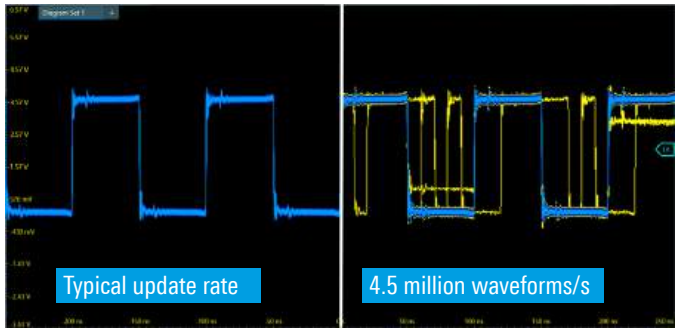
Available with active automatic measurements, FFTs or cursor measurements

The MXO 4 oscilloscope offers a high update rate even when FFTs, automatic measurements or cursor measurements are active. Also when performing analysis with deep memory acquisitions, the MXO-EP based signal processing path ensures smooth workflows.



Quickly and reliably detect sporadic signal faults

The statistical confidence in results grows with the number of waveforms acquired. A high update rate increases the likelihood of detecting and displaying signal faults and including them in the analysis. Its high update rate enables the MXO 4 to generate trustworthy statistical results based on a high number of waveforms acquired in a short time. This is crucial for quickly understanding electronic circuits.



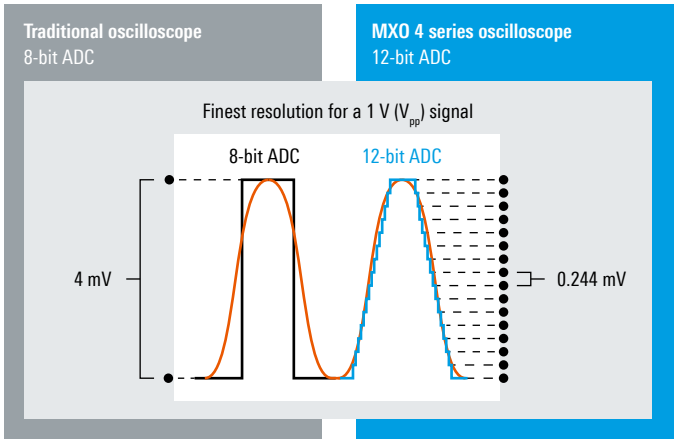
SEE YOUR SIGNALS ACCURATELY

LOWEST MEASUREMENT NOISE AND HIGHEST VERTICAL RESOLUTION

- **12-bit ADC for high vertical resolution at all sample rates across the full bandwidth**
- **18-bit architecture with HD mode**
- **Low noise at 50 Ω input impedance (1 mV/div setting)**
  - **104 µV (at 1 GHz, 12-bit standard mode)**
  - **56 µV (at 500 MHz, 14-bit HD mode)**
- **ENOB performance of > 10 bit**
- **Industry's highest available offset range of ±5 V at 500 µV/div**

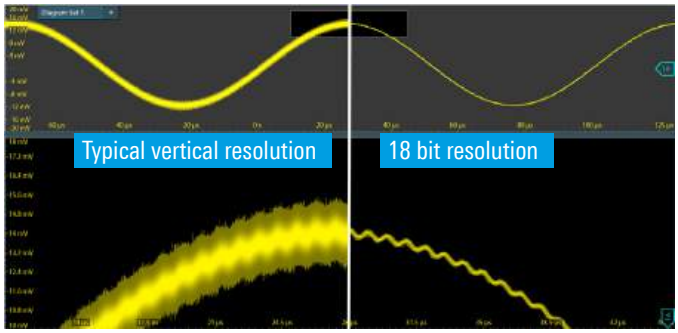
12-bit ADC even at the fastest sample rates

All MXO 4 series oscilloscopes incorporate a 12-bit ADC. 12 bit vertical resolution delivers 4096 quantization levels for precise vertical sampling. This is a 16-fold improvement over 8-bit ADCs. The ADC stays in 12-bit mode all the time, even at the fastest sample rates.



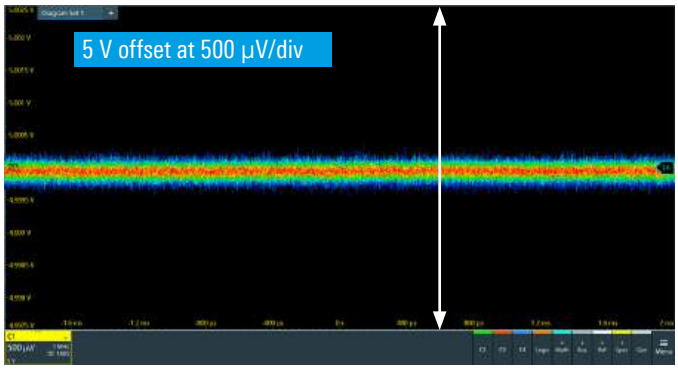
18-bit architecture with HD mode

Offering a user tradeoff between bandwidth and bits of resolution, HD mode, implemented in hardware for fast speed, achieves up to 18 bit vertical resolution. This allows you to see sharper waveforms with more signal details that would otherwise be masked by noise. In addition to superior vertical resolution, the MXO 4 series oscilloscope is engineered with the lowest-in-industry system measurement noise of just 22 µV AC (RMS) at 1 mV/div.



Vertical sensitivity to 500 µV/div with ±5 V offset range

The MXO 4 series oscilloscope offers an outstanding sensitivity down to 500 µV/div without any unexpected reduction in bandwidth. With an offset of ±5 V at higher sensitivity vertical scale, you can easily place the signal at the center of the screen. A higher offset enables use of more sensitive vertical resolution, meaning a higher number of ADC bits and lower noise.



CAPTURE MORE TIME

DEEPEST STANDARD MEMORY

- **Industry's deepest memory of 400 Mpoints per channel (optionally 800 Mpoints interleaved)**
- **Standard segmented memory (10 000 segments, optionally 1 000 000 segments)**
- **Standard history mode (10 000 acquisitions, optionally 1 000 000 acquisitions)**

Deep memory as an insurance policy

After bandwidth and sample rate, memory depth is the most important attribute that determines an oscilloscope's ability to handle a large range of troubleshooting tasks. More acquisition memory gives oscilloscopes the ability to capture more time. More memory enables oscilloscopes to retain the maximum sample rate and bandwidth even with slower timebase settings.

With 400 Mpoints acquisition memory standard on all four channels simultaneously, the MXO 4 series oscilloscope offers up to 100 times the standard memory compared to the primary competitor.

Maintain fast sample rates with slow timebase settings

Ever adjusted your oscilloscope timebase to capture longer periods of time, pressed stop, then zoomed in to find signal details that do not look right? If so, you have experienced the aliasing problem that oscilloscopes with shallow memory have. The deep memory of the MXO 4 enables longer time captures at full sample rate.

Standard segmented memory

Use segmented memory to capture signals separated by inactivity. Examples include laser pulses, serial bus activities and RF pulses. The segmented memory of the MXO 4 series oscilloscope enables signal capture over a long observation period of up to 1 000 000 segments.

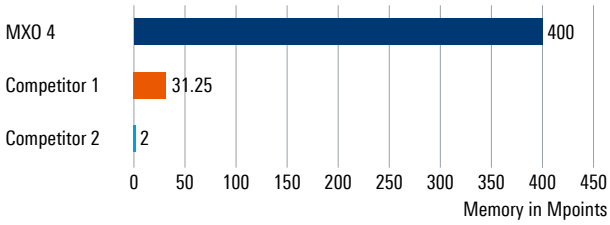
Standard history capability

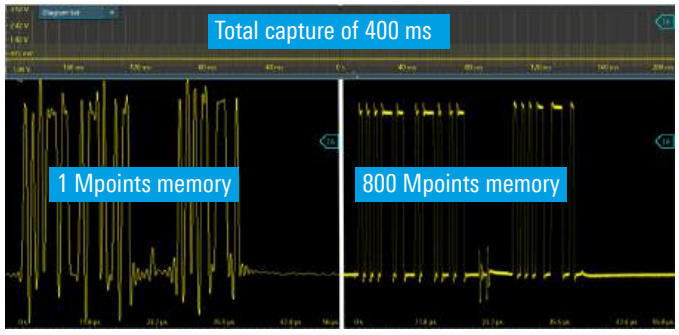
Press stop and use history mode to see previously captured acquisitions. History mode is an always-on capability. All measurement and analysis tools are available in history mode, including the serial bus decoding and automatic measurements.

Need even more memory?

During tests that involve looking at power up/power down behavior or decoding bus events over a longer period of time, there is always the wish to record longer time intervals. The memory extension option turns on 800 Mpoints (2 channels interleaved), up to 1 000 000 segments and up to 1 000 000 acquisitions.

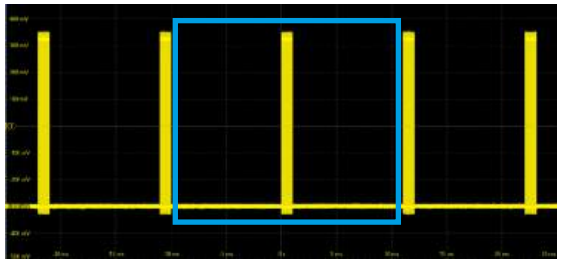
Standard memory per channel

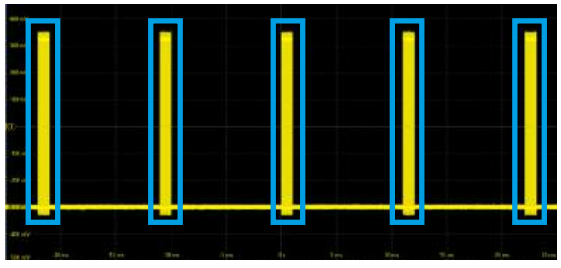




Traditional single-shot acquisition

Total acquisition time = memory depth/sample rate





Segmented memory acquisition

Acquisition time per segment = memory depth/# of segments

FASTEST ZONE TRIGGER

VISUALIZE TRIGGER EVENT GRAPHICALLY

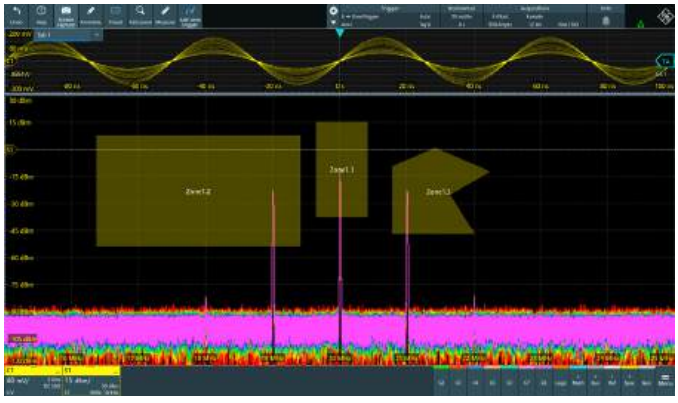
- **Fastest zone trigger: 600 000 waveforms/s**
- **Draw a total of 32 zone areas: 4 zones with 8 zone areas each**
- **Zone trigger across analog, spectrum and math sources**
- **Combine zone trigger with history and segmentation mode**
- **Compatible with FreeRun triggering**

Easy trigger condition setup visually as standard feature

Designs are becoming more complex and predefined trigger conditions may no longer effectively capture needed events. The zone trigger on MXO series oscilloscopes can easily be drawn on signal diagrams to specify whether traces have to pass through defined areas to qualify. Simply activate the function on the toolbar and draw the area on an analog waveform, spectrum or even math to define complex trigger conditions.

Spectrum zone trigger

Rohde&Schwarz is the first in the industry to offer zone trigger capability for spectrum analysis. Starting with the R&S®RTO series, the MXO series has an even higher update rate for detecting spurious spectrum events. The responsive spectrum makes it ideal for EMI debugging. The fast zone trigger on the MXO series goes a step further and offers trigger capability across time, spectrum and even math waveforms.



32 zone trigger areas across analog sources, spectrum and math

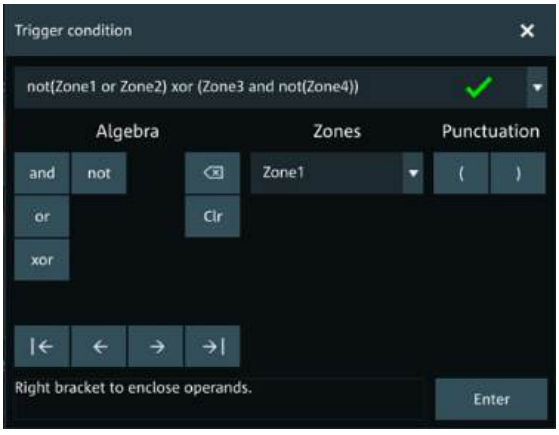
Graphically define 32 zone areas (4 zones with up to 8 areas each) on the screen. You can use the MXO series zone triggering for analog signals, math functions, spectra and zoom windows. Combine zone trigger with the oscilloscope FreeRun trigger mode to capture signals as quickly as possible without looking for a hardware trigger event.

Hardware accelerated zone trigger

Zone triggering complements traditional oscilloscope triggering to quickly and graphically isolate events. The MXO series zone trigger is implemented in the ASIC, the only hardware-accelerated solution and the fastest on the market with an update rate of 600 000 waveforms/s and less than 1.45 µs blind time between trigger events. The solution is up to 10 000x faster than competing zone triggering products. A more complex trigger setup with fast waveform acquisition is possible and increases the probability of isolating rare events without affecting responsiveness.

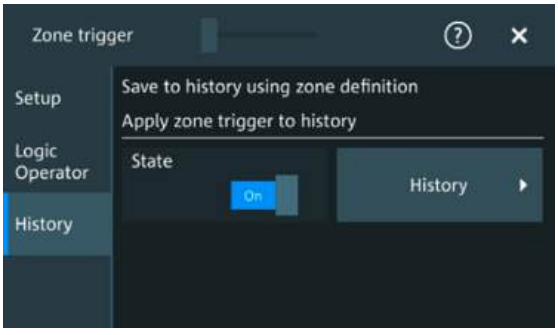
Complex HD trigger with zone logics

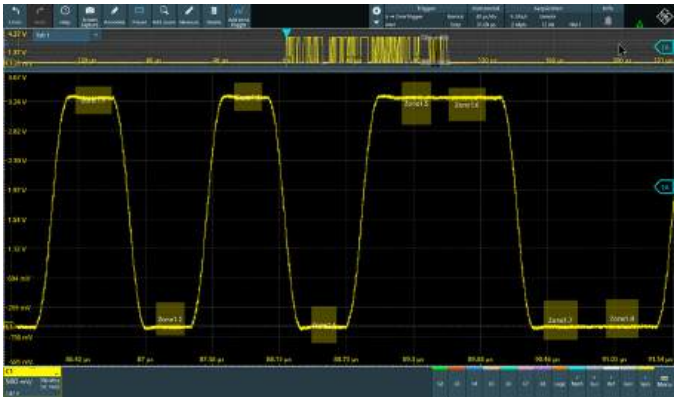
The MXO digital trigger can use the HD enhanced samples together with the zone trigger. Zones defined can also work across different sources. Logical definitions can enhance detection of required events.



Store zone trigger events in history

Apply zone triggering capability to history and segmentation mode and store only waveforms that match the zone trigger criteria in the oscilloscope memory. Very long time captures are possible when combined with the MXO series deep memory.





Use zone trigger on protocols to trigger on a specific packet sequence

Power rail measurements with zone trigger to isolate power consumption events during RF transmissions

ISOLATE EVENTS WITH MORE PRECISION

HIGH-PRECISION DIGITAL TRIGGER

- **Industry's most sensitive trigger: 0.0001 vertical division**
- **Best in class trigger jitter of just 1 ps**
- **World's fastest trigger rearm time of < 21 ns**
- **Adjustable digital trigger filters**
- **User definable hysteresis**

Modern digital trigger

The MXO-EP ASIC incorporates the Rohde&Schwarz patented digital trigger system. With digital triggering, signal measurement and triggering take place in a common path, whereas with older analog trigger architectures, incoming signals are split and fed to a measurement and a trigger path. Digital triggers offer numerous advantages.

Adjustable digital trigger filters

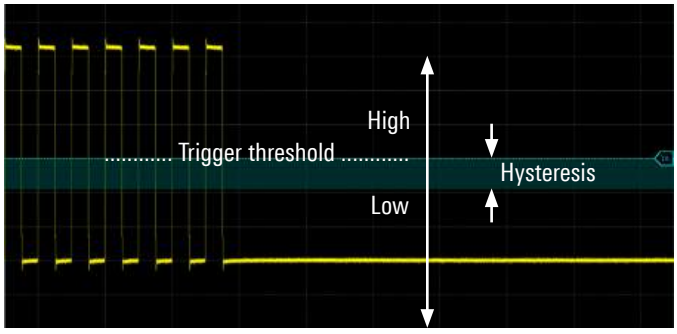
Use the up to 18-bit HD mode for triggering to reduce measurement system noise. The digital trigger architecture makes it possible to adapt the cutoff frequency of the digital lowpass filter to the signal to be measured. Conventional oscilloscopes limit triggering on filtered waveforms, on the MXO the same filter settings can be used for both the trigger signal and the measurement signal. As a result, noise on the trigger signal can be suppressed, for instance while simultaneously capturing and displaying the filtered or unfiltered measurement signal.

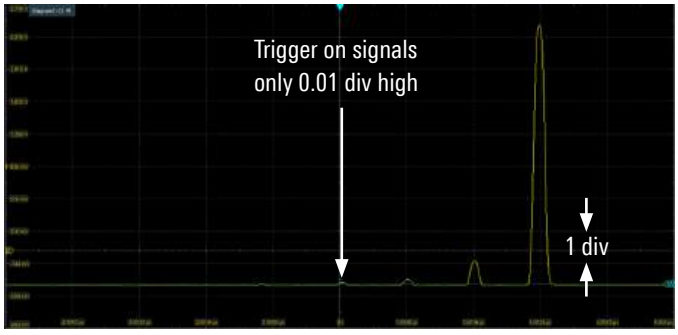
World's most sensitive trigger

The MXO 4 series digital trigger is up to 10000 times more sensitive than competing trigger systems. High trigger sensitivity enables users to isolate difficult-to-find small physical layer anomalies in the presence of large signals, accelerating debugging and troubleshooting.

User definable hysteresis

Use automated trigger hysteresis settings or manually enter your values. Unlike using oscilloscopes with analog triggers, MXO 4 series users have full access to control all trigger hysteresis settings. This provides additional flexibility for determining where to trigger, including how much trigger noise suppression is desired.





SPECTRUM ANALYSIS

SUPERIOR RF MEASUREMENT CAPABILITY

- **Pristine RF spectrum**
- **Dedicated RF controls**
- **RF/time domain views with independent controls**
- **Gated spectrum for easy correlation between frequency and time**

RF insights into your measurements

The MXO 4 series oscilloscope is engineered with spectrum analysis in mind to bring forward fast and powerful analysis capabilities. It boasts an industry leading spectrum acquisition rate of 45 000 FFT/s. This allows capture of spurious spectrum events, especially when doing EMI debugging. The pristine RF characteristics of the instrument deliver great spectrum performance together with a synchronized time domain view.

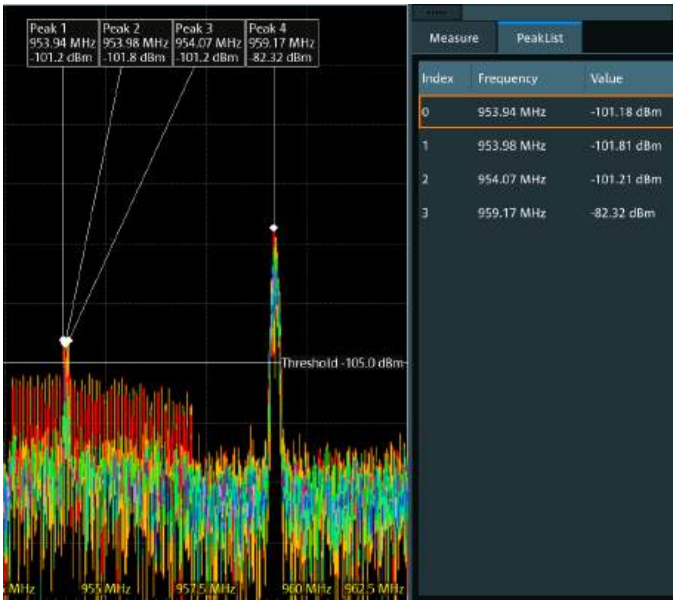
RF characteristics	
Simultaneous spectrum	up to 4 possible
Spectrum update rate	> 45 000 FFT/s
Sensitivity/noise power density	–160 dBm (1 Hz)
Noise figure	14 dB
Dynamic range	106 dB
Spurious-free dynamic range (SFDR)	65 dBc
Second harmonic distortion	–60 dBc
Third harmonic distortion	–59 dBc

Frequency analysis setup made easy

You can configure spectrum analysis measurements on the MXO 4 by simply entering typical parameters: center frequency, span and resolution bandwidth (RBW). The spectrum settings are independent of the time domain settings but the time and frequency domains are time-correlated.

Automatic peak list and max./min. hold measurements

Rohde&Schwarz understands the need for additional tools in spectrum measurements. This is why the MXO 4 includes advanced spectrum analysis functions like max. and min. hold as well as peak list indication as part of the standard features. The values in the peak list are also shown in the diagram, allowing easy correlation and quick insights into the spectrum diagram.



SUPERIOR USER EXPERIENCE

ADVANCED USABILITY, EASY DOCUMENTATION, FAST REMOTE CONTROL

Quick access to important tools

The toolbar 1 enables quick access to important tools. Choose from a variety of tools and arrange them with maximum flexibility. The main menu 2 provides access to all instrument settings. The keys 3 left of the main menu key enable activation of the desired signals and provide quick access to analog channel, math function, FFT, arbitrary waveform generator and serial bus analysis settings.

R&S®SmartGrid

Configure your individual waveform layout on the screen using the R&S®SmartGrid function 4. See the fundamental signal parameters in the signal bar 5. From here, drag&drop waveforms into the R&S®SmartGrid and arrange them as desired. Superimposing waveforms is also possible.

Enhanced touchability

The box design 6 implemented for all instrument settings provides enhanced touchability. Tap on any part of a box to change the value of the parameter.

Search function

Easily find any oscilloscope capability you are looking for by simply typing it into the search box 7.

Save results fast

Save waveforms in various file formats or download them via Ethernet or USB for later analysis with MATLAB or Excel. You can also save screen content, measurement data and reports.

Documentation at the press of a key

Document your measurements quickly:

- Screenshots including waveforms and results
- Clear grid annotations for easy-to-read signal characteristics
- Color-coded labeling to highlight signal portions of interest, e.g. anomalies
- Save waveforms and measurement results in binary or CSV format for signal analysis on a PC

Documentation		
Contents	waveform	complete
		selection (zoom, cursor, gate, manual)
		number of acquisitions
		history memory
		measurement results
Format	measurement data	binary, CSV, 1 to 4 channels
	graphics	PNG, JPG, BMP, TIF, PDF
Drivers		VXI, LabVIEW, LabWindows/CVI, .NET
Remote control		web interface, VNC, SCPI
Languages		choose from 13

Remote control access: anytime, anywhere

Remotely control your MXO 4 and view the display on a PC or mobile device. View the same user interface as on the instrument itself. All oscilloscope functions are also available remotely via Ethernet or USB.

Language selection

The MXO 4 series user interface supports multiple languages. Just a few seconds are needed to switch languages while the instrument is running, making the oscilloscope truly international.

ENHANCED USABILITY

13.3" high resolution, multitouch display

- ► High resolution: 1920 × 1080 pixel (Full HD)
- ► Gesture support speeds up scaling and zooming
- ► Easy-to-see signal details

Interfaces

- ► Three USB 3.1 and two USB 2.0 ports
- ► USB device port, Ethernet
- ► HDMI port

Integrated arbitrary waveform generator

- ► Two-channel 100 MHz arbitrary waveform generator
- ► Wide range of waveforms and modulation types
- ► Easy configuration of frequency, amplitude, offset and noise

16 logic channels

- ► Add 16 logic channels without reducing number of analog channels
- ► High MSO sample rates for precise time synchronization between oscilloscope and probes

Intuitive front panel design for efficient operation

- Fast, direct access to primary instrument settings
- Quickly adjust settings with knobs and keys
- Sectional layout makes finding the right function easy

Clear orientation with color-coded LEDs

- Color-coded keys and knobs enable fast correlation with signal sources
- Indication of currently selected signal sources
- Selection between fine/course adjustment made simple

Active probe interfaces

- Support for over 30 Rohde&Schwarz current and voltage probes
- 50 Ω and 1 MΩ path enable support of an even wider range of passive and active probes, including ones from third parties

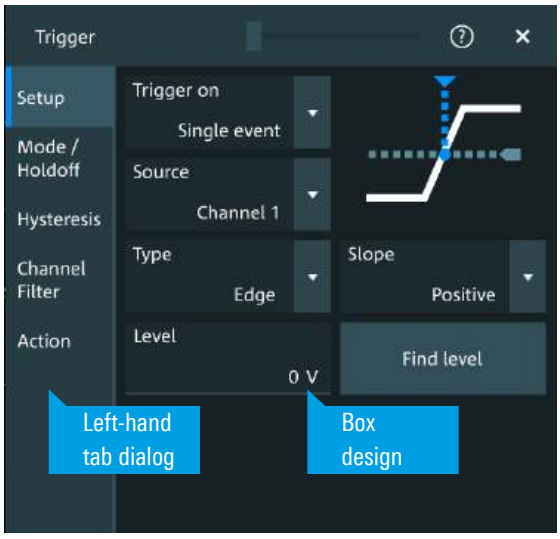
FUN TO DRIVE

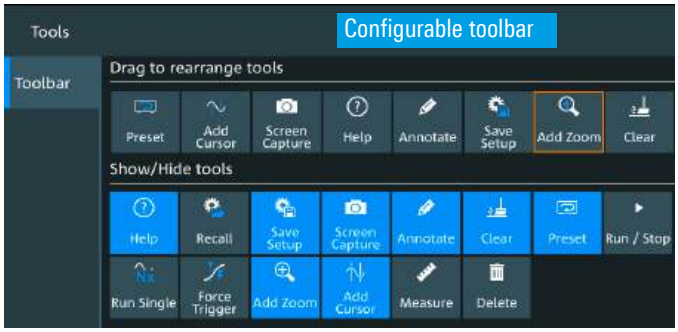
15-MINUTE LEARNING CURVE, ENHANCED TOUCHABILITY, INTUITIVE NAVIGATION

Superior usability

Extensive user feedback and research into smart device user interface concepts led to the development of the MXO 4 series user interface:

- The main menu key in the lower right corner of the touchscreen opens a pull-up menu that provides access to all of the oscilloscope's functions. The main menu is positioned within easy reach of the front panel, so that users can quickly switch between the touchscreen and the front panel controls
- The left-hand tab dialogs produce small areas, maximizing the waveform viewing area
- Box design to touch anywhere in a large target area
- The keys in the signal bar on the lower left make it easy to turn on/off signal sources and to adjust the R&S®SmartGrid layout
- Unique in the industry is the toolbar for quick access to your favorite tools
- The toolbar can be personalized. Icons, e.g. for measurement, cursors and spectrum display, can be rearranged, added or removed
- Fast one-touch access to trigger setup, horizontal settings and acquisition control directly from the menu bar on the upper right
- Select the icon with the Rohde&Schwarz logo to see current instrument details including LAN IP and firmware version
- The user interface is consistent with that of the R&S®RTO6 and R&S®RTP oscilloscopes (see photos below)



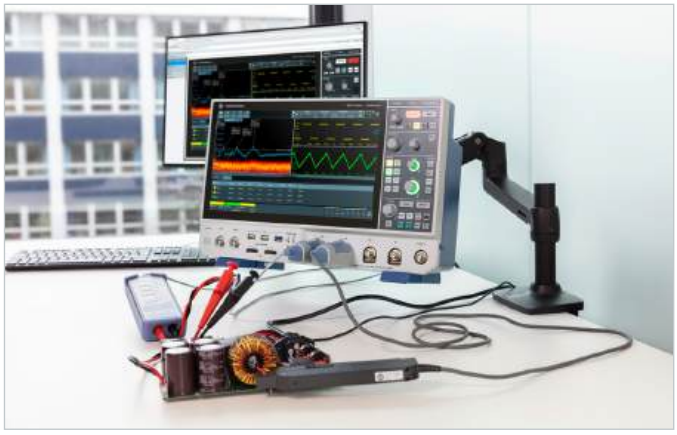


YOUR GO-TO TOOL

READY FOR MANY USES

An oscilloscope as flexible as you

Need additional test capability? Customize your MXO 4 series oscilloscope with the application software and probes that your applications need.



Need digital channels?

Add 16 digital channels with the R&S®MXO4-B1 mixed signal option (MSO). Unlike some other oscilloscopes that force a tradeoff between digital and analog channel usage, the MXO 4 series digital channels can be used simultaneously with all analog channels. Simply connect the required R&S®MXO4-B1 probes (one or two) to the MXO 4 to use the digital channels.

Need configurable waveform generation?

With the R&S®MXO4-B6 arbitrary waveform generator option, you can add two integrated 100 MHz arbitrary waveform generators. Waveforms captured on the oscilloscope can be replayed by the generator and noise can be added to create worst case performance to determine system tolerance. Select from a wide range of available waveshapes or load an arbitrary waveform.

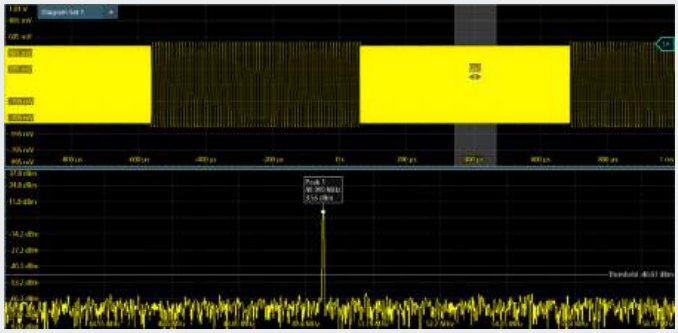
Choose from a wide selection of compatible probes

Rohde&Schwarz provides a broad portfolio of current and voltage probes. All MXO 4 series oscilloscope channel inputs include a Rohde&Schwarz probe interface connection for Rohde&Schwarz active probes. Many third-party probes are also compatible with the instrument.

EMI DEBUGGING

Easy navigation in frequency domain

The MXO 4 spectrum function has the familiar interface of a spectrum analyzer. The spectrum measurement setup dialog offers basic spectrum analyzer parameters such as start and stop frequency and resolution bandwidth. In spectrum mode, the MXO 4 time domain settings are unaffected. This makes navigation in the frequency domain an easy task. The maximum FFT capture bandwidth corresponds to the MXO 4 series bandwidth, allowing a quick overview of all of a DUT's emissions from 0 Hz to 1.5 GHz.



Gated spectrum for correlated time and frequency analysis

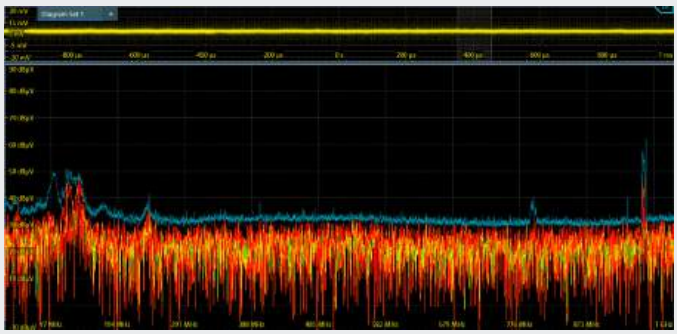
With the gated spectrum function, it is possible to restrict spectrum analysis to a user-defined region of the captured time domain signal. Excessive spectral emissions can be correlated to dedicated time periods in a signal. Typical applications include the correlation of unwanted emissions with fast switching edges in switched-mode power supplies or with data transfers on bus interfaces. Having identified the problem, the design engineer can easily check the effectiveness of remedies such as blocking capacitors or reduced rise/fall times by observing the level change of the spectral emission.

Ultra-fast spectrum acquisitions for detecting random and spurious spectrum events

The MXO 4 series architecture is optimized in terms of hardware and software to leverage the powerful MXO-EP ASIC capabilities to deliver fast and responsive spectrum captures. This is critical in detecting random and spurious emissions that are otherwise hidden due to the blind time in oscilloscope acquisitions. Spectrum analysis includes max. hold, min. hold and average functionality to keep track of spectrum events that occur during testing. These important test receiver functions come standard with the MXO 4 series spectrum function.

The right setup with the right probes

Rohde&Schwarz offers the compact R&S®HZ-15 near-field probe set, which is particularly helpful for EMI debugging of embedded designs. The most compact probe in this set allows capturing near-field emissions from single circuit lines. The R&S®HZ-15 covers the frequency range from 30 MHz to 3 GHz. With reduced sensitivity, it can also be used below 30 MHz. The optional R&S®HZ-16 preamplifier provides 20 dB gain in the frequency range from 100 kHz to 3 GHz, in case higher sensitivity is needed.



LOGIC ANALYSIS

Logic analysis enabled by default

The MXO 4 series oscilloscopes have the R&S®MXO4-B1 mixed signal option (MSO) hardware built into every instrument. The MSO option provides the logic probes required for using the 16 digital channels.

See more signal details with fast sample rate and deep memory

With a sample rate of 5 Gsample/s, the MXO 4 series oscilloscope provides high time resolution of 200 ps for all digital channels. This sample rate is available over the entire memory depth of 400 Mpoints per channel. The mixed signal option offers comprehensive trigger capabilities to detect critical events such as narrow glitches or certain logical patterns.

Analysis of low speed serial buses with digital channels

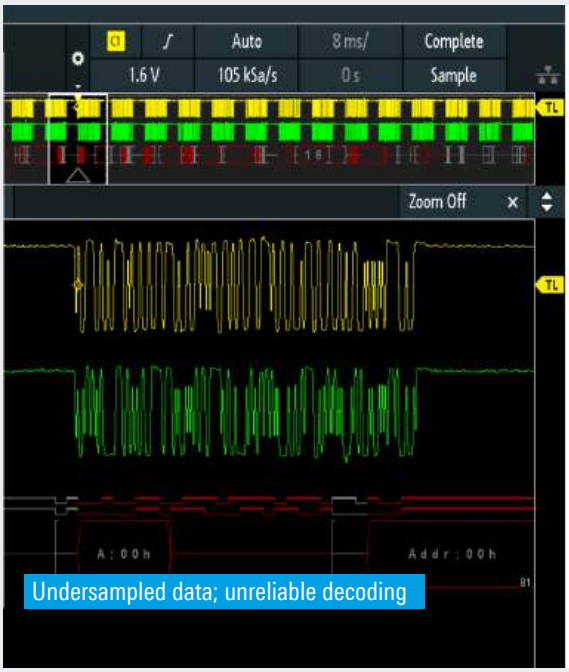
Today, high speed interfaces are often combined with low speed control or programming buses in a single device. You can use the digital channels of the R&S®MXO4-B1 option to trigger and decode low speed serial protocols such as SPI and I^2C with the appropriate protocol options. All protocol analysis tools for the analog channels, such as decode table and search, are also available for the digital channels. Trigger on protocol details such as start, address and data in order to focus on dedicated events.

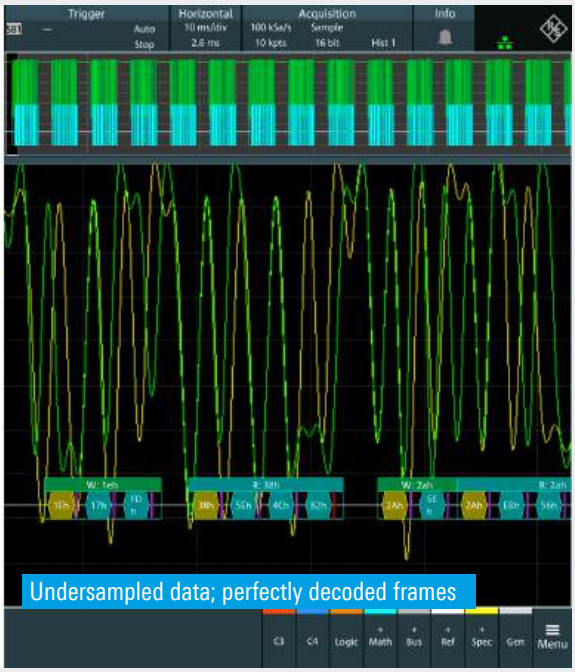
SERIAL BUS ANALYSIS

Dual-path protocol analysis

With the MXO 4 series, you can experience protocol analysis innovation. Traditional oscilloscopes typically capture data packets in the decoding path using the same sample rate as in the waveform path.

The MXO 4 series offers dual-path protocol analysis. You can set the instrument sample rate for the waveform path, and the oscilloscope will automatically use another internal decoupled sample rate for the decoding path. Even with very slow sample rates, the protocol data is correctly decoded. With conventional oscilloscopes, decoding would not be possible due to undersampling.





Capture more data packets with deep memory

Need to capture long time periods? You can use the MXO 4 series extended memory to capture more data packets. With a memory depth of up to 800 Mpoints, the MXO 4 can capture long periods of time where causes and effects are widely apart. During the entire capture, signal details are time-correlated with packet content for fast debugging.

Trigger and decode packages

Option	Description	Buses
R&S®MXO4-K510	low speed serial buses	I²C/SPI/RS-232/RS-422/RS-485/UART/QUAD-SPI
R&S®MXO4-K520	automotive buses	CAN/CAN FD/CAN XL/LIN/SENT
R&S®MXO4-K530	aerospace protocols	ARINC 429/MIL-STD-1553
R&S®MXO4-K550	MIPI low speed protocols	SPMI/REFE
R&S®MXO4-K560	automotive Ethernet buses	10BASE-T1S

Individual screen setup

Zoom in and out on the decoded protocol data using the vertical and horizontal control knobs or using your fingers on the touchscreen. Use the R&S®SmartGrid function to rearrange the windows displayed on the screen to best fit your viewing preferences. The decoded bus data can be overlaid on the captured signal and/or displayed in a separate window.

Index	State	Start	Address type	Address	RWBit	Data rate
1	Ok	-46.338 ms	7 bit	30	Write	310.000 kbps
2	Ok	-46.21 ms	7 bit	56	Read	309.700 kbps
3	Ok	-46.045 ms	7 bit	42	Write	310.000 kbps
4	Ok	-45.975 ms	7 bit	42	Read	309.700 kbps
5	Ok	-45.77 ms	7 bit	0	Undef.	---

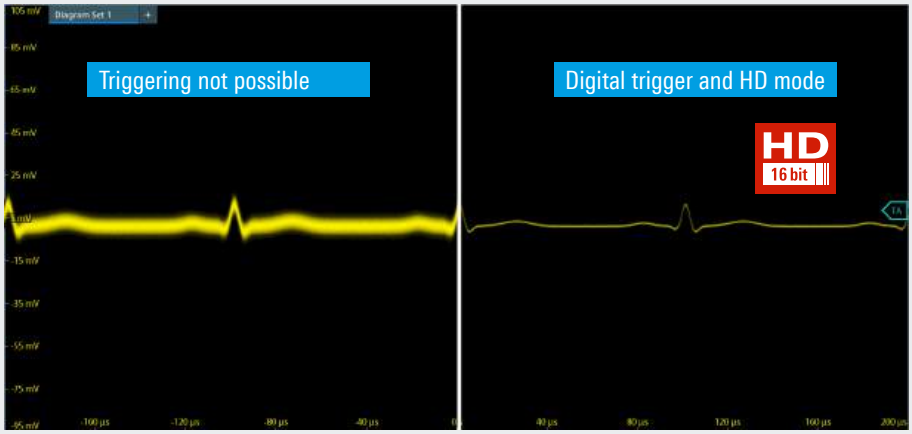
POWER ANALYSIS

See power signal details with up to 18 bit resolution

Even the smallest signal details of a highly dynamic signal matter for power measurements, for example when verifying $R_{DS(on)}$ for a MOSFET. The HD mode of the MXO 4 series oscilloscope increases the vertical resolution up to 18 bit so that previously unseen signal details become visible and can be measured. The oscilloscope also offers adjustable digital filters that allow noise suppression resulting in sharper waveforms with more signal details.

Digital trigger for enhanced debugging capabilities

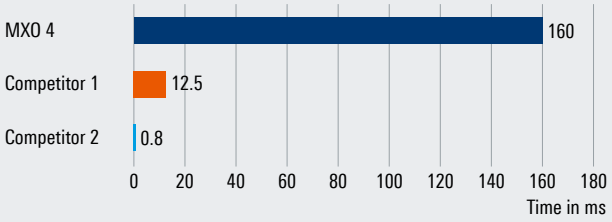
With up to 18 bit vertical resolution, the MXO 4 series digital trigger architecture enables triggering on the smallest vertical variation sampled. The MXO 4 trigger system offers sensitivity of 0.0001 div and is adjustable to factor in different trigger requirements, for example to avoid false triggering on noise. It is also possible, with the digital trigger, to adapt the filter cutoff frequency only on the trigger path while maintaining the original waveform for viewing and measurements.



Maintaining fast sample rates with deepest memory

Analyzing power up/power down and transient behavior of power supplies requires high sample rates and long recording times. With up to 800 Mpoints of memory, highest in its class, the MXO 4 series oscilloscope can record long periods of time while maintaining high sample rates of up to 5 Gsample/s.

Acquisition time (at 5 Gsample/s)



Extensive probe portfolio: high voltage and current probes

The Rohde&Schwarz portfolio of high voltage probes includes active differential probes for voltage up to 6000 V (peak). These probes offer exceptional common mode rejection over a broad frequency range. Rohde&Schwarz current probes enable accurate, non-intrusive measurements of DC and AC current. Different models are available to measure current in the range from 1 mA to 2000 A with a bandwidth of up to 120 MHz.

The R&S®RT-ZISO isolated probing system can withstand high common mode voltage levels of up to 60 kV and excellent common mode rejection at 1 GHz. With input range from 20 mV to 3 kV, it is another great probe addition for power measurements.

Characterizing input power quality

Measuring AC circuit power quality can be tedious due to the numerous calculations required to determine the real, apparent and reactive power. An oscilloscope is ideal for this work because it provides a clear view of the waveform characteristics between voltage and current, allowing engineers to quickly identify and resolve problems. The R&S®MXO4-K31 enables power quality measurements and provides concurrent analysis of three pairs of voltage and current sources.

Harmonic current analysis in line with standards

Different standards for limiting the harmonic current must be met in AC power supplies. Identifying distortion from harmonic content is tedious without a proper tool. The R&S®MXO4-K31 includes current harmonic analysis to help test in line with all common standards. Users can setup three concurrent harmonic measurements.

R&S®MXO4-K31 power analysis option	
Power quality	active, apparent and reactive power, crest factor and phase angle
Current harmonics	THD RMS and fundamental functions, in line with EN 6100-3-2 classes A, B, C, D, MIL-STD-1399 and RTCA DO-160
More analysis functions to be added in future.	

FREQUENCY RESPONSE ANALYSIS

Creating Bode plots with the MXO 4 series

Perform low frequency response analysis

The R&S®MXO4-K36 frequency response analysis (FRA) option lets you perform low frequency response analysis on your oscilloscope easily and quickly. It measures the frequency response of a variety of electronic devices, including passive filters and amplifier circuits. For switched-mode power supplies, it measures the control loop response (CLR) and power supply rejection ratio (PSRR).

The FRA option uses the oscilloscope's built-in arbitrary waveform generator to create stimulus signals in the range from 10 mHz to 100 MHz. Measuring the voltage ratios of the stimulus signal and the output signal of the DUT at each test frequency, the oscilloscope plots gain and phase logarithmically.

Features and functionalities

Amplitude profiles

The R&S®MXO4-K36 allows users to configure amplitude profiles for the generator output level. This helps optimize signal-to-noise ratio (SNR) at different frequencies when measuring CLR and PSRR. Users can also load lookup tables for generator settings.

Improved resolution and marker support

Users can define the number of points per decade to set the required resolution and sweep time. Markers can be placed on the traces with a table showing the corresponding parameter values. An auto placement function makes it easy for users to determine the phase and gain margin.

Parallel display of time domain

Parallel display of time and frequency domain allows users to monitor if an injected signal causes distortion that leads to measurement errors. These effects are hard to spot from just the Bode plot. Using the time domain window together with the Bode plot significantly facilitates adjusting the amplitude profile to the optimal level.

Result table

The measurement result table displays the frequency, gain and phase shift for each measured point. The markers and result table provide interactive display of the selected information. For reporting purposes, screenshots, result table or both can be saved to a USB device.

Broad probe portfolio

Accurate CLR and PSRR characterization depend on the right probes, since the peak-to-peak amplitudes of both the input and output voltage can be very low at some test frequencies. These small amplitudes could be buried in the oscilloscope noise floor and in the DUT switching noise. We recommend the low-noise R&S®RT-ZP1X 38 MHz bandwidth 1:1 passive probes that reduce attenuation errors and have the best SNR.

R&S®MXO4-K36 frequency response analysis option	
Note: R&S®MXO4-B6 is a prerequisite for FRA applications.	
Frequency range	10 mHz to 100 MHz
Amplitude mode	fixed or amplitude profile
Amplitude level	10 mV to 10 V into high Z; 5 mV to 5 V into 50 Ω
Test points	10 points to 500 points per decade

DEBUGGING POWER RAILS AND SWITCHING CHARACTERISTICS

Debugging and characterizing power rails

Accurately measure ripple and PARD

The MXO series excels in precise measurements of power noise and ripple. The low noise capability ensures accurate power integrity measurements, even at the millivolt level. The oscilloscope stands out with a fast update rate and the unique FreeRun triggering feature for quick identification of infrequent and worst-case ripple, as well as periodic and random disturbance (PARD) anomalies. The uncompromised automatic measurements of the MXO facilitate faster statistic correlation through rapid acquisition. The oscilloscopes also offer high offsets of ±5 V at the highest sensitivity, making them suitable for basic power integrity measurements even with 10x passive probes.

Power rail characterization with high fidelity probes

The R&S®RT-ZPR probe is an excellent for accurate power rail characterization with high bandwidth, sensitivity, low noise and large offset compensation capabilities. A bandwidth of up to 2 GHz, sensitive down to a 1:1 attenuation ratio and low noise performance make the R&S®RT-ZPR probe ideal for precise ripple measurements. Combined with the probe's advanced frequency analysis capabilities, periodic and random disturbances (PARD) are effectively isolated. Furthermore, the probe has a high-precision, 18-bit DC voltmeter (R&S®ProbeMeter) for instant DC voltage readout, enhancing measurement accuracy.

Characterizing power transistor switching behavior

Newer technologies in fast power MOSFET, IGBT and wide bandgap (WBG) devices require a closer look at transistor switching behavior to improve overall system efficiency with better timing control. The digital trigger in the MXO series enables precise triggering with hysteresis control that helps prevent false event detection. The ABR sequential trigger with 0 delay timing available between events also enables complex trigger setups that would not be possible without the digital trigger architecture. The 18-bit HD mode and the zone trigger give the MXO excellent event detection even in noisy environments.

Safety with isolation and high CMRR measurements

The R&S®RT-ZISO isolated probing system is designed for measurement challenges in high voltage and fast switching environments. The power-over-fiber architecture galvanically isolates the device under test (DUT) from the measurement setup for the highest common mode rejection ratio (CMRR) up to 1 GHz. The probe works seamlessly with the MXO series and is useful when characterizing high-side gate switching, where fast and high voltage transitions in the source node generate fast common signals. The probe can also be applied to high bandwidth current sensing over a series shunt resistor.

INTEGRATED ARBITRARY WAVEFORM GENERATOR

Compact and configurable

Two-channel 100 MHz arbitrary waveform generator

Equipped with the R&S®MXO4-B6 option, the MXO 4 oscilloscope offers a fully integrated two-channel 100 MHz arbitrary waveform generator. With up to 625 Msample/s and 16 bit resolution, the generators are suitable for implementing prototype hardware and for educational purposes. The integrated generators provide both standard and arbitrary waveforms as stimulus signals to the DUT. They can be operated as function and/or modulation generators and also support the sweep mode.

Wide range of waveforms and modulation types

The integrated arbitrary waveform generators deliver sine, square/pulse, ramp, triangle, sine cardinal (sinc), arbitrary and noise waveforms as stimulus signals to the DUT. For all waveforms, you can set the frequency, amplitude, offset and noise and also add bursts.

The modulation feature supports AM, FM, FSK and PWM modulations for sine, rectangle, triangle and ramp waveshapes.

R&S®MXO4-B6 arbitrary waveform generator option	
Analog output	2 channels
Bandwidth	100 MHz
Amplitude	high impedance: 10 mV to 10 V (peak-to-peak), 50 Ω: 5 mV to 5 V (peak-to-peak)
Arbitrary waveform length	1 sample to 40 Msample per channel
Sample rate	1 sample/s to 312.5 Msample/s
Vertical resolution	16 bit
Operating modes	► function and arbitrary waveform generator (DC, sine, square/pulse, triangle, ramp, inverse ramp, sinc, arbitrary) ► modulation (AM, FM, FSK, PWM) ► frequency sweep ► noise

EXTENSIVE PROBE PORTFOLIO

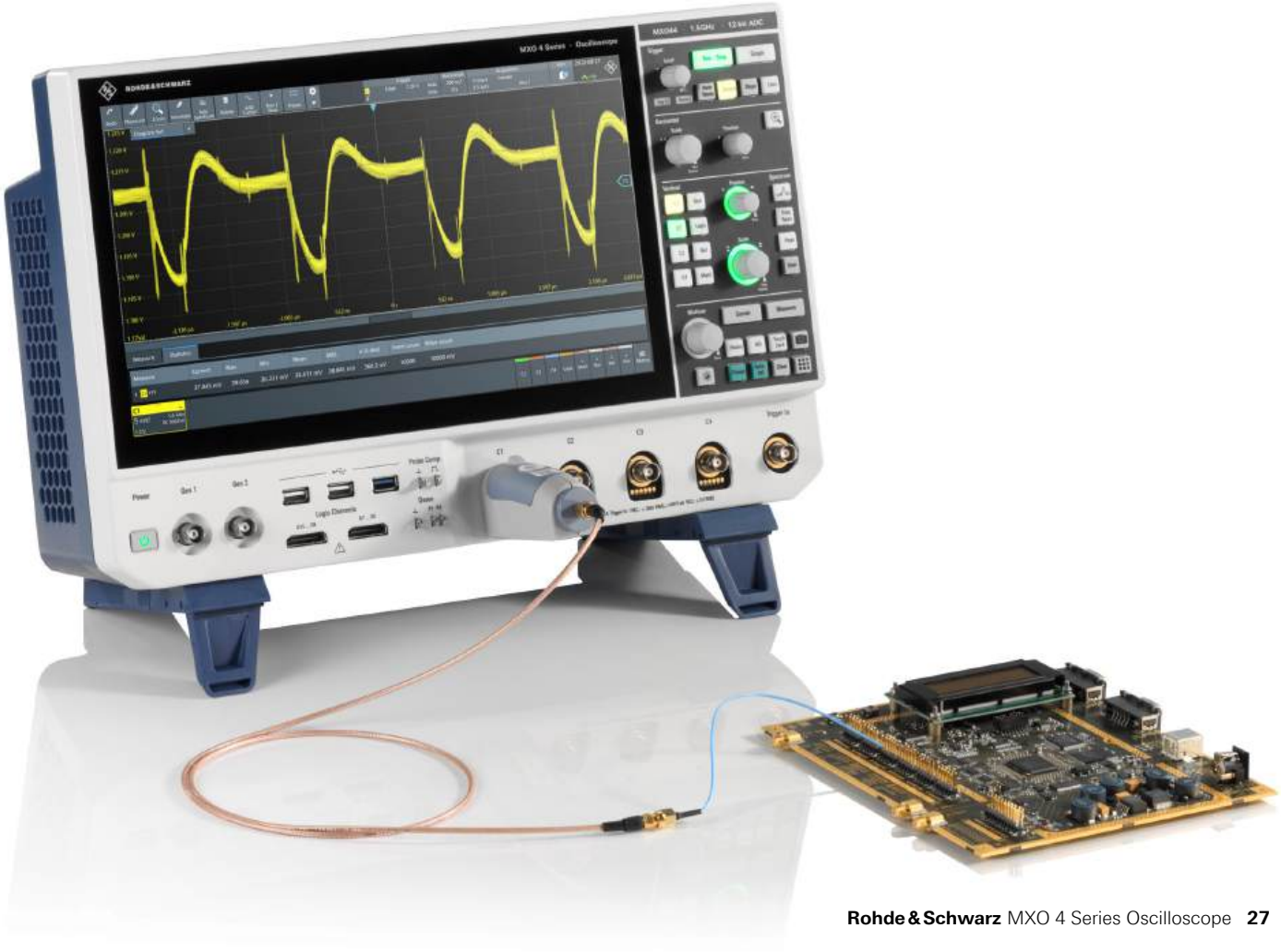
THE RIGHT PROBE FOR THE BEST MEASUREMENT

Extensive range of probes for all measurement tasks

A complete portfolio of high-quality passive and active probes covers all measurement tasks. With an input impedance of 1 MΩ, the active probes only put a minimum load on the signal source operating point. The active single-ended probes offer a very wide dynamic range, e.g. 60 V (V_{pp}) at 1 GHz, even at high frequencies, preventing signal distortion.

Complete portfolio for power measurements

The portfolio of dedicated power measurement probes includes active and passive probes for different voltage and current ranges – from µA to kA and from µV to kV. Dedicated power rail probes help detect even small and sporadic distortions on DC power rails.



Micro button for convenient instrument control

The situation is familiar to every engineer: You have carefully positioned the probe on the DUT and you want to start measuring, but you do not have a free hand. The micro button on Rohde&Schwarz active probes solves the problem. It is conveniently located close to the probe tip, and you can assign it different functions such as run/stop, autoset and adjust offset.

High voltage differential probes

The R&S®RT-ZHD series high voltage differential probes provide an excellent common mode rejection ratio (CMRR) over a wide bandwidth of up to 200 MHz and can safely measure up to 6000 V peak voltages. These probes exhibit exceptionally low noise, making them ideal for switching power analysis.

Like all active probes from Rohde&Schwarz, the R&S®RT-ZHD probes are equipped with the R&S®ProbeMeter, a high-precision DC voltmeter offering 0.1% accuracy while ensuring 0.5% gain accuracy and very low measurement drift. They also have an integrated 5 MHz analog filter, an audible common mode voltage overrange indicator and a micro button to give users full awareness of and control over the probe measurements.

High voltage differential probes for switching power analysis measurements.

Rohde&Schwarz has a comprehensive probe portfolio to meet every probing need.

► For more information, see product brochure "Probes and accessories for Rohde&Schwarz oscilloscopes" (PD 3606.8866.12)

Passive probes included as standard (38 MHz to 700 MHz)

R&S®RT-ZP11, R&S®RT-ZP1X

Passive probes come standard with every Rohde&Schwarz oscilloscope. They are low cost, general purpose probing solutions for a broad range of applications.

Passive broadband probes (8 GHz)

R&S®RT-ZZ80

These are an economical yet powerful alternative to active probes for measuring high speed signals on low impedance lines. Their input impedance is low and remains practically constant over the entire bandwidth. They feature extremely low input capacitance, very low noise and high linearity.

Active single-ended broadband probes (1 GHz to 6 GHz)

R&S®RT-ZS10E, R&S®RT-ZS10, R&S®RT-ZS20, R&S®RT-ZS30, R&S®RT-ZS60

A very high dynamic range and exceptionally low offset and gain errors combined with the right accessories make these probes ideal for use with Rohde&Schwarz oscilloscopes.

R&S®RT-ZD40: browser adapters to easily vary the pin offset

Active differential broadband probes (1 GHz to 4.5 GHz)

R&S®RT-ZD10, R&S®RT-ZD20, R&S®RT-ZD30, R&S®RT-ZD40

A flat frequency response and high input impedance with low input capacitance permit precise measurements on differential signals while keeping the load on the DUT low. The high common mode rejection over the entire probe bandwidth ensures high immunity to interference. Special browser adapters allow flexible contacting with high signal fidelity.

R&S®RT-ZA15 external attenuator for R&S®RT-ZD20/-ZD30

Power rail probes (2 GHz and 4 GHz)

R&S®RT-ZPR20, R&S®RT-ZPR40

Wide bandwidth, high sensitivity, very low noise and extra-large DC offset make these probes an excellent tool for characterizing power rails. The integrated high-precision DC voltmeter (R&S®ProbeMeter) provides instantaneous DC voltage readout.

High voltage probes (100 MHz to 400 MHz; ±750 V to ±6000 V)

R&S®RT-ZH03, R&S®RT-ZH10, R&S®RT-ZH11, R&S®RT-ZD01, R&S®RT-ZHD07, R&S®RT-ZHD15, R&S®RT-ZHD16, R&S®RT-ZHD60

The Rohde&Schwarz portfolio of high voltage probes includes passive single-ended and active differential probes for voltages up to 6000 V (peak). Different models allow measurements in up to CAT IV environments. Differential probes provide exceptional common mode rejection over a wide bandwidth.

Current probes (20 kHz to 120 MHz; ±1 mA to ±2000 A)

R&S®RT-ZC02, R&S®RT-ZC03, R&S®RT-ZC05B, R&S®RT-ZC10, R&S®RT-ZC10B, R&S®RT-ZC15B, R&S®RT-ZC20, R&S®RT-ZC20B, R&S®RT-ZC30, R&S®RT-ZC31

Rohde&Schwarz current probes enable accurate, non-intrusive measurements of DC and AC currents. Different models are available to measure currents in the range from 1 mA to 2000 A with a bandwidth of up to 120 MHz. Current probes are available with the Rohde&Schwarz probe interface or a BNC connector for an external power supply.

EMC near-field probes (30 MHz to 3 GHz)

R&S®HZ-15, R&S®HZ-17

Powerful E and H near-field probes for the frequency range from 30 MHz to 3 GHz with an optional preamplifier expand the application range of the MXO 4 series oscilloscope to include EMI debugging.

AND THERE IS SO MUCH MORE ...

AN OSCILLOSCOPE THAT EVOLVES WITH YOUR NEEDS

Grows with your needs – fully software based upgrades

The MXO 4 series flexibly adapts to evolving requirements for your project. The MXO 4 oscilloscopes come equipped with all hardware and software options. To enable a desired option, all you have to do is purchase a software license and activate the function or upgrade via keycode. This includes bandwidth upgrades up to 1.5 GHz, mixed signal option, memory upgrade, arbitrary waveform generator, serial bus triggering and decoding, and frequency response analysis. This makes retrofitting very easy.

Regular firmware improvements

Regular firmware updates add new functionality to the MXO 4 series oscilloscopes. Download the latest firmware version at www.rohde-schwarz.com and use a USB storage device or LAN connection for installation. This will keep your MXO 4 series oscilloscope up to date.

Multilingual support: choose among thirteen languages

The user interface and online help of the MXO 4 series oscilloscopes support thirteen languages (English, German, French, Spanish, Italian, Portuguese, Czech, Polish, Russian, Simplified and Traditional Chinese, Korean and Japanese). You can change the language in just a few seconds while the instrument is running.

Safe transport and easy rack mounting

An extensive selection of storage and transportation accessories means the MXO 4 series oscilloscopes are always fully protected and easy to transport. The rackmount kit allows easy installation of the oscilloscope in integrated environments.

Accessories	
Front cover	R&S®MXO4-Z1
Soft case	R&S®MXO4-Z3
Transit case, with trolley function	R&S®MXO4-Z4
19" rackmount kit	R&S®ZZA-MXO4
VESA mounting interface	100 mm × 100 mm VESA standard pattern on the rear of all instruments

THE MXO SERIES

... See the big picture with all the small details ...

SPECIFICATIONS OF BASE UNIT

Vertical system: analog channels

Input channels		4 channels
Input impedance		50 Ω ± 1.5%, 1 MΩ ± 1% || 12 pF (meas.)
Analog bandwidth (–3 dB)	at 50 Ω input impedance	
	MXO 4	≥ 200 MHz
	MXO 4 with -B243 option	≥ 350 MHz
	MXO 4 with -B245 option	≥ 500 MHz
	MXO 4 with -B2410 option	≥ 1 GHz
	MXO 4 with -B2415 option	≥ 1.5 GHz [1]
	at 1 MΩ input impedance	
	MXO 4	≥ 200 MHz (meas.)
	MXO 4 with -B243 option	≥ 350 MHz (meas.)
	MXO 4 with -B245 option	≥ 500 MHz (meas.)
	MXO 4 with -B2410 option	≥ 700 MHz (meas.) [2]
	MXO 4 with -B2415 option	≥ 700 MHz (meas.) [2]
Additional bandwidth filters available up to instrument bandwidth		1 GHz, 500/350/200/100/50/20 MHz (meas.)
Rise/fall time (calculated)	10% to 90% at 50 Ω	
	MXO 4	< 1.75 ns
	MXO 4 with -B243 option	< 1 ns
	MXO 4 with -B245 option	< 700 ps
	MXO 4 with -B2410 option	< 350 ps
	MXO 4 with -B2415 option	< 234 ps
Vertical resolution		12 bit, up to 18 bit for high-definition (HD) mode
Effective number of bits (meas.)	at 50 Ω, 50 mV/div, with HD mode and digital filters, 10 MHz sine signal with 80% full-scale	
	10 MHz	10.1
	20 MHz	9.6
	100 MHz	8.7
	200 MHz	8.4
	300 MHz	8.2
	500 MHz	7.9
	1 GHz	7.3
Input sensitivity	at 50 Ω	0.5 mV/div to 1 V/div, entire analog bandwidth supported for all input sensitivities
	at 1 MΩ	0.5 mV/div to 10 V/div, entire analog bandwidth supported for all input sensitivities
DC gain accuracy	offset and position set to 0 V, after self-alignment	
	input sensitivity > 5 mV/div	±1% of full scale
	input sensitivity ≤ 5 mV/div to ≥ 1 mV/div	±1.5% of full scale
	input sensitivity < 1 mV/div	±2.5% of full scale
Input coupling	at 50 Ω	DC
	at 1 MΩ	DC, AC (> 7 Hz)
Maximum input voltage	at 50 Ω	5 V (RMS), 30 V (V_p)
	at 1 MΩ	300 V (RMS), 400 V (V_p), derates at 20 dB/decade to 5 V (RMS) above 250 kHz
	at 1 MΩ with R&S®RT-ZP11 passive probe	400 V (RMS), 1650 V (V_p), 300 V (RMS) (CAT II); for derating and details, see R&S®RT-Zxx Standard Probes specifications (PD 3607.3851.22)
Position range		±5 div

[1] 1.5 GHz analog bandwidth in interleave mode with 5 Gsample/s real-time sampling rate.
[2] With R&S®RT-ZP11 passive probe.

Vertical system: analog channels		
Offset range at 50 Ω	input sensitivity	
	100 mV/div to 1 V/div	±20 V
	0.5 mV/div to < 100 mV/div	±5 V
Offset range at 1 MΩ	input sensitivity	
	800 mV/div to 10 V/div	±200 V
	80 mV/div to < 800 mV/div	±50 V
	0.5 mV/div to < 80 mV/div	±(5 V – input sensitivity × position)
Offset accuracy		±(0.35 % × |net offset| + 0.5 mV + 0.1 div × input sensitivity) (net offset = offset – position × input sensitivity)
DC measurement accuracy	after adequate suppression of measurement noise using high-definition (HD) mode or waveform averaging or a combination of both	±(DC gain accuracy × |reading – net offset| + offset accuracy)
Channel-to-channel isolation (each channel with same input sensitivity)	input frequency within instrument bandwidth	> 60 dB (1:1000)

Vertical system: analog channels						
RMS noise floor [3]						
At 50 Ω (meas.)	Input sensitivity	Analog bandwidth (–3 dB)				
		20 MHz	200 MHz	350 MHz	500 MHz	1 GHz
	0.5 mV/div	20 µV	43 µV	47 µV	50 µV	98 µV
	1 mV/div	22 µV	45 µV	50 µV	54 µV	104 µV
	2 mV/div	25 µV	52 µV	56 µV	61 µV	116 µV
	5 mV/div	43 µV	72 µV	77 µV	84 µV	152 µV
	10 mV/div	76 µV	118 µV	120 µV	131 µV	238 µV
	20 mV/div	148 µV	219 µV	219 µV	241 µV	436 µV
	50 mV/div	360 µV	508 µV	492 µV	543 µV	1.01 mV
	100 mV/div	747 µV	1.17 mV	1.19 mV	1.30 mV	2.47 mV
	200 mV/div	1.40 mV	2.13 mV	2.14 mV	2.34 mV	4.43 mV
	500 mV/div	3.47 mV	4.91 mV	4.80 mV	5.27 mV	10.13 mV
	1 V/div	6.88 mV	9.71 mV	9.47 mV	10.41 mV	19.96 mV
At 1 MΩ (meas.)	Input sensitivity	Analog bandwidth (–3 dB)				
		20 MHz	100 MHz	200 MHz	350 MHz	500 MHz
	0.5 mV/div	28 µV	40 µV	42 µV	47 µV	51 µV
	1 mV/div	28 µV	40 µV	46 µV	50 µV	53 µV
	2 mV/div	30 µV	43 µV	49 µV	54 µV	58 µV
	5 mV/div	44 µV	58 µV	67 µV	71 µV	78 µV
	10 mV/div	73 µV	92 µV	109 µV	109 µV	120 µV
	20 mV/div	138 µV	169 µV	199 µV	198 µV	218 µV
	50 mV/div	344 µV	442 µV	525 µV	529 µV	586 µV
	100 mV/div	739 µV	959 µV	1.13 mV	1.14 mV	1.24 mV
	200 mV/div	1.40 mV	1.74 mV	2.06 mV	2.07 mV	2.27 mV
	500 mV/div	3.47 mV	4.43 mV	5.22 mV	5.28 mV	5.75 mV
	1 V/div	7.11 mV	8.92 mV	10.44 mV	10.53 mV	11.49 mV
	2 V/div	13.83 mV	16.9 mV	19.87 mV	19.56 mV	21.38 mV
	5 V/div	34.84 mV	44.32 mV	52.43 mV	53.39 mV	57.97 mV
	10 V/div	57.16 mV	68.58 mV	80.66 mV	78.53 mV	85.46 mV

[3] HD mode active for bandwidths ≤ 500 MHz.

Vertical system: digital channels		
Input channels		16 logic channels (D0 to D15)
Arrangement of input channels		arranged in two logic probes with 8 channels each; assignment of logic probes to channels (D0 to D7 and D8 to D15) displayed on probes
Input impedance		100 kΩ ± 2% || ~4 pF (meas.) at probe tips
Maximum input frequency	signal with minimum input voltage swing and hysteresis setting "normal"	400 MHz (meas.)
Maximum input voltage		±40 V (V_p)
Minimum input voltage swing		500 mV (V_{pp}) (meas.)
Threshold groups		D0 to D3, D4 to D7, D8 to D11 and D12 to D15
Threshold level	range	±8 V in 25 mV steps
	predefined	CMOS 5.0 V, CMOS 3.3 V, CMOS 2.5 V, TTL, ECL, PECL, LVPECL
Threshold accuracy	threshold level between ±4 V	±(100 mV + 3% of threshold setting)
Comparator hysteresis		normal, robust, maximum

Horizontal system		
Timebase range		selectable between 200 ps/div and 10000 s/div, time per div settable to any value within range
Channel-to-channel deskew range	between analog channels	±20 ms
	between digital channels	±100 ns
Reference position		0% to 100% of measurement display area
Horizontal position range (trigger offset range)	max.	+(memory depth/current sampling rate)
	min.	–5000 s
Modes		normal
Channel-to-channel skew	between analog channels	< 100 ps (meas.)
	between digital channels	< 500 ps (meas.)
Timebase accuracy	after delivery/calibration, at +23 °C	±0.2 ppm
	during calibration interval	±1 ppm
Delta time accuracy	corresponds to time error between two edges of equal polarity on same acquisition and channel; signal amplitude greater than 5 div, measurement threshold set to 50%, vertical gain 10 mV/div or greater; rise time lower than four sampling periods; waveform acquired in real-time mode	±(0.20/real-time sampling rate + timebase accuracy × |reading|) (peak) (meas.)

Acquisition system		
Sampling rate	analog channels (real time)	max. 5 Gsample/s on 2 channels, max. 2.5 Gsample/s on 4 channels
	analog channels (interpolated)	max. 5 Tsample/s
	digital channels	max. 5 Gsample/s on each channel
Waveform acquisition rate	max.	> 4500000 waveforms/s
Trigger rearm time	min.	< 21 ns
Memory depth [4]	standard	► 400 Mpoints with 4 active channels (single capture) ► 400 Mpoints with 2 active channels (run continuous)
	with R&S®MXO4-B108 option	► 800 Mpoints with 2 active channels (single capture) ► 800 Mpoints with 1 active channel (run continuous)
Acquisition modes	sample	middle sample in decimation interval
	peak detect	largest and smallest sample in decimation interval
	average	average value of samples in decimation interval
	number of averaged waveforms	2 to 16777215
	envelope	envelope of acquired waveforms

[4] The maximum available memory depth depends on the bit resolution of the acquired data and, therefore, on the acquisition system settings such as decimation mode, use of waveform arithmetics and high-definition (HD) mode.

Acquisition system		
Sampling modes	real-time	max. sampling rate depending on ADC
	interpolated time	enhancement of sampling resolution by interpolation; max. equivalent sampling rate is 5 Tsample/s
Interpolation modes		linear, sin(x)/x, sample & hold
Fast segmentation mode	continuous recording of waveforms in acquisition memory without interruption due to visualization	
	max. real-time waveform acquisition rate	> 4600000 waveforms/s
	min. blind time between consecutive acquisitions	< 21 ns

High-definition (HD) mode		
General description	The high-definition mode increases the bit resolution of waveform signals by using digital filtering, leading to reduced noise. Because of the MXO 4 series digital trigger concept, signals with higher bit resolution are used as inputs to the trigger.	
Bit resolution	bandwidth, at 5 Gsample/s	bit resolution
	1 kHz to 10 MHz	18 bit
	100 MHz	16 bit
	200 MHz	15 bit
	500 MHz	14 bit
Real-time sampling rate	all models	max. 5 Gsample/s on 2 channels, max. 2.5 Gsample/s on 4 channels

Trigger system		
Trigger sources		analog channels (C1 to C4), digital channels (D0 to D15), trigger input, serial bus
Trigger level range		±5 div from center of screen
Trigger modes		auto, normal, single, n single
Trigger sensitivity		0.0001 div, from DC to instrument bandwidth for all vertical scales
Trigger jitter	full-scale sine wave of frequency set to –3 dB bandwidth	< 1 ps (RMS) (meas.)
Coupling mode	standard	same as selected channel
	HF reject	cutoff frequency selectable from 1 kHz to 500 MHz
	LF reject	attenuates frequencies < 50 kHz
Trigger hysteresis	modes	auto (default setting) or manual
	sensitivity	0.0001 div, from DC to instrument bandwidth for all vertical scales
Holdoff range	time	100 ns to 10 s, fixed and random
Main trigger modes		
Edge	triggers on specified edge (positive, negative or either) and level	
Glitch	triggers on glitches of positive, negative or either polarity that are shorter or longer than a specified width	
	glitch width	200 ps to 1000 s
Width	triggers on positive or negative pulse of specified width; width can be shorter, longer, inside or outside a specified range	
	pulse width	200 ps to 1000 s
Runt	triggers on pulse of positive, negative or either polarity that crosses one threshold but fails to cross a second threshold before crossing the first one again; runt pulse width can be arbitrary, shorter, longer, inside or outside a specified range	
	runt pulse width	200 ps to 1000 s
Window	triggers when signal enters or exits a specified voltage range; triggers also when signal stays inside or outside the voltage range for a specified period of time	
Timeout	triggers when signal stays high, low or unchanged for a specified period of time	
	timeout	0 ps to 1000 s
Interval	triggers when the time between two consecutive edges of the same polarity (positive or negative) is shorter, longer, inside or outside a specified range	
	interval time	200 ps to 1000 s

Trigger system		
Slew rate	triggers when the time required by a signal edge to toggle between user-defined upper and lower voltage levels is shorter, longer, inside or outside a specified range; edge slope may be positive, negative or either	
	toggle time	0 ps to 1000 s
Setup & hold	triggers on setup time and hold time violations between clock and data present on any two input channels; monitored time interval may be specified by the user in the range from –100 s to +100 s around a clock edge and must be at least 200 ps wide	
Pattern	triggers when a logical combination (AND, NAND, OR, NOR) of the input channels stays true for a period of time shorter, longer, inside or outside a specified range	
State	triggers when a logical combination (AND, NAND, OR, NOR) of the input channels stays true at an edge (positive, negative or either) in one selected channel	
Advanced trigger modes		
Zone trigger	triggers on user-defined zones drawn on the display	
	source	acquired waveforms (input channels), math waveforms (including power analysis waveforms), spectrum waveforms, XY plots
	number of zones/areas	up to 4 zones with up to 8 areas each
	area shapes	polygons with up to 16 points
	area types	must intersect, must not intersect
	combination of zones	logical combination of zones of multiple sources using Boolean expressions
	trigger compatibility	requires sequence trigger A ▷ zone trigger where primary A condition can be: edge, glitch, width, runt, window, timeout, interval, slew rate, setup & hold, state, pattern
Sequence trigger (A/B/R trigger)	triggers on B event after occurrence of A event; delay condition after A event specified as time interval; an optional R event resets the trigger sequence to A	
	A event	edge, glitch, width, runt, window, timeout, interval, slew rate
	B event	edge, glitch, width, runt, window, timeout, interval, slew rate
	R event	edge, glitch, width, runt, window, timeout, interval, slew rate
Serial bus trigger	optional	see dedicated triggering and decoding options in Ordering information in this product brochure
Trigger input	input impedance	50 Ω (meas.) or 1 MΩ (meas.) || 11 pF (meas.)
	max. input voltage at 50 Ω	30 V (V_p)
	max. input voltage at 1 MΩ	300 V (RMS), 400 V (V_p), derates at 20 dB/decade to 5 V (RMS) above 250 kHz
	trigger level	±5 V
	sensitivity	
	input frequency ≤ 500 MHz	300 mV (peak-to-peak) (meas.)
	input coupling	AC, DC (50 Ω and 1 MΩ)
	trigger filters	HF reject (attenuates frequencies > 50 kHz), LF reject (attenuates frequencies < 50 kHz), noise reject
	trigger modes	edge (positive, negative or either)
Trigger output	functionality	A pulse is generated for each event triggering signal acquisition.
	output voltage	0 V to 5 V (nom.) at high impedance, 0 V to 2.5 V (nom.) at 50 Ω
	pulse width	selectable between 16 ns and 50 ms
	pulse polarity	low active or high active
	output delay	depends on trigger settings

Spectrum analysis		
General description	Spectrum analysis allows signal analysis in the frequency domain.	
Spectrum	sources	channel 1, channel 2, channel 3, channel 4
	setting parameters	center frequency, frequency span, resolution bandwidth (automatic or manual), gate position, gate width, vertical scaling, vertical position
	scaling	dBm, dBV, dBµV, V (RMS)
	span	1 Hz to 1.8 GHz[5]
	resolution bandwidth (RBW)	span/4 ≥ RBW ≥ span/6000
	windows	flat top, Hanning, Hamming, Blackman, rectangular, Kaiser Bessel, Gaussian
	trace types	normal, max. hold, min. hold, average
	max. real-time waveform acquisition rate	> 40 000 waveforms/s
Gate	delimits the display region used for spectrum analysis	
Peak list	The values in the peak list are also shown in the diagram to allow easy correlation.	

RF characteristics		
Sensitivity/noise density	at 1 GHz (measurement of power spectral density at 1 GHz at input sensitivity 2 mV/div, corresponding to –30 dBm input range of the oscilloscope, using spectrum analysis with center frequency 1 GHz, span 500 kHz, RBW 3 kHz)	–160 dBm (1 Hz) (meas.)
Noise figure	at 1 GHz (calculated based on the noise power density above)	14 dB (meas.)
Dynamic range	measured for a 1 GHz input carrier with level –3 dBm at input of oscilloscope, using spectrum analysis with center frequency 1 GHz, span 2 MHz, RBW 400 Hz at +20 MHz from center frequency	106 dB (meas.)
Absolute amplitude accuracy	0 Hz to 1.2 GHz	±1 dB (meas.)
Spurious-free dynamic range (excluding harmonics)	measured for a 250 MHz input carrier with level –3 dBm at input sensitivity 50 mV/div, using spectrum analysis with center frequency 900 MHz, span 1.8 GHz, RBW 300 kHz	65 dBc (meas.)
Second harmonic distortion	measured for a 250 MHz input carrier with level –3 dBm at input sensitivity 50 mV/div, using spectrum analysis with center frequency 900 MHz, span 1.8 GHz, RBW 300 kHz	–60 dBc (meas.)
Third harmonic distortion	measured for a 250 MHz input carrier with level –3 dBm at input sensitivity 50 mV/div, using spectrum analysis with center frequency 900 MHz, span 1.8 GHz, RBW 300 kHz	–59 dBc (meas.)

Waveform measurements		
Automatic measurements	measurements on acquired waveforms (input channels), math waveforms, reference waveforms	amplitude, high, low, maximum, minimum, peak-to-peak, mean, RMS, sigma, positive overshoot, negative overshoot, area, rise time, fall time, positive pulse width, negative pulse width, period, frequency, positive duty cycle, negative duty cycle, delay, phase, burst width, pulse count, edge count, pulse train, positive switching, negative switching, cycle area, cycle mean, cycle RMS, cycle sigma, setup, hold, setup/hold time, setup/hold ratio, slew rate rising, slew rate falling, delay to trigger
	gate	delimits the display region evaluated for automatic measurements
	reference levels	user-configurable vertical levels define support structures for automatic measurements
	statistics	displays maximum, minimum, mean, standard deviation and measurement count for each automatic measurement
	number of active measurements	16

[5] The stop frequency depends on the analog bandwidth of the instrument.

Waveform measurements		
Cursor measurements	available cursors	up to two cursor sets on screen, each set with two horizontal and two vertical cursors
	target waveforms	acquired waveforms (input channels), math waveforms, reference waveforms, XY diagrams
	operating modes	vertical measurements, horizontal measurements or both; vertical cursors either placed manually or locked to waveform

Waveform math		
General features	number of math equations	up to 5
	number of reference waveforms	up to 4
	sources	channel 1, channel 2, channel 3, channel 4, math waveforms 1 to 4, reference waveforms 1 to 4
Functions	operators	add, subtract, multiply, divide, absolute value, square, square root, integrate, differentiate, $\log_{10}$, $\log_e$, $\log_2$, reciprocal, invert, lowpass, highpass, rescale (a*x+b)
	filters	lowpass, highpass
	filter types	Gaussian, rectangular
	gate	delimits the display region used for waveform maths

Display characteristics	
Display types	Yt, XY, zoom, spectrum
Display configuration (waveform layout)	The display area can be split into separate diagram areas by dragging and dropping signal icons for the desired waveforms into the R&S®SmartGrid. Each diagram can hold any number of signals. Diagrams can be stacked on top of each other and later accessed via dynamic tabs (Tab 1, etc.).
Signal icons	Each active waveform is represented by a signal icon on the signal bar; the signal icon displays the individual vertical and acquisition settings.
Toolbar	Enables quick access to important functions; allows direct setting of their most common parameters in a simple menu and provides access to more detailed parameter settings in the main menu. The toolbar can be individually configured to include the user's preferred tools.
Upper menu bar	Displays trigger, horizontal and acquisition system settings; allows quick access to these settings.
Main menu	Provides access to all instrument settings in a compact menu structure.
Axis labeling	The x-axis and y-axis are labeled with values and physical unit.
Diagram labeling	Diagrams may be individually labeled with a descriptive, user-defined name.
Diagram layout	The grid, crosshair, axis labeling and diagram labeling can be switched on and off separately.
Persistence	50 ms to 50 s, or infinite
Zoom	vertical and horizontal; touch interface simplifies resize and drag operations on zoom window
Signal colors (waveform coding)	predefined or user-defined color tables for persistence display

History function and segmented memory			
Acquisition memory	automatic	automatic setting of segment size and sample rate	
	manual	user-defined setting of segment size and sample rate	
Memory segmentation	function	memory is divided into segments for signal acquisition	
	number of segments	record length	segments[6] (up to)
		1 kpoints	1048575
		2 kpoints	524287
		5 kpoints	262143
		10 kpoints	131071
		20 kpoints	65535
		50 kpoints	32767
		100 kpoints	16383
		200 kpoints	9361
		500 kpoints	4095
		1 Mpoints	2113
		2 Mpoints	1056
		5 Mpoints	427
		10 Mpoints	213
		20 Mpoints	106
		50 Mpoints	41
		100 Mpoints	20
		200 Mpoints	9
		400 Mpoints	4
		800 Mpoints[7]	2
	Segmentation is available for all analog and digital channels, protocol decoding and spectrum analysis.		
Fast segmented mode	continuous recording of waveforms in acquisition memory without interruption due to visualization; for blind time between consecutive acquisitions, see “Acquisition system“		
History mode	function	The history mode is an always-on function and provides access to past acquisitions in the segmented memory.	
	timestamp resolution	1 ns	
	history player	replays recorded waveforms; repetition possible; adjustable speed; manual switching to next/previous segment; numerical segment number input	
	analysis options	overlay all segments, average all segments, envelope all segments	

Mask testing		
Test definition	number of masks	up to 8 simultaneously
	source	acquired waveforms (input channels), math waveforms, reference waveforms, spectrum waveforms, XY plots
	fail condition	waveform hit
	test rate	up to 4 million waveforms/s
	action on error	acquisition stop, beep, save waveform, pulse on trigger out
Mask definition with segments	number of segments per mask test	up to 8
	segment definition	array of at least 3 points defines an inner region
Result statistics	category	total completed acquisition, failed acquisition, passed acquisition, fail rate, overall test result (pass/fail)
Visualization options	waveform style	vectors, dots
	mask colors	predefined colors for mask without violation (translucent gray), mask with violation (translucent red)

[6] With R&S®MXO4-B108 memory option. The maximum number of segments depends on the number of active channels and the bit resolution of the acquired data and, therefore, on the acquisition system settings such as decimation mode, use of waveform arithmetics and high-definition (HD) mode. The maximum number of segments without the R&S®MXO4-B108 memory option is limited to 10000.

[7] With R&S®MXO4-B108 memory option.

Miscellaneous		
Remote control	web interface	full operation of the instrument's touch interface, keys and multifunction wheel via web browser
	VNC	control of the instrument through virtual network computing
	SCPI	standard instrument programming interface through VISA
Languages	available languages for the user interface	English, German, French, Simplified Chinese, Traditional Chinese, Japanese, Russian, Spanish, Italian, Portuguese, Korean, Czech, Polish
	online help on the instrument	English

Inputs and outputs		
Front		
Channel inputs		BNC; for details, see "Vertical system"
	probe interface	auto detection of passive probes, Rohde&Schwarz probe interface for active probes
Trigger input		BNC; for details, see "Trigger system"
	probe interface	auto detection of passive probes
Arbitrary waveform generator outputs (requires R&S®MXO4-B6 option)		BNC; for details, see R&S®MXO4-B6, arbitrary waveform generator, demo lugs and GND lug
Digital channel inputs	D15 to D8, D7 to D0	interfaces for R&S®RT-ZL04 logic probe
Probe compensation output	signal shape	rectangle, V_{low} = 0 V, V_{high} = 3.3 V, amplitude 3.3 V (V_{pp}) ± 5% (meas.)
	frequency	1 kHz ± 1% (meas.)
Ground jack		connected to ground
USB interfaces		1 × USB 3.1 Gen 1 port, type A, 2 × USB 2.0 high speed port, type A
Rear		
Trigger output		BNC; for details, see "Trigger system"
USB interfaces		2 × USB 3.1 Gen 1 port, type A, 1 × USB 3.1 Gen 1 port, type B
LAN interface		RJ-45 connector, supports 10/100/1000BASE-T
External monitor interface		HDMI, 1920 × 1080 pixel at 60 Hz, output of oscilloscope display
Reference input	connector	BNC
	impedance	50 Ω (nom.)
	input frequency	10 MHz (±20 ppm)
	sensitivity	≥ –10 dBm into 50 Ω, ≤ 10 dBm at 10 MHz
Reference output	connector	BNC
	impedance	50 Ω (nom.)
	output signal	10 MHz (specified with timebase accuracy), 8 dBm (nom.)
Security slot		for standard Kensington lock
VESA mounting interface		100 mm × 100 mm VESA standard pattern
Right side		
Ground jack		connected to ground

General data		
Display	type	13.3" LC TFT color display with capacitive touchscreen
	resolution	1920 × 1080 pixel (Full HD)
Temperature		
Temperature range	operating temperature range	0 °C to +50 °C
	storage temperature range	–40 °C to +70 °C
		in line with MIL-PRF-28800F, section 4.5.5.1.1.1, class 3, tailored to +45 °C for operation
Climatic resistance	damp heat	+25 °C/+50 °C at 85 % relative humidity, cyclic, in line with IEC 60068-2-30
Altitude		
Operating		up to 3000 m above sea level
Nonoperating		up to 4600 m above sea level
Mechanical resistance		
Vibration	sinusoidal	5 Hz to 150 Hz, max. 1.8 g at 55 Hz; 0.5 g from 55 Hz to 150 Hz, in line with EN 60068-2-6
		10 Hz to 55 Hz, in line with MIL-PRF-28800F, section 4.5.5.3.2, class 3
	random	8 Hz to 500 Hz, acceleration 1.2 g (RMS), in line with EN 60068-2-64
		5 Hz to 500 Hz, acceleration 2.058 g (RMS), in line with MIL-PRF-28800F, section 4.5.5.3.1, class 3
Shock		40 g shock spectrum, in line with MIL-STD-810G, method no. 516.6, procedure I
		30 g functional shock, half sine, duration 11 ms, in line with MIL-PRF-28800F, section 4.5.5.4.1
Electromagnetic compatibility (EMC)		
RF emissions		in line with CISPR 11/EN 55011, group 1, class A (for a shielded test setup); instrument complies with emission requirements stipulated by EN 55011, EN 61326-1 and EN 61326-2-1 class A, making it suitable for use in industrial environments
Immunity		in line with IEC/EN 61326-1 table 2, immunity test requirements for equipment used in industrial environments [8]
Certifications		VDE, $_{C}$CSA$_{US}$, KC
Calibration interval		1 year
Power supply		
AC supply		100 V to 240 V ±10 % at 50 Hz to 60 Hz and 400 Hz ±5 %, max. 2.3 A to 1.3 A, in line with MIL-PRF-28800F, section 3.5
Power consumption		max. 210 W
Safety		in line with IEC 61010-1, EN 61010-1, CAN/CSA-C22.2 No. 61010-1, UL 61010-1
Mechanical data		
Dimensions	W × H × D	414 mm × 279 mm × 162 mm (16.3 in × 10.99 in × 6.38 in)
Weight	without options, nominal	6.0 kg (13.23 lb)
Rackmount height	with R&S®ZZA-MXO4 rackmount kit	6 HU

[8] Test criterion is displayed noise level within ±1 div for an input sensitivity of 5 mV/div.

ORDERING INFORMATION

Designation	Type	Order No.
MXO 4 series, base unit		
Oscilloscope, 200 MHz, 4 channels	MXO 4	1335.5050.04
Base unit (including standard accessories: 700 MHz passive probe (10:1) per channel, accessories bag, quick start guide, power cord)		
Choose your bandwidth upgrade		
Upgrade of MXO 4 to 350 MHz bandwidth	R&S®MXO4-B243	1335.4276.02
Upgrade of MXO 4 to 500 MHz bandwidth	R&S®MXO4-B245	1335.4299.02
Upgrade of MXO 4 to 1 GHz bandwidth	R&S®MXO4-B2410	1335.4318.02
Upgrade of MXO 4 to 1.5 GHz bandwidth	R&S®MXO4-B2415	1335.4330.02
Choose your options		
Mixed signal option for MXO 4 series with 16 digital channels	R&S®MXO4-B1	1335.4130.02
Arbitrary waveform generator, 100 MHz, 2 analog channels	R&S®MXO4-B6	1335.4147.02
Memory upgrade to 800 Mpoints on 2 channels	R&S®MXO4-B108	1335.5772.02
Power analysis	R&S®MXO4-K31	1335.5566.02
Frequency response analysis	R&S®MXO4-K36	1335.5572.02
Low speed serial buses (I²C/SPI/QuadSPI/UART/RS-232/RS-422/RS-485)	R&S®MXO4-K510	1335.5195.02
Automotive protocols (CAN/CAN FD/CAN XL/LIN/SENT)	R&S®MXO4-K520	1335.5550.02
Aerospace protocols (ARINC 429, MIL-STD-1553)	R&S®MXO4-K530	1335.5208.02
MIPI low speed protocols (SPMI/REFE)	R&S®MXO4-K550	1335.5214.02
Automotive Ethernet protocols (10BASE-T1S)	R&S®MXO4-K560	1335.5943.02
Application bundle with the following options: R&S®MXO4-B6, R&S®MXO4-K31, R&S®MXO4-K36, R&S®MXO4-K510, R&S®MXO4-K520	R&S®MXO4-PK1	1335.5237.02
Choose your additional probes		
Passive probes: single-ended		
700 MHz, 10 MΩ, 10:1, 400 V, 9.5 pF, 2.5 mm	R&S®RT-ZP11	1803.0005.02
500 MHz, 10 MΩ, 10:1, 400 V, 9.5 pF, 2.5 mm	R&S®RT-ZP10	1409.7550.00
500 MHz, 10 MΩ, 10:1, 300 V, 10 pF, 5 mm	R&S®RT-ZP05S	1333.2401.02
38 MHz, 1 MΩ, 1:1, 55 V, 39 pF, 2.5 mm	R&S®RT-ZP1X	1333.1370.02
Active broadband probes: single-ended		
1.0 GHz, 1 MΩ, Rohde&Schwarz probe interface	R&S®RT-ZS10E	1418.7007.02
1.0 GHz, 1 MΩ, R&S®ProbeMeter, micro button, Rohde&Schwarz probe interface	R&S®RT-ZS10	1410.4080.02
1.5 GHz, 1 MΩ, R&S®ProbeMeter, micro button, Rohde&Schwarz probe interface	R&S®RT-ZS20	1410.3502.02
Active broadband probes: differential		
1.0 GHz, 1 MΩ, R&S®ProbeMeter, micro button, including 10:1 external attenuator, 1 MΩ, 60 V DC, 42.4 V AC (peak), Rohde&Schwarz probe interface	R&S®RT-ZD10	1410.4715.02
1.5 GHz, 1 MΩ, R&S®ProbeMeter, micro button, Rohde&Schwarz probe interface	R&S®RT-ZD20	1410.4409.02
Power rail probe		
2.0 GHz, 1:1, 50 kΩ, ±0.85 V, ±60 V offset, Rohde&Schwarz probe interface	R&S®RT-ZPR20	1800.5006.02
High voltage probes: passive		
250 MHz, 100:1, 100 MΩ, 850 V, 6.5 pF	R&S®RT-ZH03	1333.0873.02
400 MHz, 100:1, 50 MΩ, 1000 V, 7.5 pF	R&S®RT-ZH10	1409.7720.02
400 MHz, 1000:1, 50 MΩ, 1000 V, 7.5 pF	R&S®RT-ZH11	1409.7737.02
High voltage probes: differential		
200 MHz, 250:1/25:1, 5 MΩ, 750 V (peak), 300 V (RMS) CAT III, Rohde&Schwarz probe interface	R&S®RT-ZHD07	1800.2307.02
100 MHz, 500:1/50:1, 10 MΩ, 1500 V (peak), 1000 V (RMS) CAT III, Rohde&Schwarz probe interface	R&S®RT-ZHD15	1800.2107.02
200 MHz, 500:1/50:1, 10 MΩ, 1500 V (peak), 1000 V (RMS) CAT III, Rohde&Schwarz probe interface	R&S®RT-ZHD16	1800.2207.02
100 MHz, 1000:1/100:1, 40 MΩ, 6000 V (peak), 1000 V (RMS) CAT III, Rohde&Schwarz probe interface	R&S®RT-ZHD60	1800.2007.02

Designation	Type	Order No.
Current probes		
20 kHz, AC/DC, 0.01 V/A and 0.001 V/A, ±200 A and ±2000 A, BNC interface	R&S®RT-ZC02	1333.0850.02
100 kHz, AC/DC, 0.1 V/A, 30 A, BNC interface	R&S®RT-ZC03	1333.0844.02
2 MHz, AC/DC, 0.01 V/A, 500 A (RMS), Rohde&Schwarz probe interface	R&S®RT-ZC05B	1409.8204.02
10 MHz, AC/DC, 0.01 V/A, 150 A (RMS), BNC interface	R&S®RT-ZC10	1409.7750K02
10 MHz, AC/DC, 0.01 V/A, 150 A (RMS), Rohde&Schwarz probe interface	R&S®RT-ZC10B	1409.8210.02
50 MHz, AC/DC, 0.1 V/A, 30 A (RMS), Rohde&Schwarz probe interface	R&S®RT-ZC15B	1409.8227.02
100 MHz, AC/DC, 0.1 V/A, 30 A (RMS), BNC interface	R&S®RT-ZC20	1409.7766K02
100 MHz, AC/DC, 0.1 V/A, 30 A (RMS), Rohde&Schwarz probe interface	R&S®RT-ZC20B	1409.8233.02
120 MHz, AC/DC, 1 V/A, 5 A (RMS), BNC interface	R&S®RT-ZC30	1409.7772K02
EMC near-field probe set		
Compact probe set for E and H near-field measurements, 30 MHz to 3 GHz	R&S®HZ-15	1147.2736.02
Logic probe [1]		
400 MHz logic probe, 8 channels	R&S®RT-ZL04	1333.0721.02
Probe accessories		
Accessory set for R&S®RT-ZP11 passive probe (2.5 mm probe tip)	R&S®RT-ZA1	1409.7566.00
Probe power supply for R&S®RT-ZC10/-ZC20/-ZC30 probes	R&S®RT-ZA13	1409.7789.02
External attenuator 10:1, 2.0 GHz, 1.3 pF, 60 V DC, 42.4 V AC (peak), for R&S®RT-ZD20/-ZD30 probes	R&S®RT-ZA15	1410.4744.02
Probe pouch for the logic probes	R&S®RT-ZA19	1335.7875.02
Power deskew and calibration test fixture	R&S®RT-ZF20	1800.0004.02
3D positioner with central tensioning knob for easy clamping and positioning of probes (span width: 200 mm, clamping range: 15 mm)	R&S®RT-ZAP	1326.3641.02
Choose your accessories		
Front cover	R&S®MXO4-Z1	1335.4360.02
Soft case	R&S®MXO4-Z3	1335.5589.02
Transit case	R&S®MXO4-Z4	1335.5595.02
19" rackmount kit, 6 HU	R&S®ZZA-MXO4	1335.5108.02
VESA mounting interface	100 mm × 100 mm VESA standard pattern	

Warranty		
Base unit		3 years
All other items [2]		1 year
Service options		
Extended warranty, one year	R&S®WE1	Contact your local Rohde&Schwarz sales office.
Extended warranty, two years	R&S®WE2	
Extended warranty with calibration coverage, one year	R&S®CW1	
Extended warranty with calibration coverage, two years	R&S®CW2	
Extended warranty with accredited calibration coverage, one year	R&S®AW1	
Extended warranty with accredited calibration coverage, two years	R&S®AW2	

[1] The R&S®MXO4-B1 mixed signal option contains two R&S®RT-ZL04 logic probes.
[2] For options installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

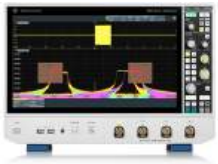
OSCILLOSCOPE PORTFOLIO




	R&S®RTH1000	R&S®RTC1000	R&S®RTB 2	R&S®RTM3000
Vertical system				
Bandwidth [1]	60/100/200/350/500 MHz	50/70/100/200/300 MHz	70/100/200/300 MHz	100/200/350/500 MHz/1 GHz
Number of channels	2 plus DMM/4	2	2/4	2/4
Vertical resolution; system architecture	10 bit; 16 bit	8 bit; 16 bit	10 bit; 16 bit	10 bit; 16 bit
V/div, 1 MΩ	2 mV to 100 V	1 mV to 10 V	1 mV to 5 V	500 µV to 10 V
V/div, 50 Ω	–			500 µV to 1 V
Digital channels	8	8	16	16
Horizontal system				
Sampling rate per channel (in Gsample/s)	1.25 (4-channel model); 2.5 (2-channel model); 5 (all channels interleaved)	1; 2 (2 channels interleaved)	1.25; 2.5 (2 channels interleaved)	2.5; 5 (2 channels interleaved)
Maximum memory (per channel; 1 channel active)	125 kpoints (4-channel model); 250 kpoints (2-channel model); 500 kpoints	1 Mpoints; 2 Mpoints	10 Mpoints; 20 Mpoints	40 Mpoints; 80 Mpoints
Segmented memory	standard, 50 Mpoints	–	standard, 260 Mpoints	option, 400 Mpoints
Acquisition rate (in waveforms/s)	50000	10000	50000 (300000 in fast segmented memory mode)	64000 (2000000 in fast segmented memory mode [2])
Trigger				
Types	digital	analog	analog	analog
Sensitivity	–	–	at 1 mV/div: > 2 div	at 1 mV/div: > 2 div
Analysis				
Mask test	tolerance mask	tolerance mask	tolerance mask	tolerance mask
Mathematics	elementary	elementary	basic (math on math)	basic (math on math)
Serial protocols triggering and decoding [1]	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, CAN FD, SENT	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I²S, MIL-STD-1553, ARINC 429
Applications [1, 2]	high-resolution frequency counter, advanced spectrum analysis, harmonics analysis, user scripting	digital voltmeter (DVM), component tester, fast Fourier transform (FFT)	digital voltmeter (DVM), fast Fourier transform (FFT), frequency response analysis	power, digital voltmeter (DVM), spectrum analysis and spectrogram, frequency response analysis
Compliance testing [1, 2]	–	–	–	–
Display and operation				
Size and resolution	7" touchscreen, 800 × 480 pixel	6.5", 640 × 480 pixel	10.1" touchscreen, 1280 × 800 pixel	10.1" touchscreen, 1280 × 800 pixel
General data				
Dimensions in mm (W × H × D)	201 × 293 × 74	285 × 175 × 140	390 × 220 × 152	390 × 220 × 152
Weight in kg	2.4	1.7	2.5	3.3
Battery	lithium-ion, > 4 h	–	–	–

[1] Upgradeable. [2] Requires an option.






MXO 4	MXO 5/MXO 5C	R&S®RTO6	R&S®RTP
200/350/500 MHz/1/1.5 GHz	100/200/350/500 MHz/1/2 GHz	600 MHz/1/2/3/4/6 GHz	4/6/8/13/16 GHz
4	4/8	4	4
12 bit; 18 bit	12 bit; 18 bit	8 bit; 16 bit	8 bit; 16 bit
500 µV to 10 V	500 µV to 10 V	1 mV to 10 V (HD mode: 500 µV to 10 V)	
500 µV to 1 V	500 µV to 1 V	1 mV to 1 V (HD mode: 500 µV to 1 V)	2 mV to 1 V (HD mode: 1 mV to 1 V)
16	16	16	16
2.5; 5 (2 channels interleaved)	5 on 4 channels; 2.5 on 8 channels (2 channels interleaved)	10; 20 (2 channels interleaved in 4 GHz and 6 GHz model)	20; 40 (2 channels interleaved)
standard: 400 Mpoints; max. upgrade: 800 Mpoints[2)]	standard: 500 Mpoints max. upgrade: 1 Gpoints[2)]	standard: 200 Mpoints/800 Mpoints; max. upgrade: 1 Gpoints/2 Gpoints	standard: 100 Mpoints/400 Mpoints; max. upgrade: 3 Gpoints
standard: 10 000 segments; option: 1 000 000 segments	standard: 10 000 segments; option: 1 000 000 segments	standard	standard
> 4 500 000	> 4 500 000 on 4 channels	1 000 000 (2 500 000 in ultra-segmented memory mode)	750 000 (> 3 000 000 in ultra-segmented memory mode)
advanced (includes zone trigger), digital trigger (15 trigger types)	advanced (includes zone trigger), digital trigger (15 trigger types)	advanced (includes zone trigger), digital trigger (15 trigger types), high speed serial pattern trigger including 5 Gbps clock data recovery (CDR)[2)]	advanced (includes zone trigger), digital trigger (14 trigger types) with real-time deembedding[2)], high speed serial pattern trigger including 8/16 Gbps clock data recovery (CDR)[2)]
0.0001 div, across full bandwidth, user controllable	0.0001 div, across full bandwidth, user controllable	0.0001 div, across full bandwidth, user controllable	0.0001 div, across full bandwidth, user controllable
user configurable, hardware based	user configurable, hardware based	user configurable, hardware based	user configurable, hardware based
advanced (formula editor)	advanced (formula editor)	advanced (formula editor, Python interface)	advanced (formula editor, Python interface)
I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, CAN FD, CAN XL, LIN, ARINC 429, MIL-STD-1553, SPMI, 10BASE-T1S, QUAD-SPI, SENT, RFFE	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, CAN FD, CAN XL, LIN, ARINC 429, MIL-STD-1553, SPMI, 10BASE-T1S, 100BASE-T1, QUAD-SPI, SENT, RFFE	I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I²S, MIL-STD-1553, ARINC 429, FlexRay, CAN FD, MIPI RFFE, USB 2.0/HSIC, MDIO, 8b10b, Ethernet, Manchester, NRZ, SENT, MIPI D-PHY, SpaceWire, MIPI M-PHY/UniPro, CXPI, USB 3.1 Gen 1, USB-SSIC, PCIe 1.1/2.0, USB Power Delivery, Automotive Ethernet 100/1000BASE-T1	I²C, SPI, UART/RS-232/RS-422/RS-485, SENT, CAN, LIN, CAN FD, MIL-STD-1553, ARINC 429, SpaceWire, USB 2.0/HSIC/PD, USB 3.1 Gen 1/Gen 2/SSIC, PCIe 1.1/2.0/3.0, 8b10b, MIPI RFFE, MIPI D/M-PHY/UniPro, Automotive Ethernet 100/1000BASE-T1, Ethernet 10/100BASE-TX, MDIO, Manchester, NRZ
power, digital voltmeter (DVM), frequency response analysis	power, digital voltmeter (DVM), frequency response analysis	power, advanced spectrum analysis and spectrogram, jitter and noise decomposition, clock data recovery (CDR), I/Q data and RF analysis (R&S®VSE), deembedding, embedding, equalization, PAM-N, TDR/TDT analysis, advanced eye diagram	advanced spectrum analysis and spectrogram, jitter and noise decomposition, real-time deembedding, embedding, equalization, PAM-N, TDR/TDT analysis, I/Q data and RF analysis (R&S®VSE), advanced eye diagram
–		see specifications (PD 5216.1640.22)	see specifications (PD 3683.5616.22)
13.3" touchscreen, 1920 × 1080 pixel (Full HD)	for MXO 5 only: 15.6" touchscreen, 1920 × 1080 pixel (Full HD)	15.6" touchscreen, 1920 × 1080 pixel (Full HD)	13.3" touchscreen, 1920 × 1080 pixel (Full HD)
414 × 279 × 162	MXO 5: 445 × 314 × 154 MXO 5C: 445 × 105 × 405	450 × 315 × 204	441 × 285 × 316
6	MXO 5: 9 MXO 5C: 8.7	10.7	18
–	–	–	–

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