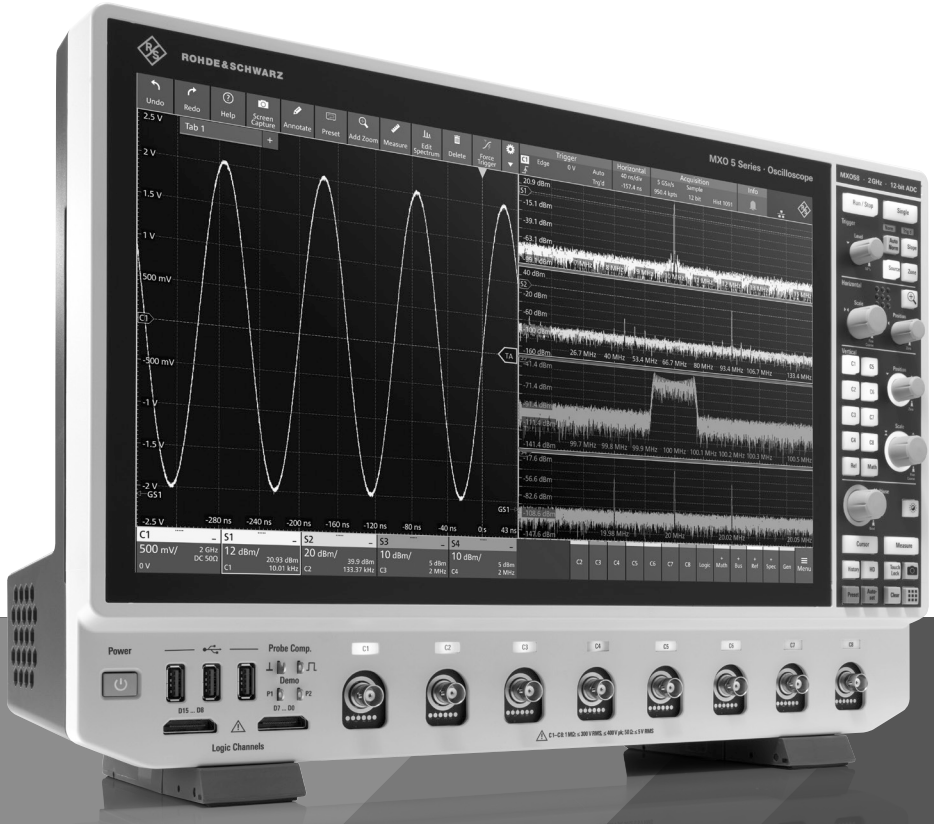
L'IMPULSION électronique
48 rue Antoine de LAVOISIER - B.P. 45 - Z.I de la Sphère
14202 HEROUVILLE SAINT CLAIR cedex
Tél. 02 31 47 53 88 ▪ Fax : 02 31 47 36 80
contact@limpulsion.fr
www.limpulsion.fr
▲ vente de composants - mesure - outillage - bureau d'études

# MXO 5 Series OSCILLOSCOPE

## Specifications




Specifications
Version 06.00

ROHDE&SCHWARZ
Make ideas real

# CONTENTS

**Definitions** ..... **3**

**Base unit** ..... **4**

Vertical system: analog channels ..... 4

Vertical system: digital channels ..... 6

Horizontal system ..... 7

Acquisition system ..... 7

High definition mode ..... 8

Trigger system ..... 8

Spectrum analysis ..... 10

RF characteristics ..... 10

Waveform measurements ..... 11

Waveform math ..... 11

Digital voltmeter ..... 11

Display characteristics ..... 12

History and segmented memory ..... 12

Miscellaneous ..... 13

Input and output ..... 13

**General data** ..... **14**

**Options** ..... **16**

R&S®MXO5-B1 mixed signal option ..... 16

R&S®MXO5-B6 arbitrary waveform generator ..... 16

R&S®MXO5-K31 power analysis ..... 18

R&S®MXO5-K36 frequency response analysis ..... 19

R&S®MXO5-K510 low speed serial buses ..... 19

R&S®MXO5-K520 automotive protocols ..... 21

R&S®MXO5-K530 aerospace protocols ..... 22

R&S®MXO5-K550 MIPI low speed protocols ..... 22

R&S®MXO5-K560 automotive Ethernet protocols ..... 23

**Ordering information** ..... **24**

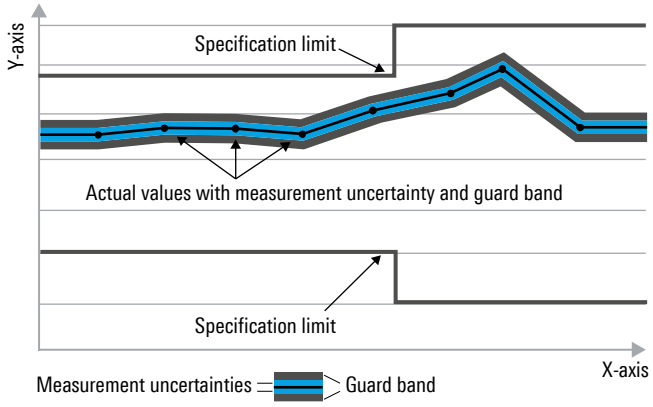
Warranty and service ..... 25

# Definitions

**General**
Product data applies under the following conditions:

- Three hours of storage at ambient temperature followed by 60 minutes of warm-up operation
- Specified environmental conditions met
- Recommended calibration interval adhered to
- All internal automatic adjustments performed, if applicable

**Specifications with limits**
Represent warranted product performance by means of a range of values for the specified parameter. These specifications are marked with limiting symbols such as <, ≤, >, ≥, ± or descriptions such as maximum, limit of, minimum. Compliance is ensured by testing or is derived from the design. Test limits are narrowed by guard bands to take into account measurement uncertainties, drift and aging, if applicable.




**Non-traceable specifications with limits (n. trc.)**
Represent product performance that is specified and tested as described under “Specifications with limits” above. However, product performance in this case cannot be warranted due to the lack of measuring equipment traceable to national metrology standards. In this case, measurements are referenced to standards used in the Rohde & Schwarz laboratories.

**Specifications without limits**
Represent warranted product performance for the specified parameter. These specifications are not specially marked and represent values with no or negligible deviations from the given value, e.g. dimensions or resolution of a setting parameter. Compliance is ensured by design.

**Typical data (typ.)**
Characterizes product performance by means of representative information for the given parameter. When marked with <, > or as a range, it represents the performance met by approximately 80 % of the instruments at production time. Otherwise, it represents the mean value.

**Nominal values (nom.)**
Characterize product performance by means of a representative value for the given parameter, e.g. nominal impedance. In contrast to typical data, a statistical evaluation does not take place and the parameter is not tested during production.

**Measured values (meas.)**
Characterize expected product performance by means of measurement results gained from individual samples.

**Uncertainties**
Represent limits of measurement uncertainty for a given measurand. Uncertainty is defined with a coverage factor of 2 and has been calculated in line with the rules of the Guide to the Expression of Uncertainty in Measurement (GUM), taking into account environmental conditions, aging, wear and tear.

Device settings and GUI parameters are designated with the format “parameter: value”.

Non-traceable specifications with limits, typical data as well as nominal and measured values are not warranted by Rohde & Schwarz.

In line with the 3GPP standard, chip rates are specified in million chips per second (Mcps), whereas bit rates and symbol rates are specified in billion bit per second (Gbps), million bit per second (Mbps), thousand bit per second (kbps), million symbols per second (Msps) or thousand symbols per second (ksps), and sample rates are specified in million samples per second (Msample/s). Gbps, Mcps, Mbps, Msps, kbps, ksps and Msample/s are not SI units.

# Base unit

## Vertical system: analog channels

| | | |
|---|---|---|
| Input channels | | 4 channels or 8 channels |
| Input impedance | | 50 Ω ± 1.5 %,<br>1 MΩ ± 1 % \|\| 12 pF (meas.) |
| Analog bandwidth (–3 dB) | 4-channel instrument | |
| | at 50 Ω input impedance | |
| | MXO 54 | ≥ 350 MHz |
| | MXO 54 with -B245 option | ≥ 500 MHz |
| | MXO 54 with -B2410 option | ≥ 1 GHz |
| | MXO 54 with -B2420 option | ≥ 2 GHz |
| | at 1 MΩ input impedance | |
| | MXO 54 | ≥ 350 MHz (meas.) |
| | MXO 54 with -B245 option | ≥ 500 MHz (meas.) |
| | MXO 54 with -B2410 option | ≥ 700 MHz (meas.) [1] |
| | MXO 54 with -B2420 option | ≥ 700 MHz (meas.) [1] |
| | 8-channel instrument | |
| | at 50 Ω input impedance | |
| | MXO 58 | ≥ 100 MHz |
| | MXO 58 with -B282 option | ≥ 200 MHz |
| | MXO 58 with -B283 option | ≥ 350 MHz |
| | MXO 58 with -B285 option | ≥ 500 MHz |
| | MXO 58 with -B2810 option | ≥ 1 GHz |
| | MXO 58 with -B2820 option | ≥ 2 GHz [2] |
| | at 1 MΩ input impedance | |
| | MXO 58 | ≥ 100 MHz (meas.) |
| | MXO 58 with -B282 option | ≥ 200 MHz (meas.) |
| | MXO 58 with -B283 option | ≥ 350 MHz (meas.) |
| | MXO 58 with -B285 option | ≥ 500 MHz (meas.) |
| | MXO 58 with -B2810 option | ≥ 700 MHz (meas.) [1] |
| | MXO 58 with -B2820 option | ≥ 700 MHz (meas.) [1] |
| 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 | |
| | 4-channel instrument | |
| | MXO 54 | < 1.75 ns |
| | MXO 54 with -B245 option | < 700 ps |
| | MXO 54 with -B2410 option | < 350 ps |
| | MXO 54 with -B2420 option | < 175 ps |
| | 8-channel instrument | |
| | MXO 58 | < 3.5 ns |
| | MXO 58 with -B282 option | < 1.75 ns |
| | MXO 58 with -B283 option | < 1 ns |
| | MXO 58 with -B285 option | < 700 ps |
| | MXO 58 with -B2810 option | < 350 ps |
| | MXO 58 with -B2820 option | < 175 ps [2] (interleaved),<br>< 350 ps (non-interleaved) |
| Vertical resolution | | 12 bit,<br>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 | 10.0 |
| | 20 MHz | 9.6 |
| | 100 MHz | 8.7 |
| | 200 MHz | 8.3 |
| | 300 MHz | 8.0 |
| | 500 MHz | 7.7 |
| | 1 GHz | 7.0 |

[1] With R&S®RT-ZP11 passive probe.

[2] 2 GHz analog bandwidth in interleave mode with 5 Gsample/s real-time sampling rate.

| | | |
|---|---|---|
| Input sensitivity | at 50 Ω | 0.5 mV/div to 3 V/div,<br>entire analog bandwidth supported for all input sensitivities |
| | at 1 MΩ | 0.5 mV/div to 10 V/div,<br>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 % full scale |
| | input sensitivity<br>≤ 5 mV/div to ≥ 1 mV/div | ±1.5 % full scale |
| | input sensitivity 500 µV/div | ±2.5 % 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 ($V_p$),<br>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 ($V_p$),<br>300 V (RMS) CAT II;<br>for derating and details,<br>see R&S®RT-Zxx Standard Probes specifications (PD 3607.3851.22) |
| Position range | | ±5 div |
| Offset range at 50 Ω | input sensitivity | |
| | 120 mV/div to 3 V/div | ±(15 V – input sensitivity × position) |
| | 33 mV/div to < 120 mV/div | ±(7 V – input sensitivity × position) |
| | 0.5 mV/div to < 33 mV/div | ±(2 V – input sensitivity × position) |
| 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\| +<br>0.5 mV + 0.1 div × input sensitivity);<br>(net offset =<br>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 ×<br>\|reading – net offset\|<br>+ offset accuracy) |
| Channel-to-channel isolation<br>(each channel at same input sensitivity) | input frequency inside instrument bandwidth | > 60 dB (1:1000) |

| **RMS noise floor** [3] | | | | | | | |
|---|---|---|---|---|---|---|---|
| At 50 Ω (meas.) | Input sensitivity | Analog bandwidth (–3 dB) | | | | | |
| | | 100 MHz | 200 MHz | 350 MHz | 500 MHz | 1 GHz | 2 GHz |
| | 0.5 mV/div | 19 µV | 26 µV | 33 µV | 39 µV | 66 µV | 111 µV |
| | 1 mV/div | 24 µV | 33 µV | 42 µV | 51 µV | 85 µV | 141 µV |
| | 2 mV/div | 25 µV | 35 µV | 44 µV | 53 µV | 89 µV | 146 µV |
| | 5 mV/div | 34 µV | 46 µV | 59 µV | 71 µV | 116 µV | 182 µV |
| | 10 mV/div | 66 µV | 89 µV | 115 µV | 138 µV | 226 µV | 350 µV |
| | 20 mV/div | 134 µV | 181 µV | 233 µV | 280 µV | 461 µV | 713 µV |
| | 50 mV/div | 324 µV | 436 µV | 563 µV | 677 µV | 1.12 mV | 1.78 mV |
| | 100 mV/div | 610 µV | 815 µV | 1.05 mV | 1.26 mV | 2.08 mV | 3.25 mV |
| | 200 mV/div | 1.26 mV | 1.69 mV | 2.17 mV | 2.60 mV | 4.31 mV | 6.74 mV |
| | 500 mV/div | 4.21 mV | 5.54 mV | 6.94 mV | 8.21 mV | 12.93 mV | 18.63 mV |
| | 1 V/div | 6.88 mV | 9.20 mV | 11.71 mV | 14.02 mV | 22.57 mV | 32.89 mV |
| | 2 V/div | 11.45 mV | 15.21 mV | 19.45 mV | 23.21 mV | 37.85 mV | 54.59 mV |
| | 3 V/div | 15.77 mV | 20.78 mV | 26.54 mV | 31.71 mV | 51.80 mV | 73.68 mV |
| At 1 MΩ (meas.) | Input sensitivity | Analog bandwidth (–3 dB) | | | | | |
| | | 100 MHz | 200 MHz | 350 MHz | 500 MHz | 700 MHz | |
| | 0.5 mV/div | 35 µV | 40 µV | 46 µV | 54 µV | 85 µV | |
| | 1 mV/div | 36 µV | 42 µV | 49 µV | 57 µV | 89 µV | |
| | 2 mV/div | 38 µV | 45 µV | 54 µV | 64 µV | 101 µV | |
| | 5 mV/div | 47 µV | 58 µV | 77 µV | 92 µV | 141 µV | |
| | 10 mV/div | 68 µV | 89 µV | 126 µV | 152 µV | 229 µV | |
| | 20 mV/div | 120 µV | 161 µV | 235 µV | 285 µV | 428 µV | |
| | 50 mV/div | 297 µV | 401 µV | 592 µV | 719 µV | 1.08 mV | |
| | 100 mV/div | 678 µV | 892 µV | 1.25 mV | 1.47 mV | 2.16 mV | |
| | 200 mV/div | 1.21 mV | 1.62 mV | 2.33 mV | 2.77 mV | 4.09 mV | |
| | 500 mV/div | 2.88 mV | 3.88 mV | 5.68 mV | 6.76 mV | 10.01 mV | |
| | 1 V/div | 6.11 mV | 8.08 mV | 11.54 mV | 13.56 mV | 18.51 mV | |
| | 2 V/div | 11.42 mV | 15.20 mV | 22.04 mV | 25.98 mV | 35.39 mV | |
| | 5 V/div | 29.10 mV | 38.75 mV | 56.46 mV | 66.60 mV | 90.40 mV | |
| | 10 V/div | 44.33 mV | 58.62 mV | 85.77 mV | 101.12 mV | 137.86 mV | |

## 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 the logic probes to the channels (D0 to D7 and D8 to D15) is displayed on the probe |
| 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 |

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

## Horizontal system

| | | |
|---|---|---|
| Timebase range | | selectable between 200 ps/div and 10000 s/div,<br>time per div settable to any value within range |
| Deskew range (channel deskew) | 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 on same acquisition and channel; signal amplitude greater than five divisions, measurement threshold set to 50 %, vertical gain 10 mV/div or greater; rise time lower than four sample 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 4 channels,<br>max. 2.5 Gsample/s on 8 channels |
| | analog channels (interpolated) | max. 5 Tsample/s |
| | digital channels | max. 5 Gsample/s on each channel |
| Waveform acquisition rate | max. | > 4 500 000 waveforms/s |
| Trigger rearm time | min. | < 21 ns |
| Memory depth [4] | standard | |
| | analog channels only | with 8 active channels:<br>• max. 500 Mpoints (single capture)<br>with 4 active channels:<br>• max. 500 Mpoints (run continuous)<br>• max. 500 Mpoints (single capture and run continuous) |
| | digital channels only (MSO) | with 16 digital channels:<br>• max. 500 Mpoints (single capture)<br>with 8 digital channels:<br>• max. 500 Mpoints (run continuous) |
| | mix analog and digital | with 2 analog and 8 digital channels:<br>• max. 500 Mpoints (single capture)<br>• max. 250 Mpoints (run continuous) |
| | with R&S®MXO5-B110 memory option 1 Gpoints | |
| | analog channels only | with 4 active channels:<br>• max. 1 Gpoints (single capture)<br>with 2 active channels:<br>• max. 1 Gpoints (run continuous) |
| | digital channels only (MSO) | with 8 digital channels:<br>• max. 1 Gpoints (single capture)<br>• max. 500 Mpoints (run continuous) |
| | mix analog and digital | with 2 analog and 8 digital channels:<br>• max. 500 Mpoints (single capture)<br>• max. 250 Mpoints (run continuous) |
| | math | |
| | with 1 active math | max. 87.5 Mpoints |
| | with 2 active math | max. 42.5 Mpoints |
| | with 4 active math | max. 20 Mpoints |
| | with 8 active math | max. 10 Mpoints |

[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 or high definition (HD) mode. Interleave channels of the MXO 58 are on C1 and C5, C2 and C6, C3 and C7 as well as C4 and C8. For the MXO 54, all 4 channels run with 5 Gsample/s and maximum bandwidth.

| | | |
|---|---|---|
| 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 16 777 215 |
| | envelope | envelope of acquired waveforms |
| Sampling modes | real-time mode | max. sampling rate set by digitizer |
| | interpolated time | enhancement of sampling resolution by interpolation; max. 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 | > 4 600 000 waveforms/s |
| | min. blind time between consecutive acquisitions | < 21 ns |

## High definition mode

| | | |
|---|---|---|
| General description | The high definition mode increases the bit resolution of the waveform signal by using digital filtering, leading to reduced noise. Because of the digital trigger concept of the MXO 5, signals with increased numeric resolution are used as the input for triggering. | |
| Numeric 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. 2.5 Gsample/s on 4 channels, max. 1.25 Gsample/s on 8 channels |

## Trigger system

| | | |
|---|---|---|
| Trigger sources | | analog channels (C1 to C8), digital channels (D0 to D15), trigger input, line trigger, 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, user adjustable |
| 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 |
| | adjustment resolution | 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 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 time between two consecutive edges of same slope (positive or negative) is shorter, longer, inside or outside a specified range | |
| | interval time | 200 ps to 1000 s |
| 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 a slope (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 |
| | number of zones/areas | up to 4 zones with up to 8 areas each |
| | area shapes | polygones 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 | |
| | trigger sources | analog channels (C1 to C8) |
| | 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 |
| Trigger input | input impedance | 50 Ω (meas.) or<br>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 ($V_p$),<br>derates at 20 dB/decade to 5 V (RMS) above 250 kHz |
| | trigger level | ±5 V |
| | sensitivity | |
| | input frequency ≤ 500 MHz | 300 mV ($V_{pp}$) (meas.) |
| | input coupling | AC, DC (50 Ω and 1 MΩ) |
| | trigger filter | HF reject (attenuates > 50 kHz),<br>LF reject (attenuates < 50 kHz),<br>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;<br>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 up to four signal analysis in the frequency domain. | |
| Spectrum | sources | channel 1 to channel 8 |
| | setup 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<br>(measurement of the 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<br>(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,<br>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 | 67 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 | –65 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 | –49 dBc (meas.) |

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

## 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 | 24 |
| Cursor measurements | available cursors | up to four 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;<br>vertical cursors either set manually or locked to waveform |

## Waveform math

| | | |
|---|---|---|
| General features | number of math equations | up to 8 |
| | number of reference waveforms | up to 8 |
| | sources | channel 1 to 8, math waveforms 1 to 8, reference waveforms 1 to 8 |
| Functions | operators | add, subtract, multiply, divide, absolute value, square, square root, integrate, differentiate, $\log_{10}$, $\log_e$, $\log_2$, reciprocal, invert, lowpass, highpass,<br>rescale ($a \cdot x + b$) |
| | filters | lowpass, highpass |
| | filter types | Gaussian, rectangular |
| | gate | delimits the display region used for waveform math |

## Digital voltmeter

| | | |
|---|---|---|
| Accuracy | | related to channel settings of voltmeter source |
| Measurements | | DC, DC RMS, AC RMS |
| Sources | MXO 54 | C1, C2, C3, C4 |
| | MXO 58 | C1, C2, C3, C4, C5, C6, C7, C8 |
| Number of measurements | | up to 4 |
| Resolution | | up to 6 digits |
| Bandwidth | | up to 20 MHz |

# Display characteristics

| | |
|---|---|
| Diagram types | Yt, zoom, spectrum |
| Display configuration (waveform layout) | The display area can be split into separate diagram areas by dragging and dropping signal icons. 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 tools; allows to set the most common parameters directly in a simple menu and gives access to more detailed parameters in the main menu. User-defined selection of tools in the toolbar. |
| 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 label | The x-axis and y-axis are labeled with values and physical unit. |
| Diagram label | Diagrams can 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 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 segments for the acquisition | |
| | number of segments | record length | segments [6] (up to) |
| | | 1 kpoints | 1 048 575 |
| | | 2 kpoints | 524 287 |
| | | 5 kpoints | 262 143 |
| | | 10 kpoints | 131 071 |
| | | 20 kpoints | 65 535 |
| | | 50 kpoints | 32 767 |
| | | 100 kpoints | 16 383 |
| | | 200 kpoints | 9 361 |
| | | 500 kpoints | 4 095 |
| | | 1 Mpoints | 2 113 |
| | | 2 Mpoints | 1 056 |
| | | 5 Mpoints | 427 |
| | | 10 Mpoints | 213 |
| | | 20 Mpoints | 106 |
| | | 50 Mpoints | 41 |
| | | 100 Mpoints | 20 |
| | | 200 Mpoints | 9 |
| | | 500 Mpoints | 3 |
| | | 1 Gpoints | 1 |
| | Segmentation is available on all analog and logic channels, protocol decoding and spectrum analysis. | | |
| Fast-segmented mode | continuous recording of waveforms in acquisition memory without interruption due to visualization; 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 the recorded waveforms; repetition possible; adjustable speed; manual next/previous segment; numerical segment number input | |
| | analyze options | overlay all segments, average all segments, envelope all segments | |

[6] With R&S®MXO5-B110 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 or high definition (HD) mode. The maximum number of segments without the R&S®MXO5-B110 memory option is limited to 10 000.

## 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 |
| | WebDAV | support for the web distributed authoring and versioning (WebDAV) protocol, which provides secure access through an application proxy |
| 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 |

## Input and output

| **Front** | | |
|---|---|---|
| Channel inputs | | BNC; for details, see Vertical system |
| | probe interface | auto detection of passive probes,<br>Rohde & Schwarz active probe interface |
| Trigger input | | BNC; for details, see Trigger system |
| | probe interface | auto detection of passive probes |
| Waveform generator outputs<br>(requires R&S®MXO5-B6 option) | | BNC; for details, see R&S®MXO5-B6, waveform generator,<br>demo lugs and GND lug |
| Digital channel inputs | D15 to D8, D7 to D0 | interface for R&S®RT-ZL04 logic probe |
| Probe compensation output | signal shape | rectangle, $V_{low}$ = 0 V, $V_{high}$ = 3.3 V<br>amplitude 3.3 V ($V_{pp}$) ± 5 % (meas.) |
| | frequency | 1 kHz ± 1 % (meas.) |
| USB interfaces | | 3 × USB 3.1 Gen 1 ports, type A plug |

| **Rear** | | |
|---|---|---|
| Trigger out | | BNC;<br>for details, see Trigger system |
| USB interface | | 1 × USB 3.1 Gen 1 port, type B plug |
| Reference input | connector | BNC |
| | impedance | 50 Ω (nom.) |
| | input frequency | 10 MHz (±20 ppm) |
| | sensitivity | ≥ –10 dBm into 50 Ω,<br>≤ 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 style lock |
| VESA mount | via R&S®MXO5-Z7 VESA adapter | VESA compatibility mounting interface, 100 mm × 100 mm pattern size, according FDMI MIS-D, up to 14 kg with M4x10 screws |

| **Right side** | | |
|---|---|---|
| Ground jack | | connected to ground |
| USB interfaces | | 2 × USB 3.1 Gen 1 ports, type A plug |
| LAN interface | | RJ-45 connector,<br>supports 10/100/1000BASE-T |
| External monitor interface | | HDMI™ 2.0 and DisplayPort++ 1.3,<br>output of oscilloscope display |

# General data

| | | |
|---|---|---|
| **Display** | type | 15.6" 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,<br>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;<br>0.5 g from 55 Hz to 150 Hz,<br>in line with EN 60068-2-6 |
| | | 10 Hz to 55 Hz,<br>in line with MIL-PRF-28800F, section 4.5.5.3.2, class 3 |
| | random | 8 Hz to 500 Hz,<br>acceleration 1.2 g (RMS),<br>in line with EN 60068-2-64 |
| | | 5 Hz to 500 Hz,<br>acceleration 2.058 g (RMS),<br>in line with MIL-PRF-28800F,<br>section 4.5.5.3.1, class 3 |
| Shock | | 40 g shock spectrum,<br>in line with MIL-STD-810G,<br>method no. 516.6, procedure I |
| | | 30 g functional shock, half sine,<br>duration 11 ms,<br>in line with MIL-PRF-28800F,<br>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);<br>the instrument complies with the emission requirements stipulated by EN 55011, EN 61326-1 and EN 61326-2-1 class A, making the instrument suitable for use in industrial environments |
| Immunity | | in line with IEC/EN 61326-1 table 2, immunity test requirements for industrial environment [7] |

| | | |
|---|---|---|
| **Certifications** | | VDE, $_{C}CSA_{US}$, KC |

| | | |
|---|---|---|
| **Calibration interval** | | 1 year |

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

| **Power supply** | | |
|---|---|---|
| AC supply | | 100 V to 240 V ± 10 % at<br>50 Hz to 60 Hz and 400 Hz ± 5 %,<br>max. 4 A to 2.5 A,<br>in line with MIL-PRF 28800F, section 3.5 |
| Power consumption | standby mode | 1.6 W |
| | all channels on, without probes | 180 W (typ.) |
| | max. | 360 W |
| Safety | | in line with IEC 61010-1,<br>IEC 61010-2-030,<br>CAN/CSA-C22.2 no. 61010-1,<br>UL 61010-1,<br>CAN/CSA C22.2 no. 61010-2-030 |

| **Mechanical data** | | |
|---|---|---|
| Dimensions | W × H × D | 445 mm × 314 mm × 153 mm<br>(17.51 in × 12.36 in × 6.02 in) |
| Weight | without options, nominal | 9.0 kg (19.85 lb) |
| Rackmount height | with R&S®ZZA-MXO5 rackmount kit | 8 HU |

# Options

## R&S®MXO5-B1 mixed signal option

Mixed signal capability is a standard functionality of the MXO 5 series oscilloscopes. The R&S®MXO5-B1 mixed signal option provides 16 digital channels with two R&S®RT-ZL04 probes.

## R&S®MXO5-B6 arbitrary waveform generator

**Arbitrary function/waveform generator, 2 analog channels**

| **General** | | |
|---|---|---|
| Output channel | | 2 channels |
| Vertical resolution | | 16 bit |
| Operating modes | | function generator, arbitrary waveform generator, modulation, frequency sweep |

| **Function generator** | output of predefined waveforms | |
|---|---|---|
| Sample rate | | 625 Msample/s |
| Waveforms | sine, square/pulse, ramp, DC, noise, sine cardinal (sinc), Gaussian pulse, Lorentz, exponential fall, exponential rise, cardiac | |
| Sine | frequency range | 1 mHz to 100 MHz |
| | amplitude flatness (relative to 1 kHz) | ≤ ±0.5 dB (meas.) |
| | total harmonic distortion (into 50 Ω) | |
| | f ≤ 10 MHz | ≤ –60 dBc (meas.) |
| | f > 10 MHz | ≤ –40 dBc (meas.) |
| | nonharmonic spurious | –75 dBc (meas.) |
| Square/pulse | frequency range | 1 mHz to 30 MHz |
| | duty cycle (if pulse width limit is not exceeded) | 0.01 % to 99.99 %, 0.01 % resolution |
| | pulse width | ≥ 16.5 ns, 0.1 ns resolution |
| | rise/fall time | 9 ns (meas.) |
| | overshoot | ≤ 2 % (meas.) |
| | jitter (cycle-to-cycle) (≥ 0.2 V ($V_{pp}$)) | ≤ 40 ps (RMS) (meas.) |
| Ramp (triangle, sawtooth) | frequency range | 1 mHz to 1 MHz |
| | variable symmetry | 0 % to 100 %, 0.1 % resolution |
| DC | level range | |
| | into 50 Ω | ± 2.5 V |
| | into open circuit | ± 5 V |
| | resolution | 1 mV |
| Noise | amplitude | |
| | DC | 0 V to 5 V ($V_{pp}$) (into 50 Ω),<br>0 V to 10 V ($V_{pp}$) (into open circuit),<br>1 mV resolution |
| | all other waveforms | 0 % to 100 % of AC signal amplitude,<br>1 % resolution |
| | bandwidth | ≥ 100 MHz |
| Sine cardinal (sinc) | frequency range | 1 mHz to 5 MHz |
| Gaussian pulse | frequency range | 1 mHz to 25 MHz |
| Lorentz | frequency range | 1 mHz to 10 MHz |
| Exponential rise/fall | frequency range | 1 mHz to 10 MHz |
| Cardiac | frequency range | 1 mHz to 1 MHz |

| | | |
|---|---|---|
| **Arbitrary waveform generator** | output of user-defined waveforms | |
| Waveform length | | 1 sample to 40 Msample on each channel |
| Sample rate | | 1 sample/s to 312.5 Msample/s |
| Filter bandwidth | | 100 MHz |
| **Modulation** | | |
| Modulation types | | amplitude modulation (AM), frequency modulation (FM), frequency-shift key modulation (FSK), pulse width modulation (PWM) |
| Carrier waveform | AM, FM, FSK | sine |
| | PWM | square/pulse |
| AM | modulation signals | sine, square, ramp (triangle, sawtooth) |
| | modulation frequency | 1 mHz to 1 MHz |
| | depth | 0 % to 100 %, 0.1 % resolution |
| FM | modulation signals | sine, square, triangle, ramp, inverse ramp |
| | modulation frequency | 1 mHz to 1 MHz |
| | frequency deviation | 1 mHz to 10 MHz |
| FSK | modulation signal | 50 % duty cycle square wave |
| | range of frequency 1, frequency 2 | 1 mHz to 100 MHz |
| | hop rate | 1 mHz to 1 MHz |
| PWM | modulation signals | sine, square, ramp |
| | depth | 0 % to 99.99 % of the duty cycle, 0.01 % resolution |

| | | |
|---|---|---|
| **Frequency sweep** | output of a sinusoidal waveform with the frequency changing linearly between the start frequency and the stop frequency within the sweep time | |
| | waveform | sine |
| | frequency range | 1 mHz to 100 MHz |
| | direction | up (start frequency < stop frequency) |
| | | down (start frequency > stop frequency) |
| | sweep time | 1 ms to 500 s |

| | | |
|---|---|---|
| **Two-channel operation** | operating modes | independent channels, coupled parameters, differential |
| | parameter coupling | none, frequency and/or amplitude |
| | relative phase | –180° to 180°, 0.1° resolution |
| | channel-to-channel skew (each channel with same output amplitude) | ≤ 200 ps (meas.) |
| | channel-to-channel isolation (each channel with same output amplitude) | ≥ 70 dB (meas.) |

| **Outputs** | | |
|---|---|---|
| Connectors | | BNC; on the front of the instrument |
| Function | | on/off, inverted |
| Output impedance | | 50 Ω (nom.) |
| Overload protection | $V_{pp}$ > 200 mV into open circuit | a short-circuit to ground is tolerated indefinitely,<br>automatic shutoff in case of voltages ≥ +12 V or ≤ –12 V (meas.) |
| | $V_{pp}$ ≤ 200 mV into open circuit | a short-circuit to ground is tolerated indefinitely,<br>automatic shutoff in case of voltages ≥ +4 V or ≤ –4 V (meas.) |
| Amplitude range [8] | sine, square/pulse, ramp, exponential rise/fall, arbitrary waveforms, sine cardinal (sinc), Gaussian, Lorentz, cardiac | |
| | into 50 Ω | 5 mV to 5 V ($V_{pp}$) |
| | into open circuit | 10 mV to 10 V ($V_{pp}$) |
| | resolution | 1 mV |
| | accuracy | ±1 % at 1 kHz |
| DC offset range | sine, square/pulse, ramp, exponential rise/fall, arbitrary waveforms | |
| | into 50 Ω | ±2.5 V ($V_{pp}$ > 100 mV),<br>±1.25 V ($V_{pp}$ ≤ 100 mV) |
| | into open circuit | ±5.0 V ($V_{pp}$ > 200 mV),<br>±2.5 V ($V_{pp}$ ≤ 200 mV) |
| | sine cardinal (sinc): DC offset range is signal amplitude dependent | |
| | into 50 Ω | –2.823 V to +2.177 V ($V_{pp}$ = 1 V) |
| | into open circuit | –5.323 V to +4.677 V ($V_{pp}$ = 1 V) |
| | Gaussian, Lorentz: DC offset range is signal amplitude dependent | |
| | into 50 Ω | –3.000 V to +2.000 V ($V_{pp}$ = 1 V) |
| | into open circuit | –5.500 V to +4.500 V ($V_{pp}$ = 1 V) |
| | cardiac: DC offset range is signal amplitude dependent | |
| | into 50 Ω | –2.814 V to +2.186 V ($V_{pp}$ = 1 V) |
| | into open circuit | –5.314 V to +4.686 V ($V_{pp}$ = 1 V) |
| | resolution | 1 mV |
| | accuracy | ±(1 % of control + (0.5 % of amplitude) + 2 mV) |
| Frequency accuracy | | \| Δf \| ≤ [ (timebase accuracy) × (nominal frequency) + 1.1 µHz ] (calc.)<br>(timebase accuracy, see Horizontal system) |

# R&S®MXO5-K31 power analysis

| **Power analysis (requires R&S®MXO5-K31 option)** | | |
|---|---|---|
| General description | The R&S®MXO5-K31 power analysis option extends the MXO 5 firmware with measurement functionality focused on switched mode power supplies (SMPS) and DC/DC converters.<br>Up to six sets of power analysis measurements are possible. | |
| Input | quality | evaluation of power quality at an AC input; measures real power, apparent power, reactive power, power factor and phase angle of power, frequency, crest factor, RMS of voltage and current |
| | harmonics | measures up to the 334th harmonic of the incoming line frequency; precompliance checking for IEC 61000-3-2 (A, B, C, D), RTCA DO-160, MIL-STD-1399, max. limit checks |
| Deskew | automated | automated compensation of the propagation delay |
| Zero offset | automated | automatic compensation of input offset |

[8] Amplitude is the sum of the AC amplitude and the noise amplitude.

# R&S®MXO5-K36 frequency response analysis

| Frequency response analysis (requires R&S®MXO5-B6 option) | | |
|---|---|---|
| Stimulus | frequency mode | single sweep or repeated sweep |
| | 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 |
| Input and output sources | | channel 1, channel 2, channel 3, channel 4 |
| Number of test points | | 10 points to 500 points per decade |
| Measurement | | dual pair of tracking gain and phase cursors |
| Diagram types | manually changeable vertical window size | parallel display of result window and input and output signal view |
| Result table | | navigation and export functions |
| Scaling | during and after test | auto scale and manual scaling and positioning |

# R&S®MXO5-K510 low speed serial buses

| I²C decoding | | |
|---|---|---|
| Protocol configuration | bit rate | auto detected |
| Trigger | source (clock and data) | any analog input channel or logical channel |
| | trigger event setup | start, stop, restart, missing ACK, address, data, address + data |
| | address setup | 7 bit or 10 bit address (value in hex or binary); read, write or either; condition =, ≠, ≥, ≤, in range, out of range |
| | data setup | data pattern up to 8 byte (hex or binary); condition =, ≠; offset within frame in range from 0 byte to 4095 byte |
| Decode | source (clock and data) | any input channel, logical channel |
| | display type | decoded bus, tabulated list |
| | color coding | frame, start/restart, address (read/write), data, ACK/NACK, stop, error |
| | data format | hex, decimal, octal, binary, ASCII |
| | filter | filter result table on frame types, field values, status |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |

| SPI decoding | | |
|---|---|---|
| Protocol configuration | type | 2-wire, 3-wire and 4-wire SPI |
| | bit rate | auto detected |
| | bit order | LSB first, MSB first |
| | word size | 4/8/12/16/20/24/28/32 bit |
| | frame condition | CS, timeout |
| | polarity (MOSI, MISO, CS, CLK) | active high, active low |
| | phase (CLK) | first edge, second edge |
| Trigger | source (MOSI, MISO, CS, CLK) | any analog input channel or logical channel |
| | bit rate | up to 50 Mbps |
| | trigger event setup | start of frame, end of frame, MOSI, MISO |
| | data setup | data pattern up to 32 bit (hex or binary); condition =, ≠; offset within frame in range from 0 bit to 4095 bit |
| Decode | source (MOSI, MISO, CS, CLK) | any input channel, logical channel |
| | display type | decoded bus, tabulated list |
| | color coding | frame, word, error |
| | data format | hex, decimal, octal, binary, ASCII |
| | filter | filter result table on frame types, field values, status |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |

| **QUAD-SPI decoding** | | |
|---|---|---|
| Protocol configuration | source (CS, SCLK, IO0 to IO3) | analog, logical, math, reference channels |
| | bit rate | auto detected |
| | polarity (SCLK) | rising, falling |
| | polarity (CS, IO0 to IO3) | active high, active low |
| | instruction mode | single, dual, quad |
| | opcode | configurable list for opcode translation<br>opcode list can be saved and loaded |
| Decode | display type | decoded bus, tabulated list |
| | color coding | frame, word, error |
| | data format | hex, decimal, octal, binary, ASCII |
| | filter | filter result table on frame types, field values, status |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |

| **UART/RS-232/RS-422/RS-485 decoding** | | |
|---|---|---|
| Protocol configuration | bit rate | 300 bps to 20 Mbps |
| | signal polarity | idle low, idle high |
| | number of bits | 5 bit to 9 bit |
| | bit order | LSB first, MSB first |
| | parity | odd, even, mark, space, none |
| | stop bit | 1, 1.5 or 2 |
| | end of packet | timeout, none |
| Trigger | source (TX and RX) | any analog input channel or logical channel |
| | trigger event setup | start bit, packet start, data, parity error, stop error, break condition |
| | data setup | data pattern (hex, decimal, octal, binary or ASCII); condition =, ≠; offset within packet in range 0 word to 4095 words |
| Decode | source (TX and RX) | any input channel, logical channel |
| | display type | decoded bus, tabulated list |
| | color coding | packet, data payload, start error, parity error, stop error |
| | data format | hex, decimal, octal, binary, ASCII |
| | filter | filter result table on frame types, field values, status |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |

# R&S®MXO5-K520 automotive protocols

| CAN FD/XL decoding | | |
|---|---|---|
| Protocol configuration | signal type | CAN_H, CAN_L |
| | bit rate | |
| | nominal bit rate | 100 kbps to 1 Mbps |
| | FD data rate | 100 kbps to 15 Mbps |
| | XL data rate | 100 kbps to 15 Mbps |
| | sampling point | 30 % to 90 % within bit period; independent settings for nominal bit rate, FD data rate and XL data rate |
| | device list | associate frame identifier with symbolic ID, load DBC file content |
| Trigger | source | any analog input channel or logical channel |
| | trigger event setup | start of frame, frame type, identifier, identifier + data, error condition (any combination of CRC error, bit stuffing error, form error and ACK error) |
| | identifier setup | identifier type (standard or extended); condition =, ≠, ≥, ≤, in range, out of range |
| | FD bits | FDF, BRS and ESI (0, 1, X) |
| | XL setup | SDT, VCID, AF; condition =, ≠, ≥, ≤, in range, out of range |
| | data setup | data pattern up to 8 byte (hex, decimal, octal, binary or ASCII); condition =, ≠ |
| Decode | source | any input channel, logical channel |
| | display type | decoded bus, tabulated list |
| | color coding | start of frame, identifier, DLC, ADS, SDT, VCID, AF, data payload, CRC, end of frame, error frame, overload frame, CRC error, bit stuffing error |
| | data format | hex, decimal, octal, binary, ASCII, symbolic |
| | filter | filter result table on frame types, field values, status |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |

| LIN decoding | | |
|---|---|---|
| Protocol configuration | version | 1.3, 2.x or SAE J602; mixed traffic is supported |
| | bit rate | 1 kbps to 20 Mbps |
| Trigger | source | any analog input channel or logical channel |
| | trigger event setup | start of frame (sync break), identifier, identifier + data, wake-up frame, error condition (any combination of checksum error, parity error and sync field error) |
| | identifier setup | range from 0d to 63d; condition =, ≠, ≥, ≤, in range, out of range |
| | data setup | data pattern up to 8 byte (hex, decimal, octal, binary or ASCII); condition =, ≠ |
| Decode | source | any input channel, logical channel |
| | display type | decoded bus, tabulated list |
| | color coding | frame, frame identifier, data payload, checksum, error condition |
| | data format | hex, decimal, octal, binary, ASCII |
| | filter | filter result table on frame types and field values |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |

## R&S®MXO5-K530 aerospace protocols

| ARINC 429 decoding | | |
|---|---|---|
| Protocol configuration | bit rate | high (100 kbps)<br>low (12.0 kbps to 14.5 kbps) |
| | signal polarity | A leg, B leg |
| | min. gap | 0 to 100 bit, off |
| | max. gap | 0 to 1000 bit, off |
| Decode | source | analog channel, math waveform, reference waveform |
| | display type | decoded bus, tabulated list, decode layers |
| | color coding | for different cell types |
| | data format | hex, decimal, octal, binary, ASCII |
| | decode layer | off, ternary symbols, bits, words |
| | filter | filter result table on frame types, field values, status |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |

## R&S®MXO5-K550 MIPI low speed protocols

| SPMI decoding | | |
|---|---|---|
| Protocol configuration | bit rate | auto detected |
| | supported version | 2.0 |
| | GSID | selectable in range 0 to 15 |
| Decode | source (SCLK and SDATA) | any input channel, logical channel, math waveform, reference waveform |
| | display type | decoded bus, tabulated list, details, decode layers |
| | color coding | arbitration sequence, command sequence, sequence start condition, device address, command, byte count, register address, data payload, parity bits, bus park cycle, ack, error |
| | data format | hex, decimal, octal, binary, ASCII |
| | decode layer | off, edges, bit |
| | filter | filter result table on frame types, field values, status |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |

# R&S®MXO5-K560 automotive Ethernet protocols

| 10BASE-T1S decoding | | |
|---|---|---|
| Protocol configuration | source | any analog input channel, math waveform, reference waveform |
| | threshold | upper/lower |
| Decode | display type | decoded bus, tabulated list, details, decode layers |
| | color coding | for different cells types |
| | data format | hex, decimal, octal, binary, signed, unsigned, ASCII |
| | decode layer | reversed bits, descrambled bits, scrambled bits, ternary symbols |
| | filter | filter result table on frame types, field values, status |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |

| 100BASE-T1 decoding | | |
|---|---|---|
| Protocol configuration | source | any analog input channel, math waveform, reference waveform |
| | polarity | normal, inverted |
| | mode | main, subordinate, auto |
| Decode | display type | decoded bus, tabulated list, details, decode layers |
| | color coding | for different cells types |
| | data format | hex, decimal, octal, binary, signed, unsigned, ASCII |
| | decode layer | reversed bits, descrambled bits, scrambled bits, ternary symbols |
| | filter | filter result table on frame types, field values, status |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |

# Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **MXO 5 series, base models** | | |
| Oscilloscope, 350 MHz, 4 channels | MXO 54 | 1802.1008K04 |
| Oscilloscope, 100 MHz, 8 channels | MXO 58 | 1802.1008K08 |
| 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 54 to 500 MHz bandwidth | R&S®MXO5-B245 | 1802.0676.02 |
| Upgrade of MXO 54 to 1 GHz bandwidth | R&S®MXO5-B2410 | 1802.0682.02 |
| Upgrade of MXO 54 to 2 GHz bandwidth | R&S®MXO5-B2420 | 1802.0699.02 |
| Upgrade of MXO 58 to 200 MHz bandwidth | R&S®MXO5-B282 | 1802.0701.02 |
| Upgrade of MXO 58 to 350 MHz bandwidth | R&S®MXO5-B283 | 1802.0718.02 |
| Upgrade of MXO 58 to 500 MHz bandwidth | R&S®MXO5-B285 | 1802.0724.02 |
| Upgrade of MXO 58 to 1 GHz bandwidth | R&S®MXO5-B2810 | 1802.0730.02 |
| Upgrade of MXO 58 to 2 GHz bandwidth | R&S®MXO5-B2820 | 1802.0747.02 |
| **Choose your options** | | |
| Mixed signal option, for MXO 5 series with 16 digital channels | R&S®MXO5-B1 | 1802.0660.02 |
| Arbitrary waveform generator, 100 MHz, 2 analog channels | R&S®MXO5-B6 | 1802.0753.02 |
| Additional M.2 SSD | R&S®MXO5-B19 | 1803.0205.02 |
| Memory option 1 Gpoints | R&S®MXO5-B110 | 1803.0211.02 |
| Power analysis | R&S®MXO5-K31 | 1802.0799.02 |
| Frequency response analysis | R&S®MXO5-K36 | 1802.1943.02 |
| Low speed serial triggering and decoding ($I^2C$/SPI/QuadSPI/UART/RS-232/RS-422/RS-485) | R&S®MXO5-K510 | 1802.1243.02 |
| Automotive serial triggering and decoding (CAN/CAN FD/CAN XL/LIN) | R&S®MXO5-K520 | 1802.1920.02 |
| Aerospace protocols decoding (ARINC 429) | R&S®MXO5-K530 | 1802.1266.02 |
| MIPI low speed protocols decoding (SPMI) | R&S®MXO5-K550 | 1802.1272.02 |
| Automotive Ethernet protocols decoding (10BASE-T1S/100BASE-T1) | R&S®MXO5-K560 | 1802.1250.02 |
| Application bundle, consists of the following options: R&S®MXO5-B6, R&S®MXO5-K31, R&S®MXO5-K36, R&S®MXO5-K510, R&S®MXO5-K520 | R&S®MXO5-PK1 | 1803.0257.02 |
| **Choose your additional probes** | | |
| Single-ended passive probes | | |
| 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, 10:1, 1 MΩ, BNC interface | R&S®RT-ZS10L | 1333.0815.02 |
| 1.0 GHz, active, 1 MΩ, Rohde & Schwarz probe interface | R&S®RT-ZS10E | 1418.7007.02 |
| 1.0 GHz, active, 1 MΩ, R&S®ProbeMeter, micro button, Rohde & Schwarz probe interface | R&S®RT-ZS10 | 1410.4080.02 |
| 1.5 GHz, active, 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, active, differential, 1 MΩ, R&S®ProbeMeter, micro button, incl. 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, active, differential, 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 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 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 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 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 | | |
| Probe set for E and H near-field measurements, 30 MHz to 3 GHz | R&S®HZ-15 | 1147.2736.02 |
| Logic probe [9] | | |
| 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 | 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-ZA1P | 1326.3641.02 |
| Bipod probe positioner | R&S®RT-ZA29 | 1801.4803.02 |
| **Choose your accessories** | | |
| Rackmount kit, for MXO 5 series with 8 HU | R&S®ZZA-MXO5 | 1802.3181.02 |
| Front cover | R&S®MXO5-Z1 | 1803.0240.02 |
| Soft case (W × H × D: 550 mm × 300 mm × 340 mm) | R&S®MXO5-Z3 | 1803.0228.02 |
| Transit case (W × H × D: 613 mm × 478 mm × 337 mm) | R&S®MXO5-Z4 | 1803.0234.02 |
| VESA adapter | R&S®MXO5-Z7 | 1803.0457.02 |
| VESA mount (compatible with standard 100 mm × 100 mm pattern) | Choose industry standard mounts according to FDMI MIS-D, up to 14 kg with M4x10 screws | |

# Warranty and service

| **Warranty** | | |
|---|---|---|
| Base unit | | 1 year |
| All other items | | 1 year |
| **Service options** | | |
| | **Service plans** | **On demand** |
| Calibration | up to five years [10] | pay per calibration |
| Warranty and repair | up to five years [10] | standard price repair |
| Contact your Rohde & Schwarz sales office for further details. | | |

The terms HDMI and HDMI High-Definition Multimedia Interface, and the HDMI Logo are trademarks or registered trademarks of HDMI Licensing, LLC in the United States and other countries.

[9] The R&S®MXO5-B1 mixed signal option contains two R&S®RT-ZL04 logic probes.

[10] For extended periods, contact your Rohde & Schwarz sales office.

**Service at Rohde&Schwarz**
**You're in great hands**

- Worldwide
- Local and personalized
- Customized and flexible
- Uncompromising quality
- Long-term dependability

L'IMPULSION électronique
48 rue Antoine de LAVOISIER - B.P. 45 - Z.I de la Sphère
14202 HEROUVILLE SAINT CLAIR cedex
Tél. 02 31 47 53 88 - Fax : 02 31 47 36 80
contact@limpulsion.fr
www.limpulsion.fr
vente de composants - mesure - outillage - bureau d'études

**Rohde&Schwarz**

The Rohde&Schwarz technology group is among the trailblazers when it comes to paving the way for a safer and connected world with its leading solutions in test&measurement, technology systems and networks&cybersecurity. Founded 90 years ago, the group is a reliable partner for industry and government customers around the globe. The independent company is headquartered in Munich, Germany and has an extensive sales and service network with locations in more than 70 countries.

www.rohde-schwarz.com

**Sustainable product design**

- Environmental compatibility and eco-footprint
- Energy efficiency and low emissions
- Longevity and optimized total cost of ownership

Certified Quality Management
ISO 9001

Certified Environmental Management
ISO 14001

**Rohde&Schwarz training**

www.training.rohde-schwarz.com

**Rohde&Schwarz customer support**

www.rohde-schwarz.com/support

R&S® is a registered trademark of Rohde&Schwarz
Trade names are trademarks of the owners
PD 3683.8196.22 | Version 06.00 | June 2024 (sk)
MXO 5 Series Oscilloscope
Data without tolerance limits is not binding | Subject to change
© 2023 - 2024 Rohde&Schwarz | 81671 Munich, Germany