# MXO 3 SERIES OSCILLOSCOPE

## Specifications

dataTec
Mess- und Prüftechnik. Die Experten.

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Specifications
Version 08.00

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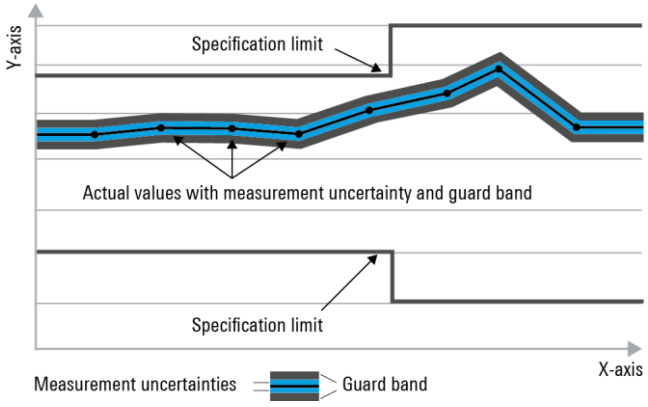
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# Definitions

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

- Three hours of storage at ambient temperature followed by 30 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) | MXO 34, 4-channel instrument | |
| | at 50 Ω input impedance | |
| | MXO 3 | ≥ 100 MHz |
| | MXO 3 with -B242 option | ≥ 200 MHz |
| | MXO 3 with -B243 option | ≥ 350 MHz |
| | MXO 3 with -B245 option | ≥ 500 MHz |
| | MXO 3 with -B2410 option | ≥ 1 GHz |
| | at 1 MΩ input impedance | |
| | MXO 3 | ≥ 100 MHz (meas.) |
| | MXO 3 with -B242 option | ≥ 200 MHz (meas.) |
| | MXO 3 with -B243 option | ≥ 350 MHz (meas.) |
| | MXO 3 with -B245 option | ≥ 500 MHz (meas.) [1] |
| | MXO 3 with -B2410 option | ≥ 500 MHz (meas.) [1] |
| | MXO 38, 8-channel instrument | |
| | at 50 Ω input impedance | |
| | MXO 3 | ≥ 100 MHz |
| | MXO 3 with -B282 option | ≥ 200 MHz |
| | MXO 3 with -B283 option | ≥ 350 MHz |
| | MXO 3 with -B285 option | ≥ 500 MHz |
| | MXO 3 with -B2810 option | ≥ 1 GHz |
| | at 1 MΩ input impedance | |
| | MXO 3 | ≥ 100 MHz (meas.) |
| | MXO 3 with -B282 option | ≥ 200 MHz (meas.) |
| | MXO 3 with -B283 option | ≥ 350 MHz (meas.) |
| | MXO 3 with -B285 option | ≥ 500 MHz (meas.) [1] |
| | MXO 3 with -B2810 option | ≥ 500 MHz (meas.) [1] |
| Additional bandwidth filters available up to instrument bandwidth | | 500/350/200/100/50/20 MHz (meas.) |
| Rise/fall time (calculated) | 10 % to 90 % at 50 Ω | |
| | MXO 34, 4-channel instrument | |
| | MXO 3 | < 3.5 ns |
| | MXO 3 with -B242 option | < 1.75 ns |
| | MXO 3 with -B243 option | < 1 ns |
| | MXO 3 with -B245 option | < 700 ps |
| | MXO 3 with -B2410 option | < 350 ps |
| | MXO 38, 8-channel instrument | |
| | MXO 3 | < 3.5 ns |
| | MXO 3 with -B282 option | < 1.75 ns |
| | MXO 3 with -B283 option | < 1 ns |
| | MXO 3 with -B285 option | < 700 ps |
| | MXO 3 with -B2810 option | < 350 ps |
| Vertical resolution | | 12 bit,<br>up to 18 bit for high definition mode |
| Input sensitivity | at 50 Ω | 1 mV/div to 1 V/div,<br>entire analog bandwidth supported for all input sensitivities |
| | at 1 MΩ | 1 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 coupling | at 50 Ω | DC |
| | at 1 MΩ | DC, AC (> 7 Hz) |

[1] With R&S®RT-ZP05M passive probe.

| | | |
|---|---|---|
| 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-ZP05M passive probe | 300 V (RMS), 450 V ($V_p$),<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 | |
| | 70 mV/div to 1 V/div | ±20 V |
| | 1 mV/div to < 70 mV/div | ±3 V |
| Offset range at 1 MΩ | input sensitivity | |
| | 1 V/div to 10 V/div | ±250 V |
| | 60 mV/div to < 1 V/div | ±30 V |
| | 1 mV/div to < 60 mV/div | ±3 V |
| 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 with same input sensitivity) | input frequency within instrument bandwidth | > 60 dB (1:1000) |

| **RMS noise floor**[2] | | | | | | |
|---|---|---|---|---|---|---|
| At 50 Ω (meas.) | Input sensitivity | Analog bandwidth (–3 dB) | | | | |
| | | 100 MHz | 200 MHz | 350 MHz | 500 MHz | 1 GHz |
| | 1 mV/div | 50 µV | 64 µV | 76 µV | 83 µV | 136 µV |
| | 2 mV/div | 53 µV | 68 µV | 81 µV | 88 µV | 143 µV |
| | 5 mV/div | 64 µV | 78 µV | 92 µV | 101 µV | 166 µV |
| | 10 mV/div | 91 µV | 107 µV | 121 µV | 133 µV | 224 µV |
| | 20 mV/div | 156 µV | 174 µV | 195 µV | 213 µV | 371 µV |
| | 50 mV/div | 380 µV | 418 µV | 468 µV | 516 µV | 901 µV |
| | 100 mV/div | 923 µV | 1.06 mV | 1.20 mV | 1.31 mV | 2.01 mV |
| | 200 mV/div | 1.60 mV | 1.76 mV | 1.96 mV | 2.12 mV | 3.46 mV |
| | 500 mV/div | 3.69 mV | 3.96 mV | 4.32 mV | 4.75 mV | 8.00 mV |
| | 1 V/div | 7.28 mV | 7.82 mV | 8.50 mV | 9.30 mV | 15.77 mV |
| At 1 MΩ (meas.) | Input sensitivity | Analog bandwidth (–3 dB) | | | | |
| | | 20 MHz | 100 MHz | 200 MHz | 350 MHz | 500 MHz |
| | 1 mV/div | 35 µV | 46 µV | 53 µV | 62 µV | 65 µV |
| | 2 mV/div | 34 µV | 48 µV | 55 µV | 66 µV | 70 µV |
| | 5 mV/div | 47 µV | 60 µV | 70 µV | 81 µV | 88 µV |
| | 10 mV/div | 74 µV | 88 µV | 102 µV | 118 µV | 129 µV |
| | 20 mV/div | 138 µV | 157 µV | 180 µV | 205 µV | 226 µV |
| | 50 mV/div | 334 µV | 372 µV | 422 µV | 477 µV | 524 µV |
| | 100 mV/div | 715 µV | 849 µV | 1.00 mV | 1.13 mV | 1.23 mV |
| | 200 mV/div | 1.37 mV | 1.56 mV | 1.79 mV | 2.02 mV | 2.21 mV |
| | 500 mV/div | 3.37 mV | 3.76 mV | 4.23 mV | 4.77 mV | 5.20 mV |
| | 1 V/div | 7.08 mV | 8.29 mV | 9.70 mV | 11.18 mV | 12.05 mV |
| | 2 V/div | 13.78 mV | 15.70 mV | 18.04 mV | 20.40 mV | 22.39 mV |
| | 5 V/div | 34.20 mV | 37.64 mV | 42.92 mV | 48.16 mV | 52.09 mV |
| | 10 V/div | 68.50 mV | 75.54 mV | 85.48 mV | 96.27 mV | 104.25 mV |

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

# Horizontal system

| | | |
|---|---|---|
| Timebase range | | selectable between 200 ps/div and 10 000 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. | 50000 s |
| | min. | –50000 s |
| Modes | | normal, roll |
| Channel-to-channel skew | between analog channels | < 100 ps (meas.) |
| | between digital channels | < 500 ps (meas.) |
| Timebase accuracy | after delivery/calibration, at +23 °C | ±2.5 ppm |
| | during calibration interval | ±3.5 ppm |
| Delta time accuracy | corresponds to time error between two edges on same acquisition and channel; signal amplitude greater than 5 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) | |
| | MXO 34 | max. 5 Gsample/s on 2 channels,<br>max. 2.5 Gsample/s on 4 channels |
| | MXO 38 | 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 [3] | standard | 125 Mpoints |
| | R&S®MXO34-B105 option | 500 Mpoints with 4 active channels (single capture),<br>500 Mpoints with 2 active channels (run continuous) |
| | R&S®MXO38-B105 option | 500 Mpoints with 8 active channels (single capture),<br>500 Mpoints with 4 active channels (run continuous) |
| Acquisition modes | sample | middle sample in decimation interval |
| | peak detect | largest and smallest sample in decimation interval |
| | average | average of acquired waveforms |
| | 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 |

[3] The maximum available memory depth depends on the bit depth of the acquired data and, therefore, on the settings of the acquisition system, such as decimation mode, waveform math or high definition mode.

## 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 3, 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 | MXO 34 | max. 5 Gsample/s on 2 channels,<br>max. 2.5 Gsample/s on 4 channels |
| | MXO 38 | max. 5 Gsample/s on 4 channels,<br>max. 2.5 Gsample/s on 8 channels |

## Trigger system

| | | |
|---|---|---|
| Trigger sources | | analog channels (C1 to C4),<br>digital channels (D0 to D15),<br>external 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 |
| 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, 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 |
| 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 ≤ 100 MHz | 300 mV ($V_{pp}$) (meas.) |
| | input frequency > 100 MHz and ≤ 500 MHz | 500 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 signal analysis in the frequency domain. | |
| Spectrum | sources | channel 1 to channel 4, math waveforms, reference waveforms |
| | 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 1.2 GHz [4] |
| | 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) | –157 dBm (1 Hz) (meas.) |
| Noise figure | at 1 GHz<br>(calculated based on the noise power density above) | 16 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 800 MHz | ±1 dB (meas.) |
| Spurious-free dynamic range (excluding harmonics) | measured for a 250 MHz input carrier and level –3 dBm at input sensitivity 50 mV/div, using spectrum analysis with center frequency 600 MHz, span 1.2 GHz, RBW 300 kHz | 65 dBc (meas.) |
| Second harmonic distortion | measured for a 250 MHz input carrier and level –3 dBm at input sensitivity 50 mV/div, using spectrum analysis with center frequency 600 MHz, span 1.2 GHz, RBW 300 kHz | –59 dBc (meas.) |
| Third harmonic distortion | measured for a 250 MHz input carrier and level –3 dBm at input sensitivity 50 mV/div, using spectrum analysis with center frequency 600 MHz, span 1.2 GHz, RBW 300 kHz | –60 dBc (meas.) |

[4] 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 |
| | track | measurement results are displayed as a continuous trace that is time-correlated to the measurement source |
| | limit check | measurements tested against user-defined limits; pass or fail conditions may trigger automatic response: beep, stop acquisition, save waveform, save results, screenshot, trigger output pulse |
| | number of active measurements | 16 |
| | result line annotation | |
| 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;<br>vertical cursors either set manually or locked to waveform |
| | source mode | single source, use  second source, multiple sources (multichannel cursor) |
| | multiple sources mode selection | acquired waveforms (input channels), math waveforms, reference waveforms |
| Waveform histogram | number of diagrams | up to 8 |
| | sources | acquired waveforms (input channels), math waveforms, reference waveforms |
| | mode | vertical, horizontal |
| | windowing | user-defined |

## Waveform math

| | | |
|---|---|---|
| General features | number of math equations | up to 8 |
| | number of reference waveforms | up to 8 |
| | sources | channel 1, channel 2, channel 3, channel 4, channel 5, channel 6, channel 7, channel 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, low pass, high pass, rescale (a * x+b) |
| | filter | low pass, high pass |
| | 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 | | 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, XY, zoom, spectrum |
| Display configuration (waveform layout) | The display area can be split into separate diagram areas by dragging and dropping signal icons. Each diagram area 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 | display 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 |
| | display of several zoomed signals: overlapping, stacked on top of each other or lined up next to each other |
| 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 [5] (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 |
| | | 400 Mpoints | 4 |
| | | 500 Mpoints | 3 |
| | 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 | 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 | |

## 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) |

[5] With R&S®MXO3-B105 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 math or high definition (HD) mode. The maximum number of segments without R&S®MXO3-B105 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 |
| 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, Rohde & Schwarz active probe interface |
| Digital channel inputs | D15 to D8, D7 to D0 | interface for R&S®RT-ZL03X 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.) |
| Demo P1 | analog signal output for demo apps | $V_p$ ≤ ±5 V (meas.) |
| Demo P2 | digital signal output demo apps | $V_p$ ≤ 3.3 V (meas.) |
| USB interface | | 2 × USB 3.1 Gen 1 ports, type A plug |

| **Rear** | | |
|---|---|---|
| Trigger input | | BNC; for details, see Trigger system |
| Trigger out | | BNC; for details, see Trigger system |
| Waveform generator output (requires R&S®MXO3-B6 option) | | BNC; for details, see R&S®MXO3-B6 option |
| USB interface | | 1 × USB 3.1 Gen 1 port, type B plug |
| LAN interface | | RJ-45 connector, supports 10/100/1000BASE-T, LXI compliant |
| External monitor interface | | HDMI, 1920 × 1080 pixel at 60 Hz, output of oscilloscope display |
| Security slot | | for standard Kensington style lock |
| VESA mount | | VESA compatibility mounting interface, 100 mm × 100 mm pattern size |

| **Right side** | | |
|---|---|---|
| Ground jack | | connected to ground |

# General data

| | | |
|---|---|---|
| **Display** | type | 11.6" LC TFT color display with capacitive touchscreen |
| | resolution | 1920 × 1080 pixel (Full HD) |

| **Temperature** | | |
|---|---|---|
| Temperature range | operating temperature range | 0 °C to +45 °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/+45 °C at 95 % 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, halfsine,<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 [6] |

| | | |
|---|---|---|
| **Certifications** | | VDE, $_{C}$CSA$_{US}$, KC |
| **EU legislation** | EU: in line with Data Act – Regulation (EU) 2023/2854 | for details, see user documentation |

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

[6] Test criterion is displayed noise level within ±1 div for 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. 2.8 A to 1.8 A,<br>in line with MIL-PRF 28800F, section 3.5 |
| Power consumption | maximum | 280 W |
| Safety | | in line with IEC 61010-1, EN 61010-1,<br>CAN/CSA-C22.2 No. 61010-1,<br>UL 61010-1 |

| **Mechanical data** | | |
|---|---|---|
| Dimensions | W × H × D | 375 mm × 233 mm × 163 mm<br>(14.76 in × 9.17 in × 6.42 in) |
| Weight | without options, nominal | 4.0 kg (8.82 lb) |
| Rackmount height | with R&S®ZZA-MXO3 rackmount kit | 5 HU |

# Options

## R&S®MXO3-B1 mixed signal option

| | | |
|---|---|---|
| Mixed signal capability is a standard functionality of the MXO 3 series oscilloscopes. The R&S®MXO3-B1 mixed signal option provides 16 digital channels with two R&S®RT-ZL03X probes. | | |
| Input channels | | 16 logic channels (from D15 to D0) |
| Arrangement of input channels | | arranged in two logic probes with 8 channels each, assignment of the logic probes to the channels D15 to D8 and D7 to D0 |
| DC input resistance | at probe tips | 100 kΩ ± 2 % (meas.) |
| Input capacitance | | 4 pF (meas.) |
| Maximum input frequency | signal with minimum input voltage swing and hysteresis setting: normal | 300 MHz (meas.) |
| Maximum input voltage | | ±40 V ($V_p$); 32 V (RMS), derates to 7 V (RMS) with 20 dB/decade at frequencies above 25 MHz |
| Minimum input voltage swing | | 500 mV ($V_{pp}$) (meas.) |
| Threshold groups | | 4 (from D15 to D12, D11 to D8, D7 to D4 and D3 to D0) |
| Threshold level | manual | ±8 V |
| | predefined | CMOS 5.0 V, CMOS 3.3 V, CMOS 2.5 V, TTL, ECL, PECL, LVPECL |
| Threshold error | threshold setting between ± 4 V | ±(100 mV + 3 % of threshold setting) |
| Hysteresis settings | | small, medium, large |
| Channel deskew | range for each channel | ±200 ns |

## R&S®MXO3-B6 arbitrary waveform generator

| | | |
|---|---|---|
| **Arbitrary function/waveform generator, 1 analog channel** | | |
| **General** | | |
| Output channel | | 1 channel |
| Vertical resolution | | 14 bit |
| Operating modes | | function generator, arbitrary waveform generator, modulation, frequency sweep |
| **Function generator** | output of predefined waveforms | |
| Sample rate | | 312.5 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 50 MHz |
| | amplitude flatness (relative to 1 kHz) | ≤ ±1.5 dB (meas.) |
| | total harmonic distortion (into 50 Ω) | |
| | f ≤ 10 MHz | ≤ –60 dBc (meas.) |
| | f > 10 MHz | ≤ –40 dBc (meas.) |
| | nonharmonic spurious | –65 dBc (meas.) |
| Square/pulse | frequency range | 1 mHz to 20 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 | 10 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 | ≥ 50 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 32 ksample |
| Sample rate | | 1 sample/s to 312.5 Msample/s |
| Filter bandwidth | | 50 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 50 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 50 MHz |
| | direction | up (start frequency < stop frequency) |
| | | down (start frequency > stop frequency) |
| | sweep time | 1 ms to 500 s |

| | | |
|---|---|---|
| **Outputs** | | |
| Connectors | | BNC; on the front of the instrument |
| Function | | on/off, inverted |
| Output impedance | | nom. 50 Ω |
| 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 [7] | 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>±0.25 V ($V_{pp}$ ≤ 100 mV) |
| | into open circuit | ±5.0 V ($V_{pp}$ > 200 mV),<br>±0.5 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®MXO3-B105 memory upgrade option

| **Extension of memory depth and memory segments** | | |
|---|---|---|
| Memory depths | MXO 34 | 500 Mpoints with 4 active channels (single capture),<br>500 Mpoints with 2 active channels (run continuous) |
| | MXO 38 | 500 Mpoints with 8 active channels (single capture),<br>500 Mpoints with 4 active channels (run continuous) |
| Memory segmentation | maximum number of segments | 1 048 575 segments |

## R&S®MXO3-K12 basic jitter analysis

| | | |
|---|---|---|
| General description | The R&S®MXO3-K12 basic jitter analysis option extends the functionality of the standard MXO 3 firmware with a suite of measurement, analysis and visualization tools for signal integrity analysis and jitter characterization. | |
| Waveform measurements | category | jitter |
| | measurements on acquired waveforms (input channels), math waveforms, reference waveforms | cycle-to-cycle jitter, N-cycle jitter, cycle-to-cycle width, cycle-to-cycle duty cycle, time-interval error, data rate, unit interval, skew delay, skew phase |
| | gate | delimits the display region evaluated for measurements |
| | reference levels | user-configurable vertical levels define support structures for measurements |
| | statistics | displays maximum, minimum, mean, standard deviation and measurement count for each measurement |
| | track | measurement results displayed as continuous trace that is time-correlated to the measurement source |

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

# R&S®MXO3-K31 power analysis

| **Power analysis** | | |
|---|---|---|
| General description | The R&S®MXO3-K31 power analysis option extends the MXO 3 firmware with measurement functionality focused on switched mode power supplies (SMPS) and DC/DC converters.<br>Up to three 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 |
| Power path | switching loss | measures switching loss and conduction loss of a power device |
| | turn on/off time | measures relationship between input AC/DC and output DC voltage, when turning SMPS off and on |
| | efficiency | measures input power and output power to calculate the efficiency of a power device |
| | safe operating area (SOA) | checks violation of voltage and current limits in which a power device can operate without damage; current versus voltage view; violation mask is user-defined; up to 4 masks; save/load of masks; export of mask violation data |
| Deskew | automated | automated compensation of the propagation delay |
| Zero offset | automated | automatic compensation of input offset |

# R&S®MXO3-K36 frequency response analysis

| **Frequency response analysis (requires R&S®MXO3-B6 option)** | | |
|---|---|---|
| Stimulus | frequency mode | single sweep, repeated sweep and single frequency |
| | frequency range | 10 mHz to 50 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 | | any analog input channel |
| 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 |
| References | number of reference waveforms | up to 4 |

# R&S®MXO3-K333 3-phase power analysis

| 3-phase power analysis | | |
|---|---|---|
| General description | The R&S®MXO3-K333 3-phase power analysis option extends the MXO 3 firmware and enables comprehensive characterization of 3-phase power systems. Automated measurements cover total power, harmonics, phase quantities, and distortion, with flexible wiring configurations to quickly visualize waveforms, harmonic spectra, numerical results, and phasor diagrams. | |
| Wiring configuration | 2V2A (3-phase-3-wire), 3V3A (3-phase-3-wire), 3VN3A (3-phase-4-wire) | |
| L-L to L-N conversion | Conversion is done for 2V2A and 3V3A wirings and used for measurements. | |
| Cycle source | selectable edge qualifier source with adjustable filter cut-off frequency | |
| Electrical analysis | power quality, harmonics, efficiency | |
| Offset compensation | automatic compensation of input offset | |
| Degauss | degauss the current probe from the menus for each channel | |
| Deskew | user can deskew voltage and current probes automatically | |
| Source support | live analog signals, math waveforms, reference waveforms | |
| Report | data export to CSV format, screenshot | |
| Power quality | measurements | real power, apparent power, reactive power, power factor and phase angle of all phase power waveforms and total power waveform |
| | | crest factor, RMS and maximum on voltage and current of the phases |
| | | RMS total voltage and current |
| | plots | phasor diagram, single phase power waveforms, total power waveform, result table |
| Harmonics | supported limit check standards | IEC 61000-3-2 A, B, C, D (2011 & 2019), MIL-STD-1399 |
| | THD measurements | THD RMS, THD fundamental |
| | plots | bar graph, single phase power waveforms, total power waveform, result table |
| Efficiency | measurements | total input power, total output power, total efficiency between input and output; statistic values of these measurements |
| | plots | total input power waveform, total output power waveform, result table |
| | additional wiring configurations | 1V1A for AC or DC |

# R&S®MXO3-K337 impedance analysis

| Impedance analysis (requires R&S®MXO3-B6 option) | | |
|---|---|---|
| Stimulus | frequency mode | single sweep, repeated sweep and single frequency |
| | frequency range | 10 mHz to 50 MHz |
| | amplitude mode | fixed or amplitude profile |
| | amplitude level | 5 mV to 5 V into 50 Ω |
| Input and output sources | | any analog input channel, math waveforms |
| Measure types | | shunt through, series through, voltage current |
| Number of test points | | 10 points to 500 points per decade |
| Measurement | | dual pair of tracking 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 during test and manual definition of start and stop, logarithmic diagram axis |
| References | number of reference waveforms | up to 4 |

# R&S®MXO3-K360 motor drive analysis

| Motor drive analysis | |
|---|---|
| General description | The R&S®MXO3-K360 motor drive analysis option extends the MXO 3 firmware and enables comprehensive characterization of motor or generator systems. Automated measurements cover mechanical power, electrical power and the total system efficiency. |
| Electrical wiring configuration | 1V1A (AC or DC), 2V2A (3-phase-3-wire), 3V3A (3-phase-3-wire), 3VN3A (3-phase-4-wire) |
| Measurements | torque, speed, angle, electrical power, mechanical power, efficiency between electrical and mechanical power, statistic values of these measurements |
| L-L to L-N conversion | Conversion is done for 2V2A and 3V3A wirings and used for measurements. |
| Cycle source | selectable edge qualifier source with adjustable filter cut-off frequency |
| Offset compensation | automatic compensation of input offset |
| Degauss | degauss the current probe from the menus for each channel |
| Deskew | user can deskew voltage and current probes automatically |
| Source support | analog signals, digital signals, math waveforms, reference waveforms |
| Report | data export to CSV format, screenshot |
| Plots | single phase power waveforms, total electrical power waveform, torque track waveform, angle track waveform, speed track waveform, total mechanic power waveform, result table |
| Mechanical encoder for torque | analog frequency, analog mV/V, analog 0 V DC |
| Mechanical sensors for speed and angle | Hall sensors, sin/cos resolvers, quadrature encoder interface (QEI) |

# R&S®MXO3-K500 bus analysis

| Protocol measurements (require corresponding R&S®MXO3-K510 to R&S®MXO3-K560 protocol options) | | |
|---|---|---|
| Frame to frame | measures the distance between the starts of two selectable frame types in seconds | • from: frame type, field type, field value<br>• to: frame type, field type field value |
| Trigger to frame | measures the distance between the trigger event and the start of a selectable frame type in seconds | frame identification; frame type, field type, field value |
| Frame to trigger | measures the distance between the start of a selectable frame type and the trigger event | frame identification; frame type, field type, field value |
| Field value | allows for the selection of frame types and displays the value of a specified field | frame identification; frame type, field type, field value tracked; field type |
| Main bit rate | measures the main bit rate of a protocol based on the relevant bits in a frame; if a protocol provides multiple bit rates, the most relevant bit rate is being measured | frame identification; frame type, field type, field value |
| Second bit rate | for protocols with multiple bit rates, the secondary bit rate is available | only available for protocols with 2 bit rates<br>frame identification; frame type, field type, field value |
| Bus idle | measures the percentage of idle time on a bus; idle time is defined as the time where the bus is not occupied by frames | no settings |
| Gap | measures the distance between the end of a frame to the start of another | no settings |
| Frame count | counts the total number of frames in each acquisition | no settings |
| Frame errors | counts the total number of erroneous frames in each acquisition | no settings |
| Frame error rate | measures the percentage of erroneous frames in relation to the total frames | no settings |
| Consecutive frame error rate | measures the percentage of follow up (consecutive) frame errors, ignoring all single frame errors | no settings |

# R&S®MXO3-K510 low speed serial buses

| **I²C triggering and decoding** | | |
|---|---|---|
| Protocol configuration | bit rate | auto detected |
| Trigger (hardware based) | 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 |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | write, read, 10 bit write, 10 bit read |
| | write | address; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>ACK-A; value 0, 1<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range;<br>ACK-D word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>ACK-D index: selects the specific data word; conditions =, in range |
| | read | address; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>ACK-A; value 0, 1<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range;<br>ACK-D word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>ACK-D index: selects the specific data word; conditions =, in range |
| | 10 bit write | address; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>ACK-A, ACK-A2; value 0, 1 for each of these options;<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range;<br>ACK-D word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>ACK-D index: selects the specific data word; conditions =, in range |

| | | |
|---|---|---|
| | 10 bit read | address; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>ACK-A; value 0, 1<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range;<br>ACK-D word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>ACK-D index: selects the specific data word; conditions =, in range |
| | error condition | no stop bit, 10 bit read address different, unknown |
| Decode | source (clock and data) | any analog or logical input channel;<br>math or reference waveform |
| | 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 |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |
| | filter | filter result table on frame types, field values, status |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

| **SPI triggering and 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 (hardware based) | 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 |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | MISO, MOSI, MISOMOSI |
| | MISO | data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range |

| | | |
|---|---|---|
| | MOSI | data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word;<br>conditions =, in range |
| | MISOMOSI | data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word;<br>conditions =, in range |
| | error condition | void, length |
| Decode | source (MOSI, MISO, CS, CLK) | any analog or logical input channel; math or reference waveform |
| | 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 |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

| QUAD-SPI triggering and decoding | | |
|---|---|---|
| Protocol configuration | source (CS, SCLK, IO0 to IO3) | any analog or logical input channel; math or reference waveform |
| | 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 |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | data |
| | data | opcode, addr, alt, dummy; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range |
| | error condition | length, opcode |
| 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 |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |

| OCTO-SPI triggering and decoding | | |
|---|---|---|
| Protocol configuration | source (CS, SCLK, IO0 to IO7, and DS) | any analog or logical input channel; math or reference waveform |
| | bit rate | auto detected |
| | polarity (SCLK, DS) | rising, falling |
| | polarity (CS, IO0 to IO7) | active high, active low |
| | instruction mode | single, dual, quad, octo |
| | command code | configurable table of command code (opcode) definitions.<br>Table can be saved and loaded from file. |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | multiple frame types as defined by user in opcode table. Each opcode (command code) becomes a unique frame type. |
| | data | opcode, cmd ext, addr, alt, dummy;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range |
| | error condition | length, opcode error |
| Decode | display type | decoded bus, tabulated list |
| | color coding | frame, word, error |
| | data format | hex, decimal, octal, binary, ASCII |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |
| Filter | The filter function selects those decode events that shall be shown n the result table. Events that do not match the criteria set will not be displayed on the table when the filter is turned on. | |
| | settings | same as trigger settings |

| **UART/RS-232/RS-422/RS-485 triggering and 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 (hardware based) | 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 |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | TX, RX |
| | TX | data; conditions =, ≠, <, ≤, >, ≥, in range, out of range |
| | RX | data; conditions =, ≠, <, ≤, >, ≥, in range, out of range |
| | error condition | start, stop, parity, break |
| Decode | source (TX and RX) | any analog or logical input channel; math or reference waveform |
| | 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 |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

| **Clocked NRZ (NRZC) triggering and decoding** | | |
|---|---|---|
| Protocol configuration | signal type | up to 3 selectable channels: data, clock and optional enable (CS); differential or single-ended |
| | min. gap time | optional (off by default); range 1 ns to 1 s; indicates min idle time for gap detection and frame separation |
| | auto threshold setup | assisted threshold configuration |
| | source | any analog or logical input channel; math or reference waveform |
| | properties | active data state (high/low), clock edge (rising/falling/both), enable state (high/low) |
| | frame separation | gap or enable (CS) signal |

| | | |
|---|---|---|
| Frame format | frame | multiple frame management,<br>frame identification and sync,<br>variable length frames,<br>variable number of cells |
| | cells | name, size (bit count), condition, numeric format, bit order, RGB color, result column |
| | file storage of frame format | save/load as xml files |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | variants | all supported bit encodings |
| | trigger event setup | frame start |
| | | pattern |
| | | advanced trigger |
| | frame start | gap, start bit |
| | advanced trigger | frame type (with OR combinations), frame fields (with AND combinations), frame field data; conditions =, ≠, <, ≤, >, ≥, in range, out of range for data count, word count, data value; error types |
| Decode | display type | decoded bus, logical signal, bus signal, tabulated list, result details, decode layers |
| | color coding | according to cell configuration table |
| | data format | according to cell configuration table |
| | decode layer | edges, binary |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |

| **Unclocked NRZ (NRZU) triggering and decoding** | | |
|---|---|---|
| Protocol configuration | signal type | up to 2 selectable channels: data and optional enable (CS); differential or single-ended |
| | min gap time | optional (off by default); range 1 ns to 1 s; indicates min idle time for gap detection and frame separation |
| | bit rate | optional (off by default); if not provided, it will be automatically calculated |
| | auto threshold setup | assisted threshold configuration |
| | source | any analog or logical input channel; math or reference waveform |
| | properties | active data state (high/low), enable state (high/low) |
| | frame separation | gap or enable (CS) signal |
| Frame format | frame | multiple frame management,<br>frame identification and sync,<br>variable length frames,<br>variable number of cells |
| | cells | name, size (bit count), condition, numeric format, bit order, RGB color, result column |
| | file storage of frame format | save/load as xml files |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | variants | all supported bit encodings |
| | trigger event setup | frame start |
| | | pattern |
| | | advanced trigger |
| | frame start | gap, start bit |
| | advanced trigger | frame type (with OR combinations), frame fields (with AND combinations), frame field data; conditions =, ≠, <, ≤, >, ≥, in range, out of range for data count, word count, data value; error types |

| | | |
|---|---|---|
| Decode | display type | decoded bus, logical signal, bus signal, tabulated list, result details, decode layers |
| | color coding | according to cell configuration table |
| | data format | according to cell configuration table |
| | decode layer | edges, binary |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |

| **Manchester triggering and decoding** | | |
|---|---|---|
| Protocol configuration | signal type | up to 2 selectable channels: data and optional enable (CS); differential or single-ended |
| | data phase | first/second edge |
| | min gap time | optional (off by default); range 1 ns to 1 s; indicates min idle time for gap detection and frame separation |
| | bit rate | optional (off by default); if not provided, it will be automatically calculated |
| | source | any analog or logical input channel; math or reference waveform |
| | properties | active data state (high/low), enable state (high/low) |
| | frame separation | gap or enable (CS) signal |
| Frame format | frame | multiple frame management,<br>frame identification and sync,<br>variable length frames,<br>variable number of cells |
| | cells | name, size (bit count), condition, numeric format, bit order, RGB color, result column |
| | file storage of frame format | save/load as xml files |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | variants | all supported bit encodings |
| | trigger event setup | frame start |
| | | pattern |
| | | advanced trigger |
| | frame start | gap, start bit |
| | advanced trigger | frame type (with OR combinations), frame fields (with AND combinations), frame field data; conditions =, ≠, <, ≤, >, ≥, in range, out of range for data count, word count, data value; error types |
| Decode | display type | decoded bus, tabulated list, result details, decode layers |
| | color coding | according to cell configuration table |
| | data format | according to cell configuration table |
| | decode layer | edges, binary |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |

# R&S®MXO3-K520 automotive protocols

| CAN FD/CAN XL triggering and 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 points | 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 (hardware based) | 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 | 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 =, ≠ |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | CBFF, CBFF-R, CEFF, CEFF-R, FBFF, FEFF, XLFF, overload, error |
| | CBFF | ID, DLC; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range |
| | CBFF-R | ID, DLC; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options; |
| | CEFF | EXT-ID, DLC; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range |
| | CEFF-R | EXT-ID, DLC; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options |
| | FBFF | ID, DLC; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>BRS, ESI; value 0, 1 for each of these options;<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range |

| | | |
|---|---|---|
| | FEFF | ID, DLC; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>BRS, ESI; value 0, 1 for each of these options;<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word;<br>conditions =, in range |
| | XLFF | priority ID, SDT, DLC, VCID, AF;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>SEC; value 0, 1;<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word;<br>conditions =, in range |
| | error condition | EOF, ack delimiter, no ack, CRC delimiter, CRC, stuff count, form, bit stuffing, unknown |
| Decode | source | any analog or logical input channel; math or reference waveform |
| | 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 |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

| **LIN triggering and decoding** | | |
|---|---|---|
| Protocol configuration | version | 1.3, 2.x or SAE J602; mixed traffic is supported |
| | bit rate | 1 kbps to 20 Mbps |
| Trigger (hardware based) | 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 =, ≠ |

| | | |
|---|---|---|
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | data, wake up, unknown |
| | data | Id; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word;<br>conditions =, in range |
| | error condition | checksum, parity, start, sync, length |
| Decode | source | any analog or logical input channel; math or reference waveform |
| | display type | decoded bus, tabulated list |
| | color coding | frame, frame identifier, data payload, checksum, error condition |
| | data format | hex, decimal, octal, binary, ASCII |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

| **SENT triggering and decoding** | | |
|---|---|---|
| Protocol configuration | signal type | data signal |
| | clock period (clock tick) | 1 µs to 100 µs |
| | clock tolerance | 0 % to 25 % |
| | data nibbles | 1 to 6 |
| | serial message type | none, short serial message and enhanced serial message |
| | CRC version | Legacy (Feb 2008) and v2010 (Latest) |
| | CRC calculation | SAE J2716 standard and TLE 4998X |
| | pause pulse | no, yes, for constant frame length |
| | frame length in clock ticks (applicable only when pause pulse = constant frame length) | 104 to 922 |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | trigger event setup | calibration or sync, transmission sequence, serial message and error condition |
| | transmission sequence status nibble setup | from 0 to F, condition =, ≠, ≥, ≤, in range, out of range |
| | transmission sequence data nibbles setup | each nibble value from 0 to F, condition =, ≠, ≥, ≤, in range, out of range |
| | serial message identifier setup | from 00 to FF, condition =, ≠, ≥, ≤, in range, out of range |
| | serial message identifier type setup (applicable only when the serial protocol = enhanced serial message in protocol configuration) | 4 bit and 8 bit |

| | | |
|---|---|---|
| | serial message data setup | 00 to FF (short serial message)<br>000 to FFF (enhanced serial message with 8 bit ID)<br>0000 to FFFF (enhanced serial message with 4 bit ID) |
| | error condition setup | form error, calibration pulse error, pulse period error, CRC error and irregular frame length error |
| Decode | source | any analog or logical input channel; math or reference waveform |
| | display type | decoded bus, tabulated list |
| | color coding | transmission sequence:<br>sync/calibration, status, data bits, CRC, pause pulse (optional), calibration pulse error, pulse period error, irregular frame length error and CRC error;<br>serial message:<br>identifier, data, CRC, form error, CRC error |
| | data format | hex, decimal, octal, binary, ASCII |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

# R&S®MXO3-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 |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | ARINC429-word |
| | ARINC429-word | label, SDI, data, SSM; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options |
| | error condition | coding, parity, unknown, gap |
| Decode | source | any analog channel, math or 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 |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |

| | | |
|---|---|---|
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

| **MIL-STD-1553 triggering and decoding** | | |
|---|---|---|
| Protocol configuration | signal type | single-ended |
| | bit rate | standard bit rate (1 Mbit/s) |
| | polarity | normal, inverted |
| | device list | associate frame identifier with symbolic ID |
| | auto threshold setup | assisted threshold configuration |
| | timing | min. gap (2 µs to 262 µs) or off;<br>max. response (2 µs to 262 µs) or off |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | command, status, cmd/status, data |
| | command | RTA, Info; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options; P value 0, 1 |
| | status | RTA, Info; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options; P value 0, 1 |
| | cmd/Status | RTA, Info; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options; P value 0, 1 |
| | data | data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range; P value 0, 1 |
| | error condition | sync, Manchester coding, parity, gap, response timeout |
| Decode | source | any analog channel, math or reference waveform |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | frame (word), sync, RTA, status bit field, parity, data field, error condition |
| | data format | hex, octal, binary, ASCII, signed, unsigned |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

| SpaceWire triggering and decoding | | |
|---|---|---|
| Protocol configuration | signal type | two channels: strobe and data (differential or single-ended) |
| | bit rate | auto adjust (strobe + data) |
| | auto threshold setup | assisted threshold configuration |
| | timing | min. gap (1 ns to 1 s) |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | data, time, FCT, null, EOP, EEP, bad esc |
| | data | conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options |
| | time | conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options |
| | bad esc | conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options; P value 0, 1 |
| | error condition | parity error, length error |
| Decode | source | any analog channel, math or reference waveform |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list, decode layers |
| | color coding | control frame, data frame, null frame, time code |
| | data format | hex, octal, binary, ASCII, signed, unsigned |
| | result export | export of all result data into CSV, XML, HTML and Py file formats |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

# R&S®MXO3-K550 MIPI low speed protocols

| SPMI triggering and decoding | | |
|---|---|---|
| Protocol configuration | bit rate | auto detected |
| | supported version | 2.0 |
| | GSID | selectable in range 0 to 15 |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | register 0 write, register write, register read, extended register write, extended register read, extended register write long, extended register read long, main write, main read |
| | register 0 write setup | sub address, data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options; ack |
| | register write/read | sub address, register address, data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options; ack (write only) |

| | | |
|---|---|---|
| | extended register write/read | sub address, byte count, register address, data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word;<br>conditions =, in range; ack (write only) |
| | extended register write long/read long | sub address, byte count, register address, register address 2, data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word;<br>conditions =, ≠, <, ≤, >, ≥, in range; ack (write only) |
| | main write/read | main address, register address, data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>frame byte; conditions =, ≠, <, ≤, >, ≥, in range; ack (write only) |
| | error condition | no response, ack, bus park, parity, length, arbitration, SSC, command, coding |
| Decode | source (SCLK and SDATA) | any analog or logical input channel; math or 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 |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

| **RFFE triggering and decoding** | | |
|---|---|---|
| Protocol configuration | signal type | two channel, single-ended |
| | bit rate | auto detected |
| | source (SCLK, SDATA) | any analog or logical input channel; math or reference waveform |
| | supported versions | 1.X, 2.0, 2.1 and 3.1 |
| | read mode | standard or read mode |
| | glitch filter | configurable glitch filter |
| | gap detection | detect gaps between sequences |

| | | |
|---|---|---|
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | trigger event setup | sequence start, sequence stop, register 0 write, register write, register read, extended register write, extended register read, extended register write long, extended register read long, error condition types |
| | sequence start setup | 4 bit sub device address;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range |
| | sequence stop setup | 4 bit sub device address;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range |
| | register 0 write setup | 4 bit sub device address, 7 bit data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options |
| | register write/read | 4 bit sub device address, 5 bit register address, 8 bit data word;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options |
| | extended register write/read | 4 bit sub device address; 8 bit address,<br>byte count: 0 to 15 (inclusive),<br>data pattern: 1 to 16 byte (hex or binary);<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>index: 1 to 16 selects the specific data frame byte; conditions =, ≠, <, ≤, >, ≥, in range |
| | extended register write long/read long | 4 bit sub device address, 8 bit address,<br>byte count: 0 to 7 (inclusive),<br>data pattern: 0 to 8 byte (hex or binary);<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>index: 1 to 8 selects the specific data frame byte; conditions =, ≠, <, ≤, >, ≥, in range |
| | interrupt summary and notification | 4 bit sub device address, bit count 0 to 32, notification and interrupt bits |
| | masked write | 4 bit sub device address; 8 bit address,<br>8 bit mask, 8 bit data pattern;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>frame byte; conditions =, ≠, <, ≤, >, ≥, in range |
| | main device ownership handover | 2 bit MID;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>frame byte; conditions =, ≠, <, ≤, >, ≥, in range |
| | main device write/read | 2 bit MID, 8 bit address,<br>16 bit data pattern;<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>frame byte; conditions =, ≠, <, ≤, >, ≥, in range |
| | main device context transfer write/read | 2 bit MID, 8 bit byte count, 8 bit address,<br>data pattern: 1 to 8 byte (hex or binary);<br>conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>index: 1 to 256 selects the specific data frame byte; conditions =, ≠, <, ≤, >, ≥, in range |
| | error condition | SSC error; length error, bus park error, parity error, no response, unknown sequence, version error,<br>min. gap between frames: 1 ns to 10 us |

| | | |
|---|---|---|
| Decode | display type | decoded bus, logical signal, bus + logical signal, tabulated list, decode layers |
| | color coding | sequence, frame, error |
| | data format | hex, octal, binary, ASCII, signed, unsigned |
| | 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 |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

| **$I^3C$ triggering and decoding** | | |
|---|---|---|
| Protocol configuration | signal type | two channel, single-ended |
| | bit rate | auto detected |
| | source (SCL, SDA) | any analog or logical input channel; math or reference waveform |
| | gap detection | detect gaps between sequences |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | $I^3C$ probe, read, write, CCC broadcast, CCC direct, HDR-DDR, HDR-ternary |
| | $I^3C$ probe | reserved; conditions =, ≠, <, ≤, >, ≥,<br>in range, out of range;<br>R/W; value 0, 1<br>ACK; value 0, 1 |
| | read | address; conditions =, ≠, <, ≤, >, ≥,<br>in range, out of range;<br>R/W; value 0, 1<br>ACK-A; value 0, 1<br>data; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>data index: selects the specific data word; conditions =, in range |
| | write | address; conditions =, ≠, <, ≤, >, ≥,<br>in range, out of range;<br>R/W; value 0, 1<br>ACK-A; value 0, 1<br>data; conditions =, ≠, <, ≤, >, ≥, in range, out of range for each of these options;<br>data index: selects the specific data word; conditions =, in range |
| | CCC broadcast | reserved; conditions =, ≠, <, ≤, >, ≥,<br>in range, out of range;<br>R/W; value 0, 1<br>ACK-A; value 0, 1<br>ccc; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>data; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>data index: selects the specific data word; conditions =, in range |

| | | |
|---|---|---|
| | CCC broadcast | reserved; conditions =, ≠, <, ≤, >, ≥,<br>in range, out of range;<br>R/W; value 0, 1<br>ACK-A; value 0, 1<br>ccc; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>data; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>data index: selects the specific data word; conditions =, in range |
| | HDR-DDR | command; conditions =, ≠, <, ≤, >, ≥,<br>in range, out of range;<br>address; conditions =, ≠, <, ≤, >, ≥,<br>in range, out of range;<br>data; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>data index: selects the specific data word; conditions =, in range<br>p; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>p index: selects the specific data word; conditions =, in range<br>crc; conditions =, ≠, <, ≤, >, ≥, in range, out of range; |
| | HDR-ternary | R/W; value 0, 1<br>command; conditions =, ≠, <, ≤, >, ≥,<br>in range, out of range;<br>address; conditions =, ≠, <, ≤, >, ≥,<br>in range, out of range;<br>data; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>data index: selects the specific data word; conditions =, in range<br>p; conditions =, ≠, <, ≤, >, ≥, in range, out of range;<br>p index: selects the specific data word; conditions =, in range |
| | error condition | ACK, parity, CRC, length, unknown |
| Decode | source (clock and data) | any input channel, logical channel |
| | display type | decoded bus, tabulated list |
| | color coding | frame, field types, status |
| | 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 |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

# R&S®MXO3-K560 automotive Ethernet protocols

| 10BASE-T1S triggering and decoding | | |
|---|---|---|
| Protocol configuration | source | any analog input channel, math or reference waveform |
| | threshold | upper/lower |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | frame type | MAC, COMMIT, BEACON or unknown |
| | MAC frame setup | destination address (condition =, ≠, <, >, ≥, ≤, in range, out of range), source address (condition =, ≠, <, >, ≥, ≤, in range, out of range), length/type (condition =, ≠, <, >, ≥, ≤, in range, out of range), data (condition =, ≠, <, >, ≥, ≤, in range, out of range), data index (condition =, in range) |
| | error condition setup | preamble, SFD, ESD, CRC |
| Decode | display type | decoded bus, tabulated list, details, decode layers |
| | color coding | for different cell 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 |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed in the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

# R&S®MXO3-K570 USB protocols

| USB 1.1/2.0 triggering and decoding | | |
|---|---|---|
| Protocol configuration | signal type | single-ended, differential |
| | protocol type | low, full, high speed |
| | bit rate | standard bit rates (1.5/12/480 Mbit/s) |
| | source | any analog input channel; math or reference waveform |
| Trigger (software based) | primary event trigger (hardware based) | edge, glitch, width, runt, windows, timeout, interval, slew rate |
| | trigger event setup | start of packet; frame types: token (IN, OUT, SOF, SETUP), data (DATA0, DATA1, DATA2 [8], MDATA [8]), handshake (ACK, NAK, STALL, NYET [8]), special (PRE/ERR, SPLIT [8], PING [8], Reserved [8]); error conditions (PID error, CRC error, length error, bit-stuffing error, incomplete) |
| | frame detail setup (field conditions) | condition =, ≠, ≥, ≤, in range, out of range |

[8] Only available in USB2.0 (high speed).

| | | |
|---|---|---|
| | data setup | byte search (hex, decimal, octal, binary or ASCII), bit separately configurable (1, 0 or don't care);<br>condition =, ≠; position-based or range-based triggering (first occurrence in packet payload) |
| | error condition | PID error, CRC error, bit-stuffing error, length error |
| Decode | source | any input channel, math waveform |
| | display type | decoded bus, logical signal, bus + logical signal, tabulated list |
| | color coding | packet identifier, payload length, frame, address, endpoint, data payload, CRC5, CRC16, error condition |
| | data format | hexadecimal, decimal, octal, binary, ASCII, unsigned |
| Filter | The filter function selects those decode events that shall be shown in the result table. Events that do not match the criteria set will not be displayed on the table when the filter is turned on. | |
| | settings | same as trigger settings |
| Format | custom frame definition | save and open xml file with format description;<br>create, delete, reorder frames |
| | frame | identify frames by type and up to 3 field values;<br>set new name and color |
| | custom payload field definition | add and delete fields that reinterpret the frame's payload (data field) |
| | payload field | name, color, first bit, bit count, repetition, bit order, numeric format with value list, linear function |

# Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Choose your base model** | | |
| Oscilloscope, 100 MHz, 4 channels | MXO 34 | 1335.2050.04 |
| Oscilloscope, 100 MHz, 8 channels | MXO 38 | 1335.2050.08 |
| Base unit (including standard accessories: 500 MHz passive probe (10:1) per channel, accessories bag, quick start guide, power cord) | | |
| **Choose your bandwidth upgrade** | | |
| Upgrade of MXO 34 to 200 MHz bandwidth | R&S®MXO3-B242 | 1335.2221.02 |
| Upgrade of MXO 34 to 350 MHz bandwidth | R&S®MXO3-B243 | 1335.2244.02 |
| Upgrade of MXO 34 to 500 MHz bandwidth | R&S®MXO3-B245 | 1335.2267.02 |
| Upgrade of MXO 34 to 1 GHz bandwidth | R&S®MXO3-B2410 | 1335.2280.02 |
| Upgrade of MXO 38 to 200 MHz bandwidth | R&S®MXO3-B282 | 1335.2815.02 |
| Upgrade of MXO 38 to 350 MHz bandwidth | R&S®MXO3-B283 | 1335.2821.02 |
| Upgrade of MXO 38 to 500 MHz bandwidth | R&S®MXO3-B285 | 1335.2838.02 |
| Upgrade of MXO 38 to 1 GHz bandwidth | R&S®MXO3-B2810 | 1335.2844.02 |
| **Choose your options** | | |
| Mixed signal option for MXO 3 series with 16 digital channels | R&S®MXO3-B1 | 1335.2073.02 |
| Arbitrary waveform generator, 50 MHz, 1 analog channel | R&S®MXO3-B6 | 1335.2850.02 |
| Memory upgrade to 500 Mpoints | R&S®MXO3-B105 | 1335.3105.02 |
| Basic jitter analysis | R&S®MXO3-K12 | 1335.3170.02 |
| Power analysis | R&S®MXO3-K31 | 1335.2880.02 |
| Frequency response analysis | R&S®MXO3-K36 | 1335.2896.02 |
| 3-phase analysis | R&S®MXO3-K333 | 1335.3334.02 |
| Impedance analysis | R&S®MXO3-K337 | 1335.3370.02 |
| Motor drive analysis | R&S®MXO3-K360 | 1335.3434.02 |
| Bus analysis | R&S®MXO3-K500 | 1335.2980.02 |
| Low speed serial buses ($I^2C$/QuadSPI/OctoSPI/SPI/UART/RS-232/RS-422/RS-485/NRZ clocked/ NRZ unclocked/Manchester) | R&S®MXO3-K510 | 1335.2867.02 |
| Automotive protocols (CAN/CAN FD/CAN XL/LIN/SENT) | R&S®MXO3-K520 | 1335.2873.02 |
| Aerospace protocols (ARINC 429/MIL-STD-1553/SpaceWire) | R&S®MXO3-K530 | 1335.2996.02 |
| MIPI low speed protocols (SPMI/RFFE/$I^3C$) | R&S®MXO3-K550 | 1335.5214.02 |
| Automotive Ethernet protocols (10BASE-T1S) | R&S®MXO3-K560 | 1335.5943.02 |
| USB protocols (USB 1.1/2.0) | R&S®MXO3-K570 | 1335.3186.02 |
| R&S®ScopeStudio Software | R&S®MXO-PC | 1801.9005.02 |
| R&S®ScopeStudio Protocol Decode Option | R&S®MXO-PC-K1 | 1804.8874.02 |
| Application bundle, consists of the following options: R&S®MXO3-B6, R&S®MXO3-B105, R&S®MXO3-K31, R&S®MXO3-K36, R&S®MXO3-K510, R&S®MXO3-K520, R&S®MXO3-K530, R&S®MXO3-K550, R&S®MXO3-K560 | R&S®MXO3-PK1 | 1335.2909.02 |
| **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-ZP05M | 1335.3505.02 |
| 700 MHz, 14.9 MΩ, 25:1, 30 V, 4 pF, MMCX | R&S®RT-ZPMMCX | 1803.1599.02 |
| 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, 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 |

| Designation | Type | Order No. |
|---|---|---|
| **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 |
| **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 | 1409.7750.02 |
| 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 | 1409.7766.02 |
| 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 | 1409.7772.02 |
| **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] | | |
| 300 MHz logic probe, 8 channels | R&S®RT-ZL03X | 1335.3005.02 |
| **Probe accessories** | | |
| Accessory set for R&S®RT-ZP10/-ZP11 passive probe (2.5 mm probe tip) | R&S®RT-ZA1 | 1409.7566.02 |
| 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-ZAP | 1326.3641.02 |
| **Choose your accessories** | | |
| Front cover | R&S®MXO3-Z1 | 1335.1902.02 |
| Soft case | R&S®MXO3-Z3 | 1335.1919.02 |
| Transit case | R&S®MXO3-Z4 | 1335.1925.02 |
| Rackmount kit, for MXO 3 oscilloscopes with 5 HU | R&S®ZZA-MXO3 | 1335.2715.02 |
| VESA mount (compatible with standard 100 mm × 100 mm pattern) | Choose industry standard mounts | |

[9] The R&S®MXO3-B1 mixed signal option contains two R&S®RT-ZL03X logic probes.

# Warranty and service

| **Warranty** | | |
|---|---|---|
| Base unit | | 3 years |
| 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. | | |

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

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