

R&S®HM01002, R&S®HM01202

Two-channel digital oscilloscopes

50 MHz to 300 MHz bandwidth



Bandwidth

50 MHz, 70 MHz, 100 MHz, 200 MHz or 300 MHz

Sampling rate

1 Gsample total, 500 Msample per channel or 2 Gsample total, 1 Gsample per channel

Memory depth

1 Msample in total, 500 ksamples per channel or 2 Msamples in total, 1 Msample per channel

FFT

The easy way to analyze the signal spectrum at a resolution of up to 128 ksamples

QuickView

Key results at the press of a button

Auto measurement

Wide variety of measurement functions

Digital voltmeter

Voltmeter measurements using the oscilloscope

Acquire

High acquisition rate to identify signal faults

Channels

High vertical sensitivity down to 1 mV/div

Serial bus analysis

Hardware-based triggering and decoding: I²C, SPI, CAN or LIN optionally available

Function generator

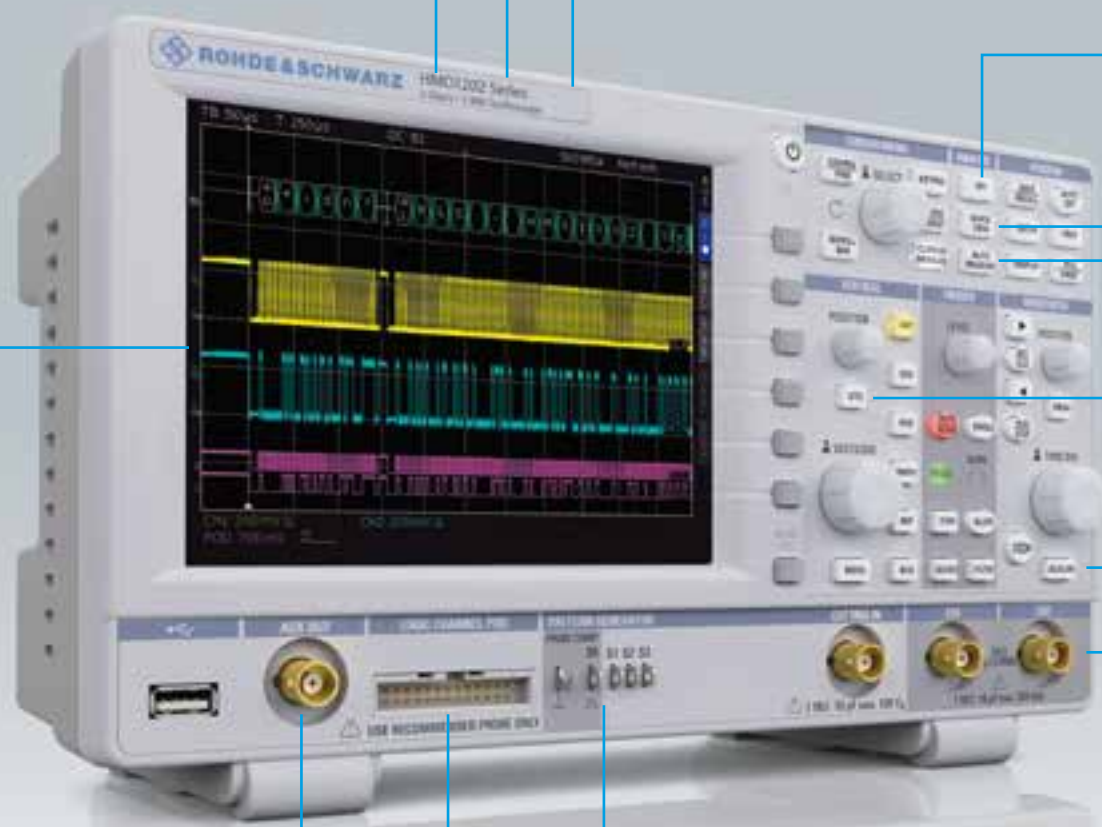
Common waveforms (sine, square, pulse, triangle, ramp) up to 50 kHz

MSO

Mixed signal functionality over eight digital inputs as standard

Pattern generator

Proprietary 4-bit patterns with up to 2 ksamples length and 50 Mbit/s



At a glance

High sensitivity, multifunctionality and a great price – that is what makes the R&S®HMO1002 and R&S®HMO1202 digital oscilloscopes so special. From embedded developers to service technicians to educators – the wide range of functions address a broad group of users. State-of-the-art, high-performance technology in a fanless design meets the high requirements of today's customers. The R&S®HMO series of digital oscilloscopes includes a wide range of upgrade options, providing true investment protection for the future.

The R&S®HMO1002 and R&S®HMO1202 digital oscilloscopes from the Rohde & Schwarz test and measurement product range feature a high waveform update rate and high vertical sensitivity, and are available with bandwidths from 50 MHz to 300 MHz. Depending on the specific model, the oscilloscope offers a maximum memory depth of 2 Msample and a sampling rate of 2 Gsample/s.

Like all R&S®HMO oscilloscopes, the R&S®HMO1002 and R&S®HMO1202 include the mixed signal functionality as standard. The separately available R&S®HO3508 logic probe can be used with all R&S®HMO oscilloscopes.

For the analysis of communications between embedded systems, hardware-based signal triggering and decoding for all common protocols (I²C, SPI, UART, CAN and LIN) is included. This option can be activated with an upgrade voucher at any time, even after sale.

The integrated pattern generator for generating protocol messages at up to 50 Mbit/s is ideal for embedded users. In addition to using predefined messages for supported serial protocols, developers can program their own signal patterns. The integrated, three-digit digital voltmeter is especially useful for service technicians. It enables the R&S®HMO1002 and R&S®HMO1202 to simultaneously perform voltage measurements on both analog channels with two values each.



A function generator for different types of signals with frequencies up to 50 kHz is useful in educational settings. Trainees and students can use these basic signals to learn a broad range of measurements. Convenience functions can be switched off in education mode.

Thanks to the powerful FFT over 128 000 test points and analysis functions in the frequency domain, the R&S®HMO1002 and R&S®HMO1202 keep pace with significantly larger oscilloscopes. The time domain signal, measurement window, FFT analysis range and measurement result are displayed on a single screen, which makes it easier to measure the spectra.

The R&S®HMO1002 and the R&S®HMO1202 offer time domain, logic, protocol and frequency analysis in a single instrument and belong to the Rohde & Schwarz scope-of-the-art family of oscilloscopes.

Key facts

Top-class hardware-based acquisition for precise measurement results

- ▮ Up to 2 Gsample sampling rate, 2 Msample memory depth
- ▮ High vertical sensitivity down to 1 mV/div
- ▮ Low-noise measurement due to state-of-the-art A/D converters
- ▮ High acquisition rate to identify signal faults

Versatile measurement functions and fast results

- ▮ Wide selection of automatic measurement functions
- ▮ QuickView: key results at the press of a button
- ▮ Mask test: easy creation of a new mask with just a few keystrokes
- ▮ FFT: the easy way to analyze the signal spectrum

Logic analysis with the MSO option

- ▮ Mixed signal functionality as standard
- ▮ Precise triggering on signal events
- ▮ Straightforward display of digital signals
- ▮ Low test point loading due to active probes

Serial bus analysis: hardware-based triggering and decoding

- ▮ Versatile trigger options for isolating specific data packets
- ▮ Color-coded display of decoded bus signals
- ▮ Direct export of analyzed data to USB flash drive
- ▮ Simultaneous decoding of two buses in realtime

The right waveform for each application

- ▮ The right signal at hand: pattern generator up to 50 Mbit/s and function generator up to 50 kHz
- ▮ Pattern generator with standard bus signals, ARB editor and counter
- ▮ Function generator with all common waveforms

Voltmeter measurements using an oscilloscope

- ▮ Three-digit display for precise voltage measurements
- ▮ Simultaneous measurement of primary and secondary voltage value per channel

Future-ready investment and scalability

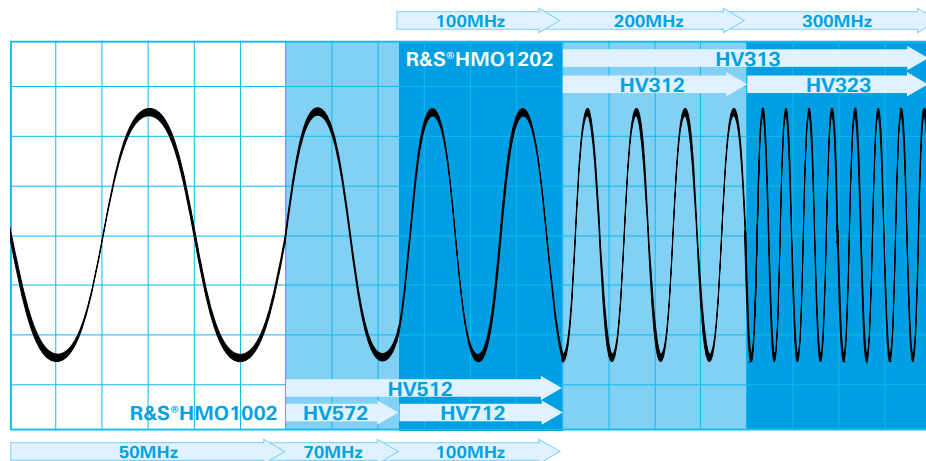
- ▮ Free firmware updates
- ▮ Bandwidth upgrades as required
- ▮ Serial bus analysis options via software licenses

Applications of the R&S®HMO1002 and R&S®HMO1202

Development lab	<ul style="list-style-type: none">▮ Digital pattern generator with standard bus signals and ARB editor▮ Automeasurement function for 28 different parameters▮ Comprehensive math functions (R&S®HMO1202)▮ Powerful zoom function▮ Fanless design (R&S®HMO1002)
Analog circuit design	<ul style="list-style-type: none">▮ Sensitivity down to 1 mV/div▮ 50 Ω or 1 MΩ input impedance (R&S®HMO1202)▮ Simultaneous voltmeter measurements on both analog channels▮ Component tester▮ FFT functionality with 128 ksample
Embedded debugging	<ul style="list-style-type: none">▮ Mixed signal functionality with eight logic channels▮ Hardware-accelerated triggering and decoding of serial buses▮ Pass/fail tests based on user-defined masks with error signal output▮ Five-digit hardware counter
Education	<ul style="list-style-type: none">▮ Function generator with all common waveforms▮ Education mode

Bandwidths from 50 MHz to 300 MHz

Depending on the requirements, the standard R&S®HMO1002 bandwidth can be upgraded from 50 MHz to 70 MHz or 100 MHz, and the standard R&S®HMO1202 bandwidth can be extended from 100 MHz to 200 MHz or 300 MHz.



Bandwidth upgrades for the R&S®HMO1002	
Description	Voucher
Bandwidth upgrade 50MHz to 70MHz	R&S®HV572
Bandwidth upgrade 50MHz to 100MHz	R&S®HV512
Bandwidth upgrade 70MHz to 100MHz	R&S®HV712

Bandwidth upgrades for the R&S®HMO1202	
Description	Voucher
Bandwidth upgrade 100MHz to 200MHz	R&S®HV312
Bandwidth upgrade 100MHz to 300MHz	R&S®HV313
Bandwidth upgrade 200MHz to 300MHz	R&S®HV323

Vouchers for bandwidth upgrades and serial bus analysis options are available from the dealer. The individual voucher number and the serial number of the instrument to be upgraded are entered at <http://vouchers.ameg.com> by the customer, who then immediately receives the respective license key.



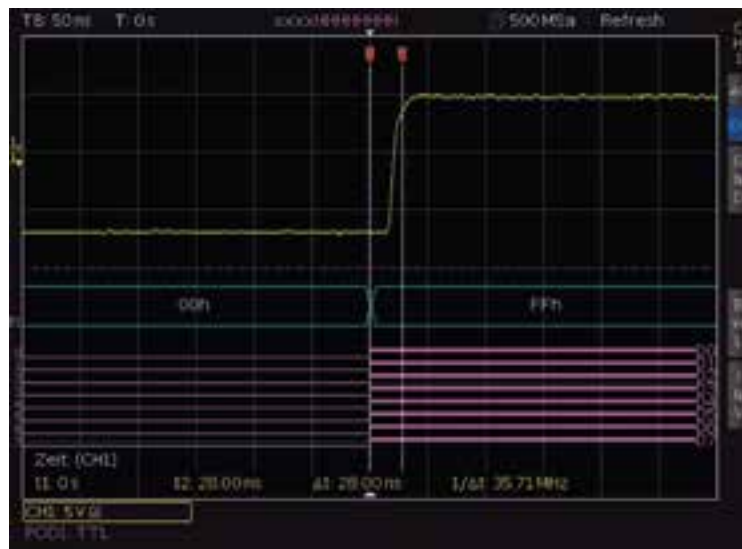
Always an MSO

Although it is unusual for this instrument class, the standard R&S®HMO1002 and R&S®HMO1202 oscilloscopes feature mixed signal functionality with no software option necessary to unlock it. Analog and digital signals can be simultaneously measured and analyzed.

New for the R&S®HMO1202: no loss of the second analog channel during measurements in MSO mode. Two analog and eight digital channels are always available.

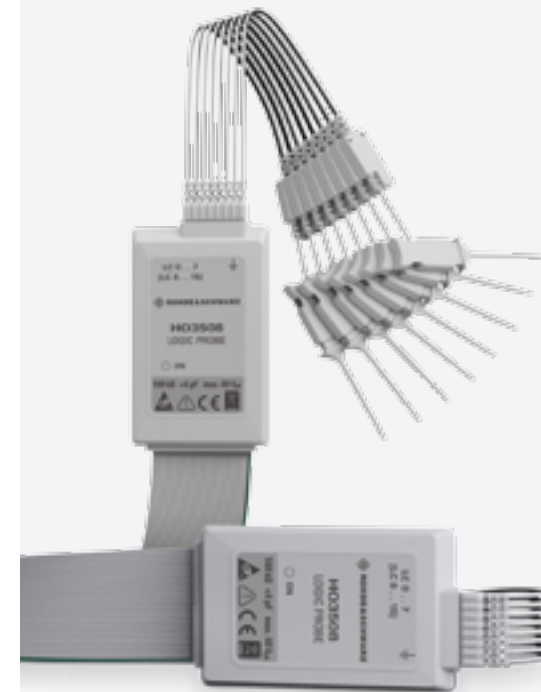
A typical real-life example is the integration of analog-to-digital converters (ADC) or digital-to-analog converters (DAC). In this case, the mixed signal technology enables users to determine latency periods using a simple cursor measurement. An MSO allows developers to fully focus on the circuit instead of on the test setup.

The R&S®HO3508 active logic probe is available separately and is not linked to a specific instrument. It can be used with all R&S®HMO oscilloscopes.



Eight-bit DAC signal change.

Optional: R&S®HO3508 logic probe



- ▀ The R&S®HO3508 logic probe fits all R&S®HMO series oscilloscopes
- ▀ No hardware lock to a specific oscilloscope
- ▀ Eight logic channels available on each logic probe
- ▀ Signal threshold adjustment for each logic probe

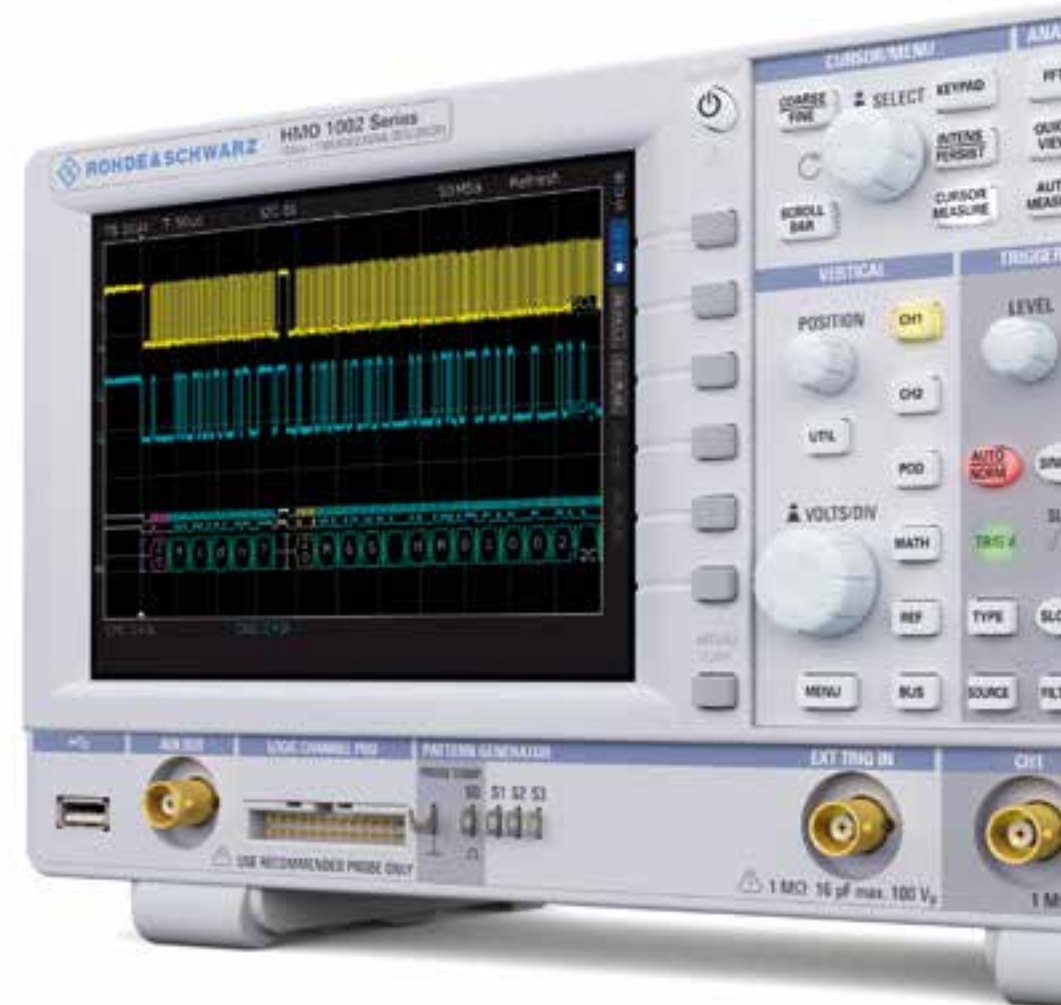
Specifications

Channels	8
Input impedance	100 kΩ <4 pF
Max. input frequency	350 MHz
Max. input voltage	40 V (DC + AC)
Signal threshold	TTL, CMOS, ECL, user-defined (-2V to +8V)
Measurement category	CAT I
Cable length	approx. 1 m

Serial bus analysis

I²C, SPI, CAN or LIN are without a doubt the most frequently used communications protocols when it comes to embedded systems interacting with the outside world. The R&S®HMO1002 and R&S®HMO1202 oscilloscopes offer hardware-based signal triggering and decoding for all of these protocols. Customers can upgrade their instruments via software license keys with the functions they need to develop their application:

Bus analysis options		
Description	Option	Voucher
I ² C, SPI, UART/RS-232 on analog and logic channels	R&S®HOO10	R&S®HV110
I ² C, SPI, UART/RS-232 on all analog channels	R&S®HOO11	R&S®HV111
CAN and LIN on analog and logic channels	R&S®HOO12	R&S®HV112



I²C bus signal in zoom view.



HEX decoded CAN bus signal.



SPI bus signal, MISO / MOSI decoded.

Serial bus trigger types:

- ▮ **I²C**: start, stop, ACK, NACK, address, data
- ▮ **SPI**: start, end, serial pattern (32 bit)
- ▮ **UART/RS-232**: start bit, frame start, symbol, pattern
- ▮ **LIN**: frame start, wake up, identifier, data, error
- ▮ **CAN**: frame start, frame end, data, identifier, error

Functions for everyday use

Pattern generator

Are you working in a distributed project, and the interface definition has been completed but the prototype hardware has yet to be implemented? The pattern generator includes a tool for user-programmable 4-bit bus signals that allows you, for example, to emulate a sensor signal in order to continue your work.



- Generate protocol messages at speeds of up to 50 Mbit/s
- Use predefined signal patterns: I²C, SPI, UART, CAN, LIN
- Create your own patterns tailored to your needs, or modify the predefined signal patterns

Function generator

Select the signal type suitable for your scope of application. The various basic types with frequencies of up to 50 kHz not only assist trainees and students with their measurements, they also support audio technicians with their assessments of filters.

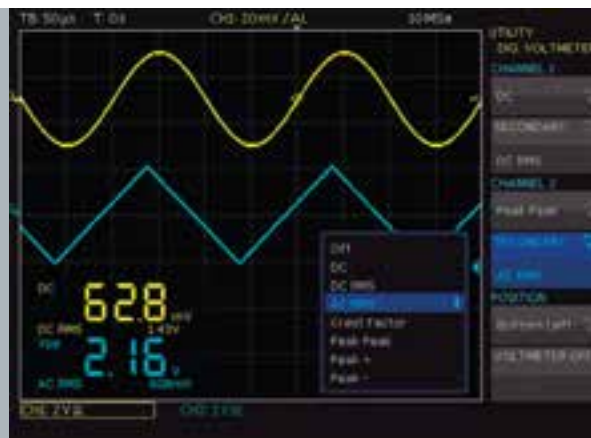


- The function generator offers all common basic waveforms up to 50 kHz
- Available waveforms: sine, square wave, pulse, triangle and ramp
- Powerful, all-in-one instrument with education mode, which allows you to turn off automatic measuring functions for educational and demonstration purposes

Digital voltmeter (DVM)

The three-digit digital voltmeter is another standard feature that is particularly useful for service technicians. Voltage measurements can be performed simultaneously for both analog channels.

Integrated into a single compact device, it helps you keep your workplace tidy.



- Simultaneous measurements on both analog channels, with two user-definable parameters each
- Available options: DC, AC + DC_{RMS}, crest factor, V_{pp} , V_{p+} , V_{p-}
- You determine the position of the values on the screen

Component tester

Our tried and tested component tester will also be at your side. A 50 Hz and a 200 Hz measuring frequency is provided to support your potentially tedious search for faulty components. And since a picture says more than a thousand words – or rather a thousand values – you will be able to tell at a glance if your error analysis is on track.



Video



R&S®HMO1002 product video

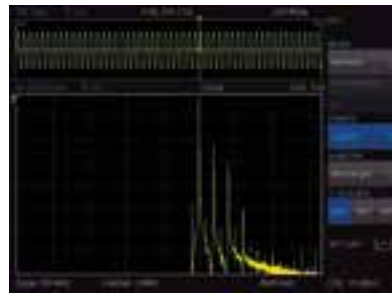
Scan, click or go directly to
<http://youtube.com/HAMEGcom>

Frequency analysis

Due to the high-performance FFT functionality of the R&S®HMO oscilloscopes, signals can also be analyzed in the frequency domain with up to 128 000 points. Other practical tools include cursor measurements and detection of signal peaks. Development engineers can complete their analysis significantly faster, even in the frequency domain.



Sinusoidal signal in the time domain.



The frequency spectrum reveals the signal distortion.

Easy analysis in the frequency domain

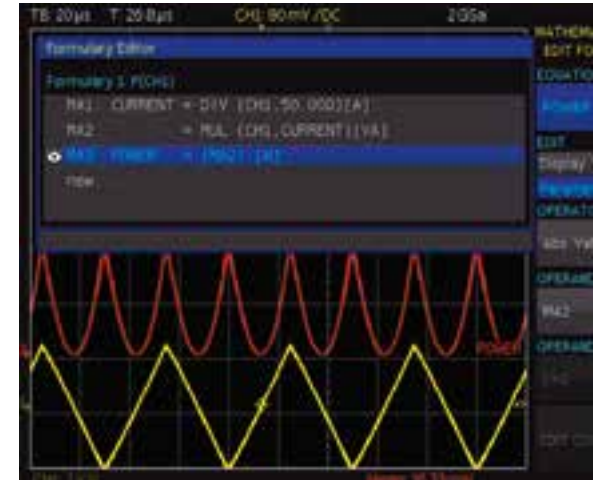
Quite often, the distortion of input signals cannot be detected with the naked eye in the time domain. For example, a sine-wave signal might appear undistorted at first glance. Only the frequency spectrum shown in the frequency domain clearly displays additional harmonics that occur at multiples of the fundamental frequency.

Since the FFT function can also be applied to stored waveforms, selected segments of signals acquired in single or stop mode can be analyzed later using a window with user-selectable width.



Comparison of R&S®HMO1002/1202 oscilloscopes

	R&S®HMO1002	R&S®HMO1202
Bandwidth	50 MHz, 70 MHz, 100 MHz (upgrade via software license)	100 MHz, 200 MHz, 300 MHz (upgrade via software license)
Analog channels	2x 1 M Ω	2x 1 M Ω or 2x 50 Ω
Sampling rate	2x 500 Msample/s or 1x 1 Gsample/s	2x 1 Gsample/s or 1x 2 Gsample/s
Memory depth	2x 500 ksample or 1x 1 Msample	2x 1 Msample or 1x 2 Msample
MSO modes with R&S®HO3508 probe	CH1 + POD or CH1 + CH2	CH1 + CH2 + POD
Digital channels (sampling rate / memory depth)	8x 500 Msample/s at 8x 500 ksample	8x 1 Gsample/s at 8x 1 Msample
External trigger input	external trigger only	external trigger, auxiliary logic channel
Mathematics	QuickMath	complex math functions with formula editor
Cooling	fanless	low-noise, temperature-regulated fan control circuit



Formula editor view for complex math functions (R&S®HMO1202).

Options and Upgrades

Bus analysis options for R&S®HMO oscilloscopes		
Description	Option	Voucher
I ² C, SPI, UART/RS-232 on analog and logic channels	R&S®HOO10	R&S®HV110
I ² C, SPI, UART/RS-232 on all analog channels	R&S®HOO11	R&S®HV111
CAN and LIN on analog and logic channels	R&S®HOO12	R&S®HV112

Service options		
Description	Option	Voucher
Extended Warranty, one year	R&S®WE1	Please contact your local Rohde & Schwarz sales office.
Extended Warranty, two years	R&S®WE2	
Extended Warranty with Calibration Coverage, one year	R&S®CW1	
Extended Warranty with Calibration Coverage, two years	R&S®CW2	

Bandwidth upgrades for the R&S®HMO1002	
Description	Voucher
Bandwidth upgrade 50 MHz to 70 MHz	R&S®HV572
Bandwidth upgrade 50 MHz to 100 MHz	R&S®HV512
Bandwidth upgrade 70 MHz to 100 MHz	R&S®HV712

Bandwidth upgrades for the R&S®HMO1202	
Description	Voucher
Bandwidth upgrade 100 MHz to 200 MHz	R&S®HV312
Bandwidth upgrade 100 MHz to 300 MHz	R&S®HV313
Bandwidth upgrade 200 MHz to 300 MHz	R&S®HV323

R&S®HMO1002 Series R&S®HMO1202 Series

2-channel digital oscilloscopes with 50/70/100/200/300MHz bandwidth

from firmware version 5.457

Display	
Screen size / type	16,5 cm (6,5") VGA color display
Resolution	640 (H) x 480 (V) pixels
Backlight	400 cd/m ² (LED)
Display range in horizontal direction	
without menu bar	12 Div (600 pixels)
with menu bar	10 Div (500 pixels)
Display range in vertical direction	
with VirtualScreen usage	8 Div (400 pixels)
with VirtualScreen usage	20 Div
Color depth	256 colors
Trace display	pseudo-color, inverse brightness
Levels of trace brightness	32
Vertical System	
DSO mode	CH1, CH2
MSO mode (POD with logic probe R&S®HO3508)	
R&S®HMO1002 series	CH1, POD, Ext.In oder CH1, CH2, Ext.In
R&S®HMO1202 series	CH1, CH2, POD, Ext.In
Analog Channels	
Y-bandwidth (-3 dB)	
(1 mV, 2 mV)/Div	
R&S®HMO1002 series	50 MHz
R&S®HMO1202 series	100 MHz
(5 mV bis 10 V)/Div	
R&S®HMO1002	50 MHz
R&S®HMO1072	70 MHz
R&S®HMO1102	100 MHz
R&S®HMO1212	100 MHz
R&S®HMO1222	200 MHz
R&S®HMO1232	300 MHz
Lower AC bandwidth	2 Hz
Bandwidth limitation (switchable)	about 20 MHz
Rise time (calculated, 10% to 90%)	
R&S®HMO1002 (50 MHz)	<7 ns
R&S®HMO1072 (70 MHz)	<5 ns
R&S®HMO1102 (100 MHz)	<3.5 ns
R&S®HMO1212 (100 MHz)	<3.5 ns
R&S®HMO1222 (200 MHz)	<1.75 ns
R&S®HMO1232 (300 MHz)	<1.15 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	
R&S®HMO1002 series	1 MΩ 16 pF ±2 pF
R&S®HMO1202 series	1 MΩ 16 pF ±2 pF, 50 Ω (switchable)
Coupling	DC, AC, GND
Max. input voltage	
1 MΩ	200 V _p (derates at 20 db/decade to 5 V above 100 kHz)
50 Ω (R&S®HMO1202 series)	5 V _{eff} , max. 30 V _s
Position range	
R&S®HMO1002 series	±5 Div (from center of screen)
R&S®HMO1202 series	±15 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 R&S®HO3508	
Thresholds	TTL, CMOS, ECL, user-defined (-2V to +8V)
Impedance	100 kΩ 4 pF
Coupling	DC
Max. input voltage	40 V _p
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 5 mV/Div	1.5 Div
from 5 mV/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 V to +5 V
Trigger Coupling	
AC	
R&S®HMO1002 series	<5 mV/Div: 10 Hz to 65 MHz
R&S®HMO1202 series	>5 mV/Div: 10 Hz to 65/90/130 MHz

R&S®HMO1202 series	<5 mV/Div: 10 Hz to 130 MHz >5 mV/Div: 10 Hz to 130/220/300 MHz
DC	
R&S®HMO1002 series	<5 mV/Div: DC to 65 MHz >5 mV/Div: DC to 65/90/130 MHz
R&S®HMO1202 series	<5 mV/Div: DC to 130 MHz >5 mV/Div: DC to 130/220/300 MHz
HF	
R&S®HMO1002 series	<5 mV/Div: 30 kHz to 65 MHz >5 mV/Div: 30 kHz to 65/90/130 MHz
R&S®HMO1202 series	<5 mV/Div: 30 kHz to 130 MHz >5 mV/Div: 30 kHz to 130/220/300 MHz
selectable filters	
LF	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 Input (BNC)	
Function	ext. trigger input, additional digital channel
Impedance	1 MΩ 16 pF ±2 pF
Accuracy	300 mV _{ss}
Trigger level range	-5 V bis +5 V
Max. input voltage	100 V _s (derates at 20 db/decade to 5 V above 100 kHz)
Trigger coupling	
AC	
R&S®HMO1002 series	10 Hz to 50/70/100 MHz
R&S®HMO1202 series	10 Hz to 100/200/300 MHz
DC	
R&S®HMO1002 series	DC to 50/70/100 MHz
R&S®HMO1202 series	DC to 100/200/300 MHz
Trigger Output via AUX OUT (BNC)	
Functions	Pulse output for every acquisition trigger event, error output on mask violation
Output level	approx. 3 V
Pulse polarity	positive
Pulse width	>150 ns (trigger event), >0.5 μs (mask violation)
Trigger Types	
Edge	
Direction	rising, falling, both
Trigger coupling	auto level AC, DC, HF
Switchable filters	LF, noise rejection
Sources	
R&S®HMO1002, R&S®HMO1202	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	16ns to 10s, resolution min. 2ns
States	H, L, X
Sources	all logic channels
Video	
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)
Serial Busses (optional)	
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 / Voucher codes	
R&S®HOO10, R&S®HV110	Analysis of I ² C, SPI, UART/RS-232 signals on analog and logic channels
R&S®HOO11, R&S®HV111	Analysis of I ² C, SPI, UART/RS-232 signals on all analog channels
R&S®HOO12, R&S®HV112	Analysis of CAN and LIN signals on analog and logic channels
Trigger types by protocols	
I ² 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
Horizontal System	
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 ±10 Div for all math, logic, bus, reference signals

Component tester	voltage (X), current (Y)
Reference signals	up to 4 references
Channel deskew	±32ns, step size 2ns
Memory zoom	up to 50.000:1
Time base	
accuracy	±50.0 x 10 ⁻⁶
aging	±10.0 x 10 ⁻⁶ per year
Operation modes	
REFRESH	
R&S®HMO1002 series	2ns/Div to 50s/Div
R&S®HMO1202 series	1ns/Div to 50s/Div
ROLL	50ms/Div to 50s/Div
Acquisition System	
Realtime Sampling Rate	
Analog channels	
R&S®HMO1002 series	2x 500MSa/s or 1x 1GSa/s
R&S®HMO1202 series	2x 1GSa/s or 1x 2GSa/s
Logic channels	
R&S®HMO1002 series	8x 500MSa/s
R&S®HMO1202 series	8x 1GSa/s
Memory depth	
Analog channels	
R&S®HMO1002 series	2x 500kSa or 1x 1MSa
R&S®HMO1202 series	2x 1MSa or 1x 2MSa
Logic channels	
R&S®HMO1002 series	500kSa per channel
R&S®HMO1202 series	1MSa per channel
Resolution	8 Bit, (HiRes up to 16Bit)
Waveform arithmetics	refresh, roll (loose/triggered), average (up to 1024), envelope, peak detect (2ns), 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	
R&S®HMO1002 series	0 to 500.000 Sa x (1/sample rate)
R&S®HMO1202 series	0 to 1.000.000 Sa x (1/sample rate) (multiplied by 2 in interlaced mode)
post-trigger	0 to 8x10 ⁶ Sa x (1/sample rate)
Waveform update rate	up to 10,000Wfm/s
Waveform display	dots, vectors, persistence afterglow
Persistence afterglow	min. 50ms

Waveform Measurements and Operation	
Operation	menu-driven (multilingual), auto-set, help functions (multilingual)
Automatic measurements	voltage (V_{pp} , V_{p+} , V_{p-} , V_{rms} , V_{avg} , V_{min} , V_{max}), 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_{pp} , V_{p+} , V_{p-}), V_{mean} , V_{rms} , standard deviation, duty cycle (pos/neg), rise/fall time (80%, 90%), ratio marker, crest factor
Quick measurements (QUICKVIEW)	voltage (V_{pp} , V_{p+} , V_{p-} , V_{rms} , V_{mean}), 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	
R&S®HMO1002	0.5 Hz bis 50/70/100MHz
R&S®HMO1202	0.5 Hz bis 100/200/300MHz
Accuracy	±50.0 x 10 ⁻⁶
Aging	±10.0 x 10 ⁻⁶ per year
Mask Testing	
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
Waveform Maths	
Quickmath	
Functions	addition, subtraction, multiplication, division
Sources	CH1, CH2
Mathematics (R&S®HMO1202 series)	
Functions	addition, subtraction, multiplication, division, minimum / maximum, square, square root, absolute value, pos/neg wave, reciprocal, inverse, log10/ln, derivation, integration, filter (lowpass/highpass)

Editing	formula editor, menu-driven
Sources	all analog channels, user-defined constants
Storage location	math. memory
Number of formula sets	5 formula sets
Number of equations	5 equations per formula set
Simultaneous display of math. functions	1 formula set with max. 4 equations
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_{rms}
Waveform arithmetics	refresh, envelope, average (up to 512)
Cursor measurement	2 horizontal cursors, previous / next peak search
Sources	all analog channels
Probe Adjust Output	
Operation	manual, adjust-wizzard
Frequency	1 kHz, 1 MHz
Level	
R&S®HMO1002 series R&S®HMO1202 series	approx. $2.5V_{pp}$ ($t_a < 4$ ns) approx. $2.5V_{pp}$ ($t_a < 1$ ns)
Pattern Generator	
Functions	square wave / probe adjust, bus signal source, counter, programmable pattern
Square wave (Probe ADJ output)	frequency range: < 1 MHz to 500 kHz level: $2.5V_{pp}$ ($t_a < 4$ ns) polarity: normal, invert duty cycle: 1% to 99%
Bus Signal Source (4 Bit)	I ² 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

Function Generator	
Waveform modes	DC, sine, square, triangle/ramp, pulse
Sine	frequency range: 0.1 Hz to 50 kHz flatness: ± 1 dB relative to 1 kHz DC offset: max. ± 3 V
Square	frequency range: 0.1 Hz to 25 kHz rise time: < 4 μ s DC offset: max. ± 3 V
Triangle / Ramp	frequency range: 0,1 Hz bis 10 kHz DC offset: max. ± 3 V
Pulse	frequency range: 0.1 Hz to 10 kHz duty cycle: 10% to 90% DC offset: max. ± 3 V
Sampling rate	978 kSa/s
Frequency accuracy	$\pm 50.0 \times 10^{-6}$
Aging	$\pm 10.0 \times 10^{-6}$ per year
Amplitude	
DC	± 3 V
DC offset error (meas.)	± 25 mV (max.)
high impedance load	60 mV _{pp} to 6 V _{pp}
50 Ω load	30 mV _{pp} to 3 V _{pp}
accuracy	3%
Digital Voltmeter	
Display (3-digit)	Primary and secondary measurement value per channel, simultaneous measuring on all channels
Functions	DC, DC _{rms} , AC _{rms} , V_{pp} , V_{p+} , V_{p-} , crest factor
Sources	all analog channels
Component Tester	
Parameters	voltage (X), current (Y)
Testing frequency	50 Hz, 200 Hz
Voltage	10 V _p (open)
Current	10 mA (short)
Reference potential	Ground (PE)
Interfaces	
for mass storage (FAT16/32)	1x USB host (type A), max. 500 mA
for remote control	Ethernet (RJ45), USB device (type B)
General Data	
Application memory	3MB 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 (color, inverted, grey-scale)
Realtime clock (RTC)	date and time
Power supply	
AC supply	100 V to 240 V, 50 Hz to 60 Hz, CAT-II
power consumption	
R&S®HMO1002	max. 25 W
R&S®HMO1202	max. 30 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
Temperature	
operating temp. range	+5 °C to +40 °C
storage temperature range	-20 °C to +70 °C
Rel. humidity	5% to 80% (without condensation)
Mechanical data	
dimensions (W x H x D)	285 x 175 x 140 mm
net weight	1.7 kg
EMC	
RF emission	in line with CISPR 11/EN 55011 class B
Immunity	in line with IEC/EN 61326-1 table 2, immunity test requirements for industrial environments. Test criterion is displayed noise level within ± 1 div for 5 mV/div input sensitivity

All specifications at 23°C after 30 minutes warm-up

Measured value (meas.): characterizes an expected product performance by means of measurement results gained from individual samples.

Accessories included: Line cord, printed operating manual, 2x RT-ZP03 probes, HZ20 adapter: BNC plug to 4 mm banana sockets, software-CD

Recommended Accessories

HZO50

AC/DC Current Probe 30 A,
DC to 100kHz



HZO51

AC/DC Current Probe
100/1000A, DC to 20kHz



HZO20

High voltage probe 1000:1
(400MHz, 1000V_{rms})



HZO30

1 GHz active probe
(0.9 pF, 1 MΩ)



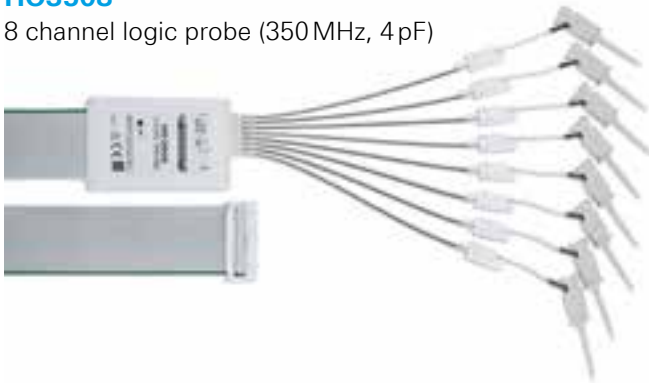
HZ115

Differential Probe
100:1/1000:1



HO3508

8 channel logic probe (350 MHz, 4 pF)



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)



R&S®RT-ZP03

Passive probe 1:1 (10MHz), 10:1 (300MHz)



R&S®RT-ZH10

Passive probe, 400 MHz, high-voltage, 100:1,
50 MΩ, 7.5 pF, 1 kV (RMS)



HZO90

Carrying case for
protection and transport



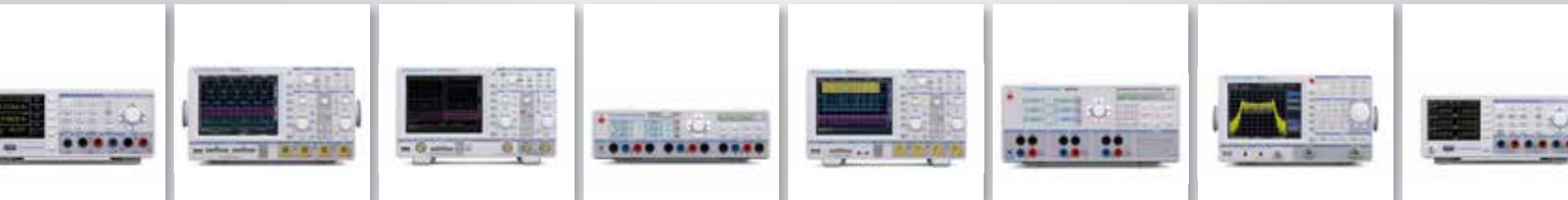
HZO91

4RU 19" rackmount kit





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