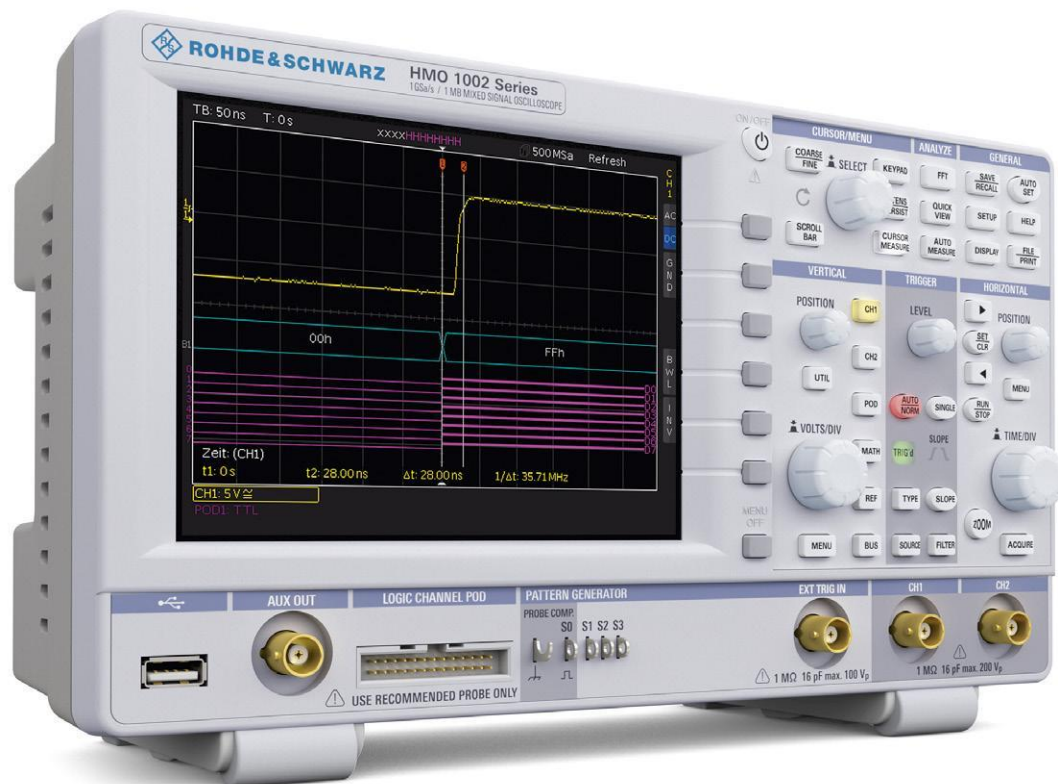


# Mixed Signal Oscilloscope

## 50/70/100 MHz

### R&S HMO1002



# 15 Technical Data

**R&S®HMO1002**  
**50/70/100MHz 2-channel mixed signal oscilloscopes**  
 Firmware: ≥ 5.0  
 All data valid at 23°C after 30 minute warm-up.

Display	
Display:	16,5 cm (6,5") VGA Color Display
Resolution:	640 (H) x 480 (V) Pixel
Backlight:	400 cd/m2 (LED)
Display range in horizontal direction	
without menu bar:	12 Div (600 Pixel)
with menu bar:	10 Div (500 Pixel)
Display range in vertical direction: 8 Div (400 Pixel)	
with Virtual Screen usage:	20 Div
Color depth:	256 colors
Levels of trace brightness:	32
Trace display:	pseudo-color, inverse brightness
Vertical System	
DSO Mode:	CH1, CH2
MSO Mode:	CH1, POD (with Logic Probe HO3508)
Analog channels	
Y-bandwidth (-3 dB)	
(1 mV, 2 mV)/Div:	50 MHz
(5 mV to 10 V)/Div:	50 MHz (basic unit) 70 MHz (with HOO572/HV572 option) 100 MHz (with HOO512/HV512 or HOO712/HV712 option)
Lower AC bandwidth:	2 Hz
Bandwidth limitation (switchable): about	20 MHz
Rise time (calculated, 10% -90%)	
50 MHz (basic unit):	<7 ns
basic unit with 70 MHz option:	<5 ns
basic unit with 100 MHz option:	<3.5 ns
DC gain accuracy (all ranges):	3% of full scale
Input sensitivity range	
all analog channels:	1 mV/Div to 10 V/Div
coarse stepping:	13 calibrated steps, 1-2-5 sequence
variable stepping:	freely between calibrated steps
Impedance:	1 MΩ    16 pF ±2 pF
Coupling:	DC, AC, GND
Max. input voltage:	200 V <sub>p</sub> (derates at 20 db/decade to 5 V above 100 kHz)
Position range:	±5 Div (from center of screen)
Channel isolation:	35 dB from DC to specified bandwidth (same V/Div range)
XY mode:	CH1, CH2
Inversion:	selectively all analog channels
Logic channels (with logic probe HO3508)	
Thresholds:	TTL, CMOS, ECL, user-defined (-2 V to +8 V)
Impedance:	100 kΩ    4 pF
Coupling:	DC
Max. input voltage:	40 V <sub>p</sub>
Trigger system	
Trigger mode	
Auto:	Triggers automatically also without any specific trigger event

Normal:	Triggers only on specific trigger events
Single:	Triggers once on a trigger event
Trigger indicator:	Screen and panel (LED)
Trigger sensitivity	
up to 5mV/Div:	1.5 Div
from 5mV/Div:	0.8 Div
Trigger level setting	
with auto level:	adjustable between peak values of a signal
without auto level:	±5 Div (from center of screen)
external	±5.0 V
Trigger coupling	
AC:	<5 mV/Div: 10 Hz to 65 MHz >5 mV/Div: 10 Hz to 65/90/130 MHz
DC:	<5 mV/Div: DC to 65 MHz >5 mV/Div: DC to 65/90/130 MHz
HF:	<5 mV/Div: 30 kHz to 65 MHz >5 mV/Div: 30 kHz to 65/90/130 MHz
selectable filters	
LF (low pass):	DC to 5 kHz (-3 db), selectable in DC and auto level mode
Noise rejection:	min. level: 1.5 Div (> 5 mV/Div) selectable with AC, DC and HF coupling
Trigger hold-off:	auto, 50 ns to 10 s
External trigger input (BNC)	
Impedance:	1 MΩ    16 pF ±2 pF
Trigger level:	0.3 V <sub>pp</sub> to 10 V <sub>pp</sub>
Max. input voltage:	100 V <sub>p</sub>
Coupling:	DC, AC
Trigger output	via AUX OUT (BNC)
Functions:	Pulse output for every acquisition trigger event, error output on mask violation
Output level:	3 V
Pulse polarity:	positive
Pulse width:	>150 ns (trigger event), >0.5 ns (mask violation)
Trigger types	
Edge	
Direction	rising, falling, both
Trigger coupling	auto level AC, DC, HF
Switchable filters	LF, noise rejection
Sources	all analog and digital channels, AC line, external (AC, DC)
Pulse width	
Polarity	positive, negative
Functions	equal, not equal, lower, higher, within/without a range
Pulse duration	16ns to 10s, resolution min. 2ns
Sources	all analog channels
Logic	
Functions:	
Boolean operators:	AND, OR, TRUE, FALSE
time based operators:	equal, not equal, lower, higher, within/without a time range, timeout
Duration:	16 ns to 10 s, resolution min. 2 ns
States:	H, L, X
Sources:	all logic channels

<b>Video</b>	
Sync. pulse polarity:	positive, negative
supported standards:	NTSC, SECAM, PAL, PAL-M, SDTV 576i, HDTV 720p, HDTV 1080i, HDTV 1080p
Field:	even/odd, either
Line:	line number selectable, all
Sources:	all analog channels, external (AC, DC)
<b>Serial Busses</b>	
Bus representation:	Up to two busses can be analyzed at the same time. Color-coded display of decoded data in ASCII, binary, decimal and hexadecimal format.
Option code	
HOO10:	Analysis of I <sup>2</sup> C, SPI, UART/RS-232 signals on analog and logic channels
HOO11:	Analysis of I <sup>2</sup> C, SPI, UART/RS-232 signals on all analog channels
HOO12:	Analysis of CAN and LIN signals on analog and logic channels
Trigger types by protocols	
I <sup>2</sup> C:	Start, Stop, ACK, NACK, Address/Data
SPI:	Start, End, Serial Pattern (32 Bit)
UART/RS-232:	Startbit, Frame Start, Symbol, Pattern
LIN:	Frame Start, Wake Up, Identifier, Data, Error
CAN:	Frame Start, Frame End, Identifier, Data, Error
<b>Horizontal System</b>	
Display	
Time domain (Yt):	main screen, time domain and zoom window
Frequency domain (FFT):	time domain and frequency domain window (FFT)
XY mode:	voltage (XY)
VirtualScreen:	virtual display of $\approx 10$ Div for all math, logic, bus, reference signals
Component tester:	voltage (X), current (Y)
Reference signals:	up to 4 references
Channel skew:	$\approx 32$ ns, step size 2 ns
Memory Zoom:	up to 50.000 : 1
Time base	
Accuracy:	50.0 x 10 <sup>-6</sup>
Aging:	10.0 x 10 <sup>-6</sup> per year
Operation Modes	
REFRESH:	2 ns/Div to 50 s/Div
ROLL:	50 ms/Div to 50 s/Div
<b>Acquisition System</b>	
realtime sampling rate	
Analog channels:	2 x 500 MSa/s or 1 x 1 GSa/s
Logic channels:	8 x 500 MSa/s
Memory depth:	2 x 500 kPts or 1 x 1 MPts
Resolution:	8 Bit, (HiRes up to 16Bit)
Waveform arithmetics:	refresh, roll (loose/triggered), average (up to 1024), envelope, peak detect (2 ns), filter (low-pass, adjustable), high resolution (up to 16 bit)
Record modes:	automatic, max. sampling rate, max. waveform rate
Interpolation	
all analog channels:	sin(x)/x, linear, sample-hold

logic channels:	pulse
Delay	
pre-trigger:	0 to 500.000 Sa x (1/sample rate), multiplied by 2 in interlaced mode
post-trigger:	0 to 8x10 <sup>6</sup> Sa x (1/sample rate)
Waveform update rate:	up to 10,000 Wfm/s
Waveform display:	dots, vectors, persistence afterglow
Persistence afterglow:	min. 50 ms
<b>Waveform measurements and Operation</b>	
Operation:	menu-driven (multilingual), auto-set, help functions (multilingual)
Automatic measurements:	voltage (V <sub>pp</sub> , V <sub>p+</sub> , V <sub>p-</sub> , V <sub>rms</sub> , V <sub>avg</sub> , V <sub>min</sub> , V <sub>max</sub> ), amplitude, phase, frequency, period, rise/fall time (80%, 90%), pulse width (pos/neg), burst width, duty cycle (pos/neg), standard deviation, delay, crest factor, overshoot (pos/neg), edge/pulse count (pos/neg), trigger period, trigger frequency
Cursor measurements:	voltage (V1, V2, ΔV), time (t1, t2, Δt, 1/Δt), ratio X, ratio Y, pulse and edge count (pos/neg), peak values (V <sub>pp</sub> , V <sub>p+</sub> , V <sub>p-</sub> ), mean/RMS/standard deviation, duty cycle (pos/neg), rise/fall time (80%, 90%), ratio marker, crest factor
Quick measurements: (QUICKVIEW)	voltage (V <sub>pp</sub> , V <sub>p+</sub> , V <sub>p-</sub> , V <sub>rms</sub> , V <sub>mean</sub> ), rise/fall time, frequency, period plus 6 additional measurement functions (see automatic measurement functions, freely selectable)
Marker:	up to 8 freely positionable markers for easy navigation
Frequency counter (hardware based)	
Resolution:	5 digit
Frequency range:	0.5 Hz to 100 MHz
Accuracy:	50.0 x 10 <sup>-6</sup>
Aging:	$\approx 10.0$ x 10 <sup>-6</sup> per year
<b>Mask Testing</b>	
Functions:	Pass/Fail comparison with an user-defined mask performed on waveforms
Sources:	all analog channels
Mask definition:	Mask enclosing acquired waveform with user-defined tolerance
Actions	
on mask violations:	beep, acquisition stop, screenshot, trigger pulse, automatically saving trace data
during acquisition:	Statistics: number of completed tests, number of passes / failed acquisitions (absolute and in percent), test duration
<b>Waveform maths</b>	
Quickmath	
Functions:	addition, subtraction, multiplication, division
Sources:	CH1, CH2
Frequency Analysis (FFT)	
Parameters:	frequency span, center frequency, vertical scale, vertical position
FFT length:	2 Kpts, 4 Kpts, 8 Kpts, 16 Kpts, 32 Kpts, 64 Kpts, 128 Kpts
Window:	Hanning, Hamming, Rectangular, Blackman

Scale:	dBm, dBV, V <sub>rms</sub>
Waveform arithmetics:	refresh, envelope, average (up to 512)
Cursor measurement:	2 horizontal cursors, previous/next peak search
Sources:	all analog channels
<b>Pattern Generator</b>	
Functions:	square wave / probe adjust, bus signal source, counter, programmable pattern
Square wave (Probe ADJ output):	frequency range: 1 MHz to 500 kHz level: 2.5 V <sub>pp</sub> (ta <4 ns) polarity: normal, invert duty cycle: 1% to 99%
Bus Signal Source (4 Bit):	I <sup>2</sup> C (100 kBit/s, 400 kBit/s, 1 MBit/s), SPI (100 kBit/s, 250 kBit/s, 1 MBit/s), UART (9600 Bit/s, 115,2 kBit/s, 1 MBit/s), CAN (up to 50 MBits/s), LIN (up to 50 MBits/s)
Counter (4 Bit):	frequency: 1 MHz to 25 MHz direction: incrementing, decrementing
Programmable pattern (4 Bit):	sampling time: 20 ns to 42 s memory depth: 2048 sa pattern idle time: 20 ns to 42 s
<b>Function Generator</b>	
Waveform modes:	DC, sine, square, triangle/ramp, pulse
Sine:	frequency range: 0.1 Hz to 50 kHz flatness: ±1 dB relative to 1 kHz
Square:	frequency range: 0.1 Hz to 50 kHz rise time: <4 ns
Triangle/ramp:	frequency range: 0,1 Hz bis 10 kHz
Pulse:	frequency range: 0.1 Hz to 10 kHz duty cycle: 10% to 90%
Sampling rate:	978 kSa/s
Frequency accuracy:	50.0 x 10 <sup>-6</sup>
Aging:	±10.0 x 10 <sup>-6</sup> per year
<b>Amplitude</b>	
high impedance load:	60 mV <sub>pp</sub> to 6 V <sub>pp</sub>
50 Ω load:	30 mV <sub>pp</sub> to 3 V <sub>pp</sub>
Accuracy:	3%
DC offset:	±3 V
<b>Digital Voltmeter</b>	
Display (3-digit):	Primary and secondary measurement value per channel, simultaneous measuring on all channels
Functions:	DC, DC <sub>rms</sub> , AC <sub>rms</sub> , V <sub>pp</sub> , V <sub>p+</sub> , V <sub>p-</sub> , crest factor
Sources:	all analog channels
<b>Component Tester</b>	
Parameters:	voltage (X), current (Y)
Testing frequency:	50 Hz, 200 Hz
Voltage:	10 V <sub>p</sub> (open)
Current:	10 mA (short)
Reference potential:	Ground (PE)
<b>Interfaces</b>	
for mass storage (FAT16/32):	1 x USB-Host (Typ A), max. 500 mA
for remote control:	Ethernet (RJ45), USB Device (Typ B)
<b>General Data</b>	
Application memory:	3 MB for references and device settings
Save/Recall	
device settings:	on internal file system or external USB memory, available file formats: SCP, HDS

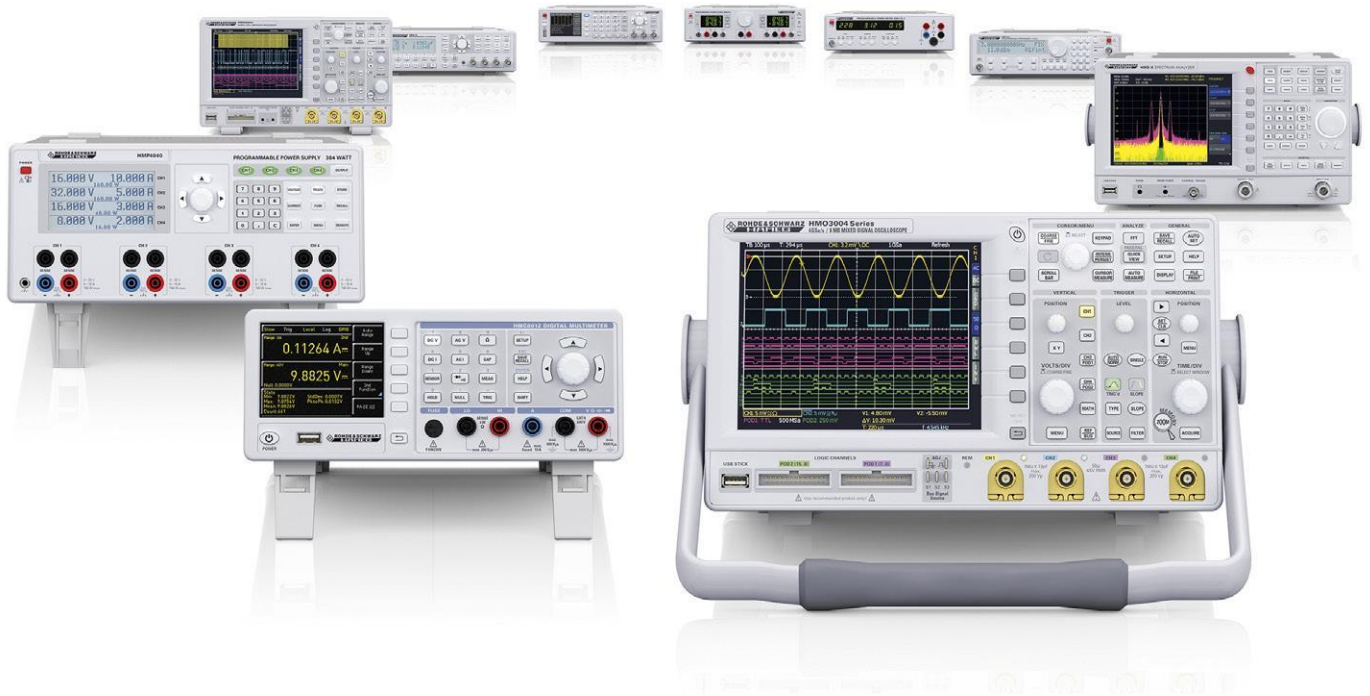
reference waveforms:	on internal file system or external USB memory, available file formats: BIN (MSB/LSB), FLT (MSB/LSB), CSV, TXT, HRT
traces:	on external USB memory, available file formats: BIN (MSB/LSB), FLT (MSB/LSB), CSV, TXT
data:	display or acquisition data
sources:	single or all analog channels
screenshots:	on external USB memory, available file formats: BMP, GIF, PNG
Realtime Clock (RTC):	date and time
<b>Power supply:</b>	
AC supply:	100 V to 240 V, 50 Hz to 60 Hz, CAT-II
Power consumption:	max. 25 W
Safety:	in line with IEC 61010-1 (ed. 3), IEC 61010-2-30 (ed. 1), EN 61010-1, EN 61010-2-030, CAN/CSA-C22.2 No. 61010-1-12, CAN/CSA-C22.2 No. 61010-2-030-12, UL Std. No. 61010-1 (3rd Edition), UL61010-2-030
Operating temperature range:	+5 °C to +40 °C
Storage temperature range:	-20 °C to +70 °C
Rel. humidity:	5% to 80% (without condensation)
<b>Mechanical Data</b>	
Dimensions (W x H x D):	285 x 175 x 140 mm
Net weight:	2.5 kg

**Accessories included:**

Line cord, printed operating manual, 2 probes : HZ154 (100 MHz, 10 : 1/1 : 1 switchable), HZ20 Adapter BNC plug / 4 mm banana socket, software-CD

**Accessories:**

- HO3508 8 channel logic probe (350 MHz, 4 pF)
- HZ115 Differential Probe 100 : 1/1000 : 1
- HZO20 High voltage probe 1000 : 1 (400 MHz, 1000 V<sub>rms</sub>)
- HZO30 1 GHz active probe (0.9 pF, 1 MΩ)
- HZO40 Active differential probe 200 MHz (10 : 1, 3.5 pF, 1 MΩ)
- HZO41 Active differential probe 800 MHz (10 : 1, 1 pF, 200 kΩ)
- HZO50 AC/DC Current Probe 30 A, DC to 100 kHz
- HZO51 AC/DC Current Probe 100/1000 A, DC to 20 kHz
- HZ51 150 MHz passive probe 10 : 1 (12 pF, 10 MΩ)
- HZ52 250 MHz passive probe 10 : 1 (10 pF, 10 MΩ)
- HZ53 100 MHz passive probe 100 : 1 (4.5 pF, 100 MΩ)
- HZO90 Carrying case for protection and transport
- HZO91 4 RU 19" rackmount kit



[www.hameg.com](http://www.hameg.com)

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