R&S®ESSENTIALS

R&S®RTC1000 OSCILLOSCOPE

Great value

- 50 MHz to 300 MHz
- Two channels

Product Brochure
Version 07.00

3 year warranty

ROHDE&SCHWARZ
Make ideas real

AT A GLANCE

High sensitivity, multifunctionality and a great price – that is what makes the R&S®RTC1000 oscilloscope 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 an extremely silent design meets the high requirements of today's customers. These oscilloscopes include a wide range of upgrade options, providing true investment protection for the future.

The R&S®RTC1000 is an X-in-one instrument that offers the functionality of an oscilloscope, logic analyzer, protocol analyzer, frequency analyzer, pattern generator, function generator, digital voltmeter and component tester in a single instrument.

BENEFITS AND KEY FEATURES

Top-class hardware-based acquisition for precise measurement results

- Up to 2 Gsample sampling rate
- 2 Msample memory depth
- Low-noise measurement due to state-of-the-art A/D converters

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

X-in-1 oscilloscope

- Oscilloscope
- Logic analyzer
- Protocol analyzer
- Waveform and pattern generator
- Digital voltmeter
- Component tester
- Frequency analysis mode
- Mask test mode

► page 6

Future-ready investment and scalability

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

Choose your Rohde & Schwarz oscilloscope				
	R&S®RTC1000	R&S®RTB2000	R&S®RTM3000	R&S®RTA4000
Number of oscilloscope channels	2	2/4 70, 100, 200, 300	2/4	4
Bandwidth in MHz	50, 70, 100, 200, 300	1.25/channel, 2.5 interleaved	100, 200, 350, 500, 1000	200, 350, 500, 1000
Maximum sampling rate in Gsample/s	1/channel, 2 interleaved	10/channel, 20 interleaved; 160 Msample (optional), segmented memory	2.5/channel, 5 interleaved	2.5/channel, 5 interleaved
Maximum memory depth in Msample	1/channel, 2 interleaved	2.5	40/channel, 80 interleaved; 400 Msample (optional), segmented memory	100/channel, 200 interleaved; 1 Gsample (standard), segmented memory
Timebase accuracy in ppm	50	10	2.5	0.5
Vertical bits (ADC)	8	1 mV/div	10	10
Minimum input sensitivity	1 mV/div	10" capacitive touch, 1280 × 800 pixel	500 µV/div	500 µV/div
Display	6.5", 640 × 480 pixel	300 000 waveforms/s in fast segmentated memory mode	10" capacitive touch, 1280 × 800 pixel	10" capacitive touch, 1280 × 800 pixel
Update rate	10 000 waveforms/s	16 channels, 2.5 Gsample/s	2 000 000 waveforms/s in fast segmentated memory mode	2 000 000 waveforms/s in fast segmentated memory mode
MSO	8 channels, 1 Gsample/s	I2C, SPI, UART/RS-232/ RS-422/RS-485, CAN, LIN	16 channels, 5 Gsample/s	16 channels, 5 Gsample/s
Protocol (optional)	I2C, SPI, UART/RS-232/ RS-422/RS-485, CAN, LIN	1 ARB, 4-bit pattern generator	I2C, SPI, UART/RS-232/RS-422/ RS-485, CAN, LIN, audio (I²S/ LJ/RJ/TDM), ARINC, MIL	I2C, SPI, UART/RS-232/ RS-422/RS-485, CAN, LIN, audio (I²S), ARINC, MIL
Generator(s)	1 generator, 4-bit pattern generator	+, –, *, /, FFT (128k points), 21 advanced functions	1 ARB, 4-bit pattern generator	1 ARB, 4-bit pattern generator
Math	+, –, *, /, FFT (128k points)	–	+, –, *, /, FFT (128k points), 21 advanced functions	+, –, *, /, FFT (128k points), 21 advanced functions
Rohde & Schwarz probe interface	–	FFT	standard	standard
RF capability	FFT		spectrum analysis 1)	spectrum analysis 1)

[1] The R&S®RTM-K18 option is not distributed in North America.

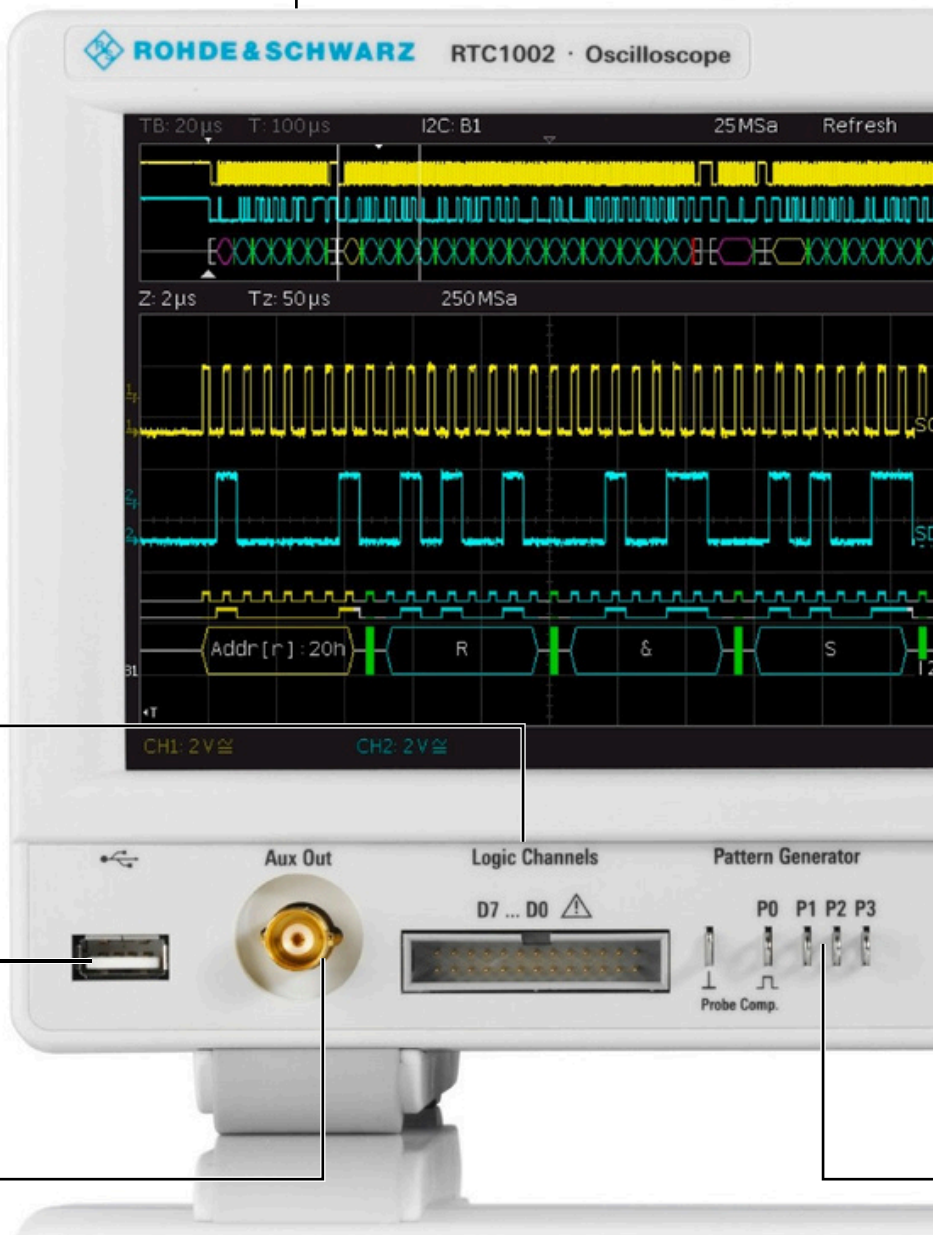
EXCELLENT FEATURES

Two displays instead of one
- 20 vertical divisions with virtual screen for straight-forward display of up to 13 signals
- Minimizable soft menus to enlarge horizontal waveform viewing area

Integrated logic analyzer (MSO)
- 8 additional digital channels
- Synchronous, time-correlated analysis of analog and digital components in embedded designs
- Fully retrofittable

Standard LAN and USB interface
- Seamless integration via MTP
- Remote display over LAN

Standard component tester



7 second boot time

FFT frequency analysis
- Standard, 128k points

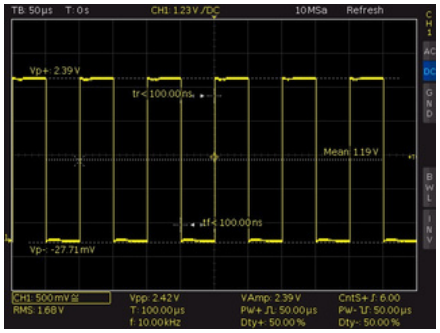
QuickView: results at the push of a button
- Graphical display of key measurement results for the active signal

Autoset function
- Automatic selection of vertical, horizontal and trigger settings for optimal viewing of active signals

Documentation of results at the push of a button

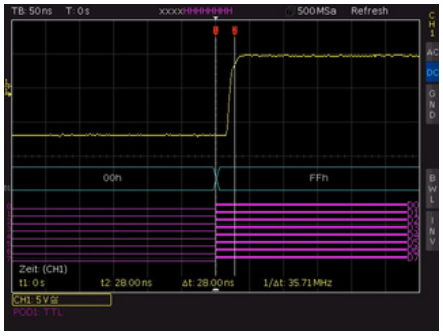
Integrated waveform and pattern generatorupto50 Mbit/s
- Output of sine, square/pulse, ramp and noise waveforms
- Output of 4-bit signal patterns

X-IN-1 OSCILLOSCOPE



Oscilloscope

With a sampling rate of up to 2 Gsample/s and a memory depth of up to 2 Msample, the R&S®RTC1000 oscilloscope excels in its class. A waveform update rate of more than 10 000 waveforms/s ensures a responsive instrument that reliably catches signal faults. Included tools provide quick results, e.g. QuickView, mask tests, FFT, math, cursors and automatic measurements (including statistics).

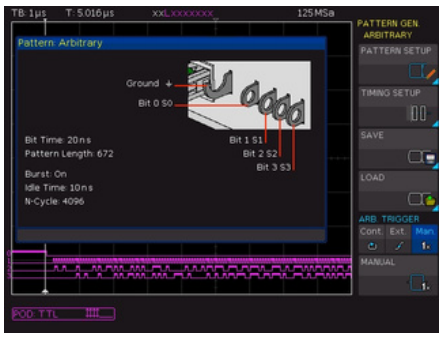


Logic analyzer

The R&S®RTC-B1 option turns every R&S®RTC1000 into an intuitive-to-use MSO with eight additional digital channels. The oscilloscope captures and analyzes signals from analog and digital components in an embedded design – synchronously and time-correlated to each other. For example, the delay between the input and output of an A/D converter can be conveniently determined using the cursor measurements.

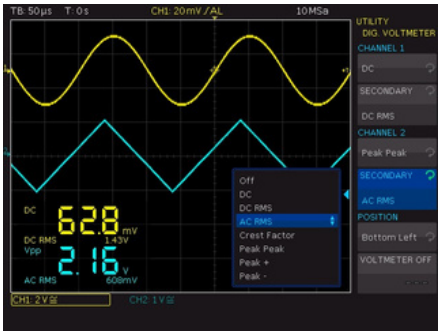
Protocol analyzer

Protocols such as I2C, SPI and CAN/LIN frequently transfer control messages between integrated circuits. The R&S®RTC1000 has versatile options for protocol-specific triggering and decoding of serial interfaces. Selective acquisition and analysis of relevant events and data is possible. With the hardware-based implementation, smooth operation and a high update rate are ensured even for long acquisitions. This is advantageous, for example, for capturing multiple packetized serial bus signals.



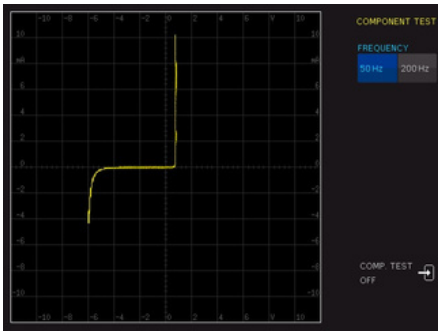
Waveform and pattern generator

The integrated R&S®RTC-B6 waveform and pattern generator up to 50 Mbit/s is useful for educational purposes and for implementing prototype hardware. In addition to common sine, square/pulse, ramp and noise waveforms, it outputs 4-bit patterns. Waveforms and patterns can be imported as CSV files or copied from oscilloscope waveforms. You can preview signals before playing them back to quickly check signal correctness. Predefined patterns for e.g. I2C, SPI, UART and CAN/LIN are provided.



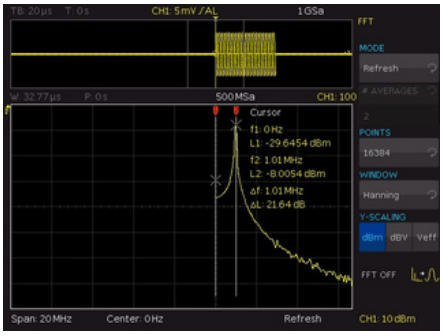
Digital voltmeter

For simultaneous measurements, the R&S®RTC1000 features a three-digit digital voltmeter (DVM) and six-digit frequency counter on each channel. Provided measurement functions include DC, AC + DC (RMS) and AC (RMS).



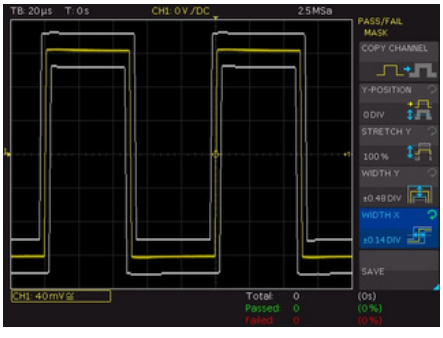
Component tester

You will also benefit from the included component tester. A 50 Hz and a 200 Hz measuring frequency are 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.



Frequency analysis mode

Difficult-to-find faults often result from the interaction between time and frequency signals. The FFT function of the R&S®RTC1000 is activated at the push of a button and by simply entering the center frequency and span. Thanks to the R&S®RTC1000 oscilloscopes' high-performance FFT functionality, signals can be analyzed with up to 128k points. Other practical tools include cursor measurements and autoset in the frequency domain.



Mask test mode

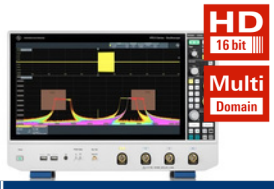
Mask tests quickly reveal whether a specific signal lies within defined tolerance limits. Masks assess the quality and stability of a DUT based on statistical pass/fail evaluation. Signal anomalies and unexpected results are quickly identified. When the mask is violated, the measurement stops. Each violation generates a pulse output at the AUX-OUT connector of the R&S®RTC1000. This pulse output can be used to trigger actions in the measurement setup.

OSCILLOSCOPE PORTFOLIO

R&S®	RTH1000	RTC1000	RTB2000	RTM3000
Vertical				
Bandwidth	60/100/200/350/500 MHz 1)	50/70/100/200/300 MHz 1)	70/100/200/300 MHz 1)	100/200/350/500 MHz/1 GHz 1)
Number of channels	2 plus DMM/4	2	2/4	2/4
Resolution	10 bit	8 bit	10 bit	10 bit
V/div 1 MΩ	2 mV to 100 V	1 mV to 10 V	1 mV to 5 V	500 µV to 10 V
V/div 50 Ω	–			500 µV to 1 V
Horizontal				
Sampling rate per channel (in Gsample/s)	1.25 (4-channel model); 2.5 (2-channel model); 5 (all channels interleaved) 125 ksample (4-channel model); 250 ksample (2-channel model); 500 ksample (50 Msample in segmented memory mode)	1; 2 (2 channels interleaved)	1.25; 2.5 (2 channels interleaved)	2.5; 5 (2 channels interleaved)
Maximum memory (per channel/1 channel active)		1 Msample; 2 Msample	10 Msample; 20 Msample (320 Msample in segmented memory mode 2))	40 Msample; 80 Msample (400 Msample in segmented memory mode 2))
Segmented memory	standard	–	option	option
Acquisition rate (in waveforms/s)	50 000	10 000	50 000 (300 000 in fast segmented memory mode 2))	64 000 (2 000 000 in fast segmented memory mode 2))
Trigger				
Options	advanced, digital trigger (14 trigger types) 2)	elementary (5 trigger types)	comprehensive (7 trigger types)	comprehensive (10 trigger types)
Mixed signal option				
Number of digital channels	8	8	16	16
1) Sampling rate of digital channels (in Gsample/s)	1.25	1	1.25	two logic probes: 2.5 on each channel; one logic probe: 5 on each channel
Memory of digital channels	125 ksample	1 Msample	10 Msample	two logic probes: 40 Msample per channel; one logic probe: 80 Msample per channel
Analysis				
Cursor meas. types	4	13 31 elementary (tolerance	4	4
Standard meas. functions	37	mask	32	32
Mask test	elementary (tolerance mask around the signal)	around the signal) elementary	elementary (tolerance mask around the signal)	elementary (tolerance mask around the signal)
Mathematics	elementary		basic (math on math)	basic (math on math)
Serial protocols triggering and decoding 1)	I2C, SPI, UART/RS-232/RS-422/ RS-485, CAN, LIN, CAN-FD, SENT	I2C, SPI, UART/RS-232/ RS-422/ RS-485, CAN, LIN	I2C, SPI, UART/RS-232/ RS-422/ RS-485, CAN, LIN	I2C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I2S, MIL-STD-1553, ARINC 429
Display functions	data logger	–	–	–
Applications 1), 2)	high-resolution frequency counter, advanced spectrum analysis, harmonics analysis, user scripting	digital voltmeter (DVM), component tester, fast Fourier transform (FFT)	digital voltmeter (DVM), fast Fourier transform (FFT), frequency response analysis	power, digital voltmeter (DVM), spectrum analysis and spectrogram, frequency response analysis
Compliance testing 1), 2)	–	–	–	–
Display and operation				
Size and resolution	7", color, 800 × 480 pixel	6.5", color, 640 × 480 pixel	10.1", color, 1280 × 800 pixel	10.1", color, 1280 × 800 pixel
Operation	optimized for touchscreen operation, parallel button operation	optimized for fast button operation	optimized for touchscreen operation, parallel button operation	
General data				
Dimensions in mm (W × H × D)	201 × 293 × 74	285 × 175 × 140	390 × 220 × 152	390 × 220 × 152
Weight in kg	2.4	1.7	2.5	3.3
Battery	lithium-ion, > 4 h	–	–	–

1) Upgradeable.

2) Requires an option.



RTA4000	RTE1000	RTO6	RTP
200/350/500 MHz/1 GHz 1)	200/350/500 MHz/1/1.5/2 GHz 1)	600 MHz/1/2/3/4/6 GHz 1)	4/6/8/13/16 GHz 1)
4	2/4	4	4
10 bit	16 bit system architecture	16 bit system architecture	16 bit system architecture
500 µV to 10 V	500 µV to 10 V	1 mV to 10 V (with HD mode: 500 µV to 10 V)	
500 µV to 1 V	500 µV to 1 V	1 mV to 1 V (with HD mode: 500 µV to 1 V)	2 mV to 1 V (with HD mode: 1 mV to 1 V)
2.5; 5 (2 channels interleaved)	5	10; 20 (2 channels interleaved in 4 GHz and 6 GHz model)	20; 40 (2 channels interleaved)
100 Msample; 200 Msample (1 Gsample in segmented memory mode)	50 Msample/200 Msample	standard: 200 Msample/800 Msample; max. upgrade: 1 Gsample/2 Gsample	standard: 50 Msample/200 Msample; max. upgrade: 1 Gsample/2 Gsample
standard	standard	standard	standard
64 000 (2 000 000 in fast segmented memory mode)	1 000 000 (1 600 000 in ultra-segmented memory mode)	1 000 000 (2 500 000 in ultra-segmented memory mode)	750 000 (3 200 000 in ultra-segmented memory mode)
comprehensive (10 trigger types)	advanced, digital trigger (13 trigger types)	advanced (includes zone trigger), digital trigger (14 trigger types)	advanced, digital trigger (14 trigger types) with real-time deembedding 2), high speed serial pattern trigger incl. 8/16 Gbps CDR 2), zone trigger 2)
16	16	16	16
two logic probes: 2.5 on each channel; one logic probe: 5 on each channel	5	5	5
two logic probes: 100 Msample per channel; one logic probe: 200 Msample per channel	100 Msample	200 Msample	200 Msample
4	3	3	3
32	4 7	4 7	47
elementary (tolerance mask around the signal)	advanced (user-configurable, hardware based)	advanced (user-configurable, hardware based)	advanced (user-configurable, hardware based)
basic (math on math)	advanced (formula editor)	advanced (formula editor)	advanced (formula editor)
I2C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I2S, MIL-STD-1553, ARINC 429	I2C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I2S, MIL-STD-1553, ARINC 429, FlexRay™, CAN-FD, MIPI RFFE, USB 2.0/HSIC, MDIO, 8b10b, Ethernet, Manchester, NRZ, MIPI D-PHY, SpaceWire, MIPI M-PHY/UniPro, SENT, CXPI, USB Power Delivery, automotive Ethernet 100BASE-T1	I2C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, I2S, MIL-STD-1553, ARINC 429, FlexRay™, CAN-FD, MIPI RFFE, USB 2.0/HSIC, MDIO, 8b10b, Ethernet, Manchester, NRZ, MIPI D-PHY, SpaceWire, MIPI M-PHY/UniPro, USB 3.1 Gen1, USB-SSIC, PCIe 1.1/2.0, USB Power Delivery, automotive Ethernet 100BASE-T1/1000BASE-T1	I2C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, MIL-STD-1553, ARINC 429, CAN-FD, MIPI RFFE, USB 2.0/HSIC, MDIO, 8b10b, Ethernet, Manchester, NRZ, MIPI D-PHY, SpaceWire, MIPI M-PHY/UniPro, USB 3.1 Gen1/Gen2, USB-SSIC, PCIe 1.1/2.0/3.0, USB Power Delivery, automotive Ethernet 100BASE-T1/1000BASE-T1
–	histogram, trend, track 2)	histogram, trend, track 2)	histogram, trend, track
power, digital voltmeter (DVM), spectrum analysis and spectrogram, frequency response analysis	power, 16 bit high definition mode (standard), advanced spectrum analysis and spectrogram	power, 16 bit high definition mode (standard), advanced spectrum analysis and spectrogram, jitter and noise decomposition, clock data recovery, I/Q data, RF analysis, deembedding, TDR/TDT analysis	16 bit high definition mode, advanced spectrum analysis and spectrogram, jitter and noise decomposition, RF analysis, real-time deembedding, TDR/TDT analysis, I/Q data, HS serial pattern trigger with 8/16 Gbps CDR
–	–	see data sheet (PD 5216.1640.22)	see data sheet (PD 5215.4152.22)
10.1", color, 1280 × 800 pixel	10.4", color, 1024 × 768 pixel	15.6", color, 1920 × 1080 pixel	12.1", color, 1280 × 800 pixel
optimized for touchscreen operation, parallel button operation			
390 × 220 × 152	427 × 249 × 204	450 × 315 × 204	441 × 285 × 316
3.3	8.6	10.7	18
–	–	–	–

SPECIFICATIONS IN BRIEF

Specifications in brief		
Vertical system		
Number of channels		2
Bandwidth (–3 dB)	R&S®RTC1002 (with R&S®RTC-B220/-B221/-B222/-B223)	50 MHz/70 MHz/100 MHz/200 MHz/300 MHz
Rise time (calculated)	R&S®RTC1002 (with R&S®RTC-B220/-B221/-B222/-B223)	7 ns/5 ns/3.5 ns/1.75 ns/1.15 ns
Input impedance		1 MΩ ± 2 % || 14 pF ± 2 pF
Input sensitivity	maximum bandwidth in all ranges	1 mV/div to 10 V/div
DC gain accuracy	offset and position = 0, maximum operating temperature change of ±5 °C after self-alignment	
	input sensitivity all ranges	3 %
Acquisition system		
Maximum realtime sampling rate		1 Gsample/s, 2 Gsample interleaved
Acquisition memory		1 Msample, 2 Msample interleaved
Horizontal system		
Timebase range		1 ns/div to 100 s/div
Trigger system		
Trigger types	standard	edge, width, video (PAL, NTSC, SECAM, PAL-M, SDTV, HDTV), pattern, timeout
	option	I2C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN
Analysis and measurement functions		
QuickView	At the push of a button, internal measurement values are written directly onto the waveform and updated continuously.	peak-to-peak voltage, pos./neg. peak, rise/fall time, mean value, RMS value, time, frequency
Automated measurements		burst width, count positive/negative pulses, count falling/rising edges, mean value, RMS cycle, RMS, mean cycle, peak±, frequency, period, amplitude, base level, pos./neg. overshoot, pulse width, duty cycle±, rise/time, delay, phase
Waveform mathematics		addition, subtraction, multiplication, division, FFT
MSO option		
Digital channels		8 (1 logic probe)
Sampling rate		1 Gsample/s
Acquisition memory		1 Msample
Waveform generator option		
Resolution, sampling rate		8 bit, 978 ksample/s
Amplitude	high Z; 50 Ω	60 mV to 6 V (V pp); 30 mV to 3 V (Vpp)
DC offset	sine	0.1 Hz to 50 kHz
	pulse/rectangle and ramp/triangle	0.1 Hz to 10 kHz
4-bit pattern generator option		
Programmable pattern	sample time	20 ns to 42 s, up/down
	memory depth	2048 sample
4-bit counter	frequency	100 mHz to 50 MHz
Square wave	frequency	1 mHz to 500 kHz
Digital voltmeter		
Measurements	DC, AC + DC (RMS), AC (RMS) resolution	up to 3 digits
Frequency counter		
Resolution		5 digits
General data		
Screen		6.5" VGA color display (640 × 480 pixel)
Interfaces		1 × USB host, USB device, LAN
Audible noise	maximum sound pressure level at a distance of 0.3 m	30.4 dB(A)
Dimensions	W × H × D	285 mm × 175 mm × 140 mm (11.22 in × 6.89 in × 5.51 in)
Weight		1.7 kg (3.75 lb)

ORDERING INFORMATION

Designation	Type	Order No.
R&S®RTC1000 base model		
Oscilloscope, 50 MHz, 2 channels	R&S®RTC1002	1335.7500P02
Base unit (including standard accessories: R&S®RT-ZP03S passive probe per channel, R&S®RTC-B6 waveform generator, power cord, getting started manual and safety instructions)		
Choose your bandwidth upgrade		
Upgrade of R&S®RTC1002 to 70 MHz bandwidth	R&S®RTC-B220	1335.7300.03
Upgrade of R&S®RTC1002 to 100 MHz bandwidth	R&S®RTC-B221	1335.7317.03
Upgrade of R&S®RTC1002 to 200 MHz bandwidth	R&S®RTC-B222	1335.7275.03
Upgrade of R&S®RTC1002 to 300 MHz bandwidth	R&S®RTC-B223	1335.7281.03
Choose your options		
Mixed signal upgrade for non-MSO models, 300 MHz	R&S®RTC-B1	1335.7323.03
Waveform generator I²C/SPI serial triggering and decoding	R&S®RTC-B6	1335.7298.03
UART/RS-232/RS-422/RS-485 serial triggering and decoding	R&S®RTC-K1	1335.7230.03
CAN/LIN serial triggering and decoding	R&S®RTC-K2	1335.7246.03
Application bundle, consists of the following options: R&S®RTC-K1, R&S®RTC-K2, R&S®RTC-K3, R&S®RTC-B6	R&S®RTC-K3	1335.7252.03
	R&S®RTC-PK1	1335.7330.02
Choose your additional probes		
Single-ended passive probes		
300 MHz, 10:1, 10 MΩ, 400 V, 12 pF	R&S®RT-ZP03S	1803.1001.03
500 MHz, 10 MΩ, 10:1, 300 V, 10 pF, 5 mm	R&S®RT-ZP05S	1333.2401.02
500 MHz, 10 MΩ, 10:1, 400 V, 9.5 pF	R&S®RTM-ZP10	1409.7708.02
38 MHz, 1 MΩ, 1:1, 55 V, 39 pF	R&S®RT-ZP1X	1333.0873.02
High voltage single-ended passive probes		
250 MHz, 100:1, 100 MΩ, 850 V, 6.5 pF	R&S®RT-ZH03	1333.1370.02
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	1409.7837.02
Current probes		
20 kHz, AC/DC, 10 A/1000 A 100 kHz, AC/DC, 30 A	R&S®RT-ZC01	1333.0850.02
10 MHz, AC/DC, 150 A 100 MHz, AC/DC, 30 A	R&S®RT-ZC02	1333.0844.02
120 MHz, AC/DC, 5 A Power supply for current probes	R&S®RT-ZC03	1409.7750.02
Active differential probes		
100 MHz, 1000:1/100:1, 8 MΩ, 1000 V (RMS), 3.5 pF	R&S®RT-ZC10	1409.7766.02
200 MHz, 10:1, 1 MΩ, 20 V diff., 3.5 pF	R&S®RT-ZD20	1422.0703.02
Logic probes	R&S®RT-ZD01	1409.7772.02
	R&S®RT-ZD30	1333.0821.02
Active 8 channel logic probe	R&S®RT-ZL03	1409.7789.02
Probe accessories	ZA13	3594.4015.02
Feedthrough termination 50 Ω	R&S®HZ22	1333.0796.02
Adapter, BNC to 4 mm dual banana	R&S®RT-ZA11	1333.0867.02
Probe pouch	R&S®RT-ZA19	1333.0967.02
Choose your accessories		
Soft case, for R&S®RTC1002 oscilloscope and accessories	R&S®RTC-Z3	1335.7875.02
Rackmount kit	R&S®ZZA-RTC1K	1333.0967.02

Service options	
Extended warranty, one year/two years	Please contact your local Rohde & Schwarz sales office.
Extended warranty with calibration coverage, one year/two years	
Extended warranty with accredited calibration coverage, one year/two years	