# R&S®RTM3000
# Oscilloscope
## Power of ten

- 100 MHz to 1 GHz
- 10-bit ADC
- 80 Msample standard memory
- 10.1" capacitive touchscreen

**3** year warranty



**10-bit ADC**

**10x memory**

**10" touchscreen**

## ROHDE&SCHWARZ

# R&S®RTM3000 Oscilloscope
## At a glance

Designed as an everyday problem solving tool, the R&S®RTM3000 combines the power of ten (10-bit ADC, 10 times the memory and 10.1" touchscreen) with an Rohde & Schwarz probe interface for use with all Rohde & Schwarz probes.

> Rohde & Schwarz stands for quality, precision and innovation in all fields of wireless communications. As an independent, family-owned company, Rohde & Schwarz finances its growth from its own funds. The company plans for the long term to the benefit of its customers. Purchasing Rohde & Schwarz products is an investment for the future.

The display, which is the largest capacitive display (10.1") with the highest resolution (1280 × 800 pixel) in its class, works just like your smartphone. Simply touch the screen to quickly navigate in pop-up menus and use gesturing to easily scale, zoom and move a waveform.

The 10-bit A/D converter yields up to a fourfold improvement over conventional 8-bit A/D converters. You get sharper waveforms with more signal details.

40 Msample memory depth is available on each channel if all channels are active. When interleaved, 80 Msample are available to capture longer signal sequences for more analysis results.

With the Rohde & Schwarz probe interface, all Rohde & Schwarz probing solutions can be used – for perfect connections to any DUT.

The R&S®RTM3000 is more than just an oscilloscope. It includes a logic analyzer, protocol analyzer, waveform and pattern generator, digital voltmeter and dedicated operating modes for frequency analysis, mask tests and long data acquisitions. You can quickly and efficiently debug all kinds of electronic systems – and the R&S®RTM3000 satisfies the all-important rule of investment protection at a very attractive price.

# R&S®RTM3000
# Oscilloscope
# Benefits and key features

## See small signal details in the presence of large signals
❙ 10-bit vertical resolution
❙ 500 µV/div: full measurement bandwidth and low noise
▷ page 4

## Capture more time at full bandwidth
❙ 40 Msample standard and 80 Msample interleaved
❙ Segmented memory: 400 Msample with history function
❙ Maintains fast sampling rates at all times
▷ page 5

## 10.1" high-resolution capacitive touchscreen with gesture support
❙ 10.1" high-resolution capacitive touch display
❙ Gesture support like on your smartphone
❙ Fast access to important tools
▷ page 6

## The best choice for power
▷ page 10

## Spectrum analysis: identify interactions between time and frequency
▷ page 12

## Protocol analysis: efficiently debug serial buses
▷ page 13

## The right probe for the best measurement
▷ page 14

## Choose your Rohde & Schwarz embedded oscilloscope

| | R&S®RTC1000 | R&S®RTB2000 | R&S®RTM3000 | R&S®RTA4000 |
|---|---|---|---|---|
| **Number of scope channels** | 2 | 2/4 | 2/4 | 4 |
| **Bandwidth in MHz** | 50, 70, 100, 200, 300 | 70, 100, 200, 300 | 100, 200, 350, 500, 1000 | 200, 350, 500, 1000 |
| **Max. sampling rate in Gsample/s** | 1.25/channel, 2.5 interleaved | 1.25/channel, 2.5 interleaved | 2.5/channel, 5 interleaved | 2.5/channel, 5 interleaved |
| **Max. memory depth in Msample** | 1/channel, 2 interleaved | 10/channel, 20 interleaved; 160 Msample (optional) segmented memory | 40/channel, 80 interleaved; 400 Msample (optional) segmented memory | 100/channel, 200 interleaved; 1 Gsample (standard) segmented memory |
| **Vertical bits (ADC)** | 8 | 10 | 10 | 10 |
| **Min. input sensitivity** | 1 mV/div | 1 mV/div | 500 µV/div | 500 µV/div |
| **Display** | 6.5", 640 × 480 pixel | 10" capacitive touch, 1280 × 800 pixel | 10" capacitive touch, 1280 × 800 pixel | 10" capacitive touch, 1280 × 800 pixel |
| **Update rate** | 5000 waveforms/s | 50 000 waveforms/s | 64 000 waveforms/s | 64 000 waveforms/s |
| **MSO** | 8 channels, 1 Gsample/s | 16 channels, 2.5 Gsample/s | 16 channels, 5 Gsample/s | 16 channels, 5 Gsample/s |
| **Protocol (optional)** | 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, audio (I²S), ARINC, MIL | I²C, SPI, UART/RS-232/RS-422/RS-485, CAN, LIN, audio (I²S), ARINC, MIL |
| **Generator(s)** | 1 ARB, 4-bit pattern generator | 1 ARB, 4-bit pattern generator | 1 ARB, 4-bit pattern generator | 1 ARB, 4-bit pattern generator |
| **Math** | +, −, *, /, FFT (128k points) | +, −, *, /, FFT (128k points) | +, −, *, /, FFT (128k points), 21 advanced functions | +, −, *, /, FFT (128k points), 21 advanced functions |
| **Rohde & Schwarz probe interface** | – | – | standard | standard |
| **RF capability** | FFT | FFT | spectrum analysis | spectrum analysis |

# See small signal details in the presence of large signals

10-bit ADC: 1024 levels, 4 times more than 8-bit ADC

500 µV/div: full bandwidth, no software magnification

## 10-bit vertical resolution

The R&S®RTM3000 features a customized Rohde & Schwarz designed 10-bit A/D converter that delivers a fourfold improvement over conventional 8-bit A/D converters.

The increased resolution results in sharper waveforms with more signal details that would otherwise be missed. One example is the characterization of switched-mode power supplies. The voltages across the switching device must be determined during the on/off times within the same acquisition. For precise measurements of small voltage components, a high resolution of more than 8-bit is essential.

## 500 µV/div: full measurement bandwidth and low noise

The R&S®RTM3000 oscilloscope offers outstanding sensitivity down to 500 µV/div. Traditional oscilloscopes can only reach this level of input sensitivity by employing software-based magnification or by limiting the bandwidth. The R&S®RTM3000 oscilloscope shows the signal's real sampling points over the full measurement bandwidth – even at 500 µV/div. This ensures high measurement accuracy.

The accuracy of the signal displayed on the screen depends on the oscilloscope's inherent noise. The R&S®RTM3000 oscilloscope precisely measures even at the smallest vertical resolution by using low-noise frontends and state-of-the-art A/D converters.
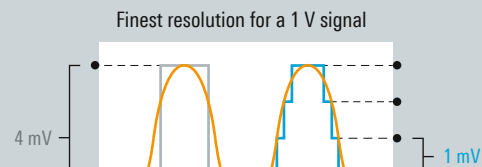
The Rohde & Schwarz designed 10-bit A/D converter ensures highest signal fidelity at highest resolution.
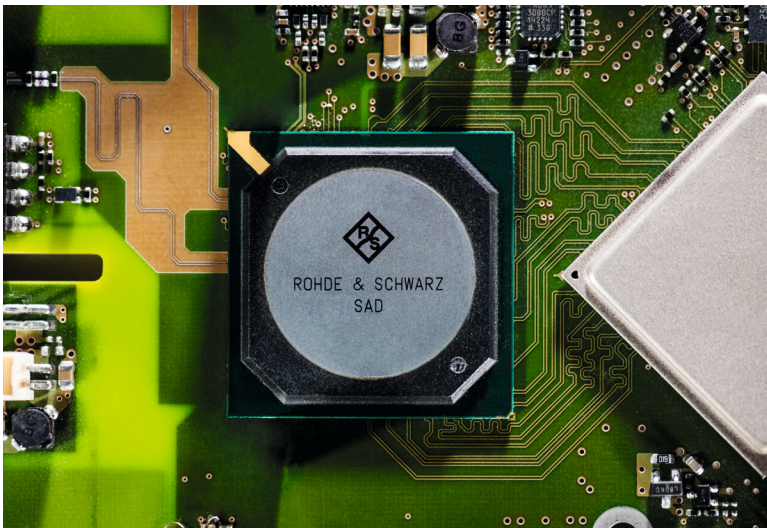
### 10-bit A/D converter: uncovers even small signal details

**Traditional scope**
▪ 8-bit vertical resolution

**R&S®RTM3000**
▪ 10-bit vertical resolution

Finest resolution for a 1 V signal

4 mV

1 mV

4

# Capture more time at full bandwidth

**80 Msample:** standard acquisition memory 8 to 40 times better

**5 Gsample:** fast sampling rate

**400 Msample:** segmented memory

## 40 Msample standard and 80 Msample interleaved

The R&S®RTM3000 offers a class-leading memory depth: 40 Msample per channel, and even 80 Msample in interleaved mode. This is eight times more than similar oscilloscopes in the same instrument class. It captures longer acquisition sequences even at high sampling rates for more analysis results, e.g. when analyzing transients of switched-mode power supplies.

Capture and analyze pulsed and burst signals over a long period. 400 Msample deep segmented memory is unique in this class.
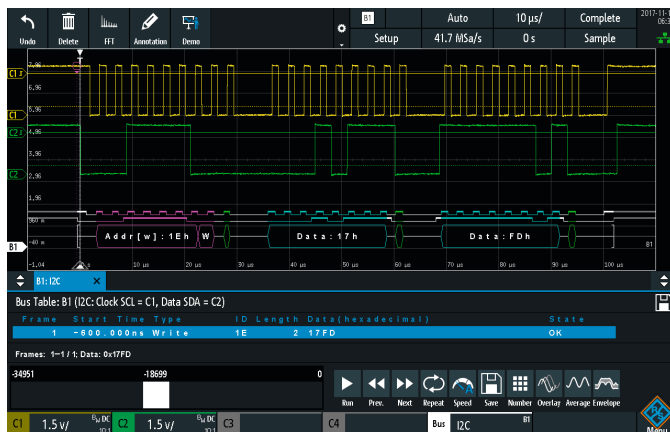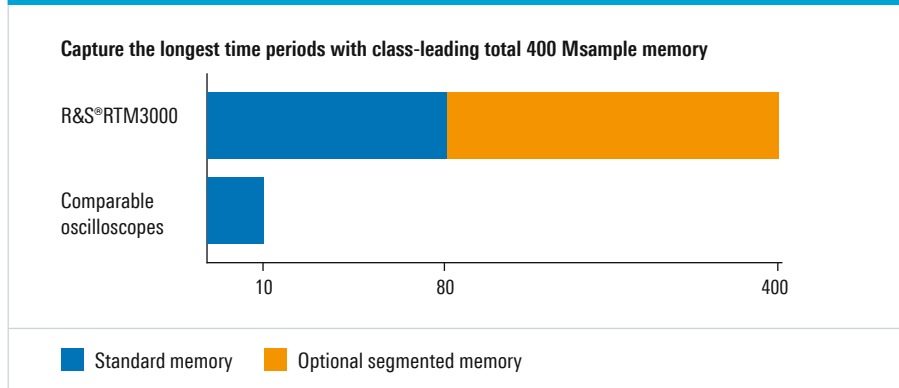


## Segmented memory: 400 Msample with history function

The R&S®RTM-K15 option with deep, segmented memory analyzes signal sequences over a long observation period. For example, protocol-based signals with communications gaps, such as I$^2$C and SPI, can be captured over several seconds or minutes. Thanks to the variable segment size from 10 ksample to 80 Msample, the 400 Msample memory is optimally utilized; more than 26000 cohesive individual recordings are possible.

In history mode, previous acquisitions to the maximum segmented memory depth of 400 Msample are available for further analysis. Functions such as mask tests, QuickMeas and FFT can be used for further analysis.

## Maintains fast sampling rates at all times

Signal faults and important events are detected better with an oscilloscope that offers a high sampling rate. Many applications require long acquisition cycles, for instance when analyzing serial protocols. With a sampling rate of up to 5 Gsample/s and a memory depth of up to 80 Msample, the R&S®RTM3000 oscilloscopes really excel here. They accurately display signals over long sequences – right down to the details.

### 8 to 40 times more memory depth than traditional oscilloscopes in the same instrument class

Capture the longest time periods with class-leading total 400 Msample memory

| | | |
|---|---|---|
| R&S®RTM3000 | | |
| Comparable oscilloscopes | | |

10   80   400

■ Standard memory   ■ Optional segmented memory

# 10.1" high-resolution capacitive touchscreen

**Quick access to important tools**
▮ Drag & drop to use analysis tools
▮ Toolbar to access functions
▮ Sidebar to intuitively configure functions

**Easily customizable waveform display with R&S®SmartGrid technology**
▮ Configurable display
▮ Resizable waveform areas
▮ Scales labeled on all axes

**10 second boot time**

**Integrated waveform and pattern generator up to 50 Mbit/s**
▮ Output of sine, square/pulse, ramp and noise waveforms
▮ Output of arbitrary waveform files and 4-bit signal patterns
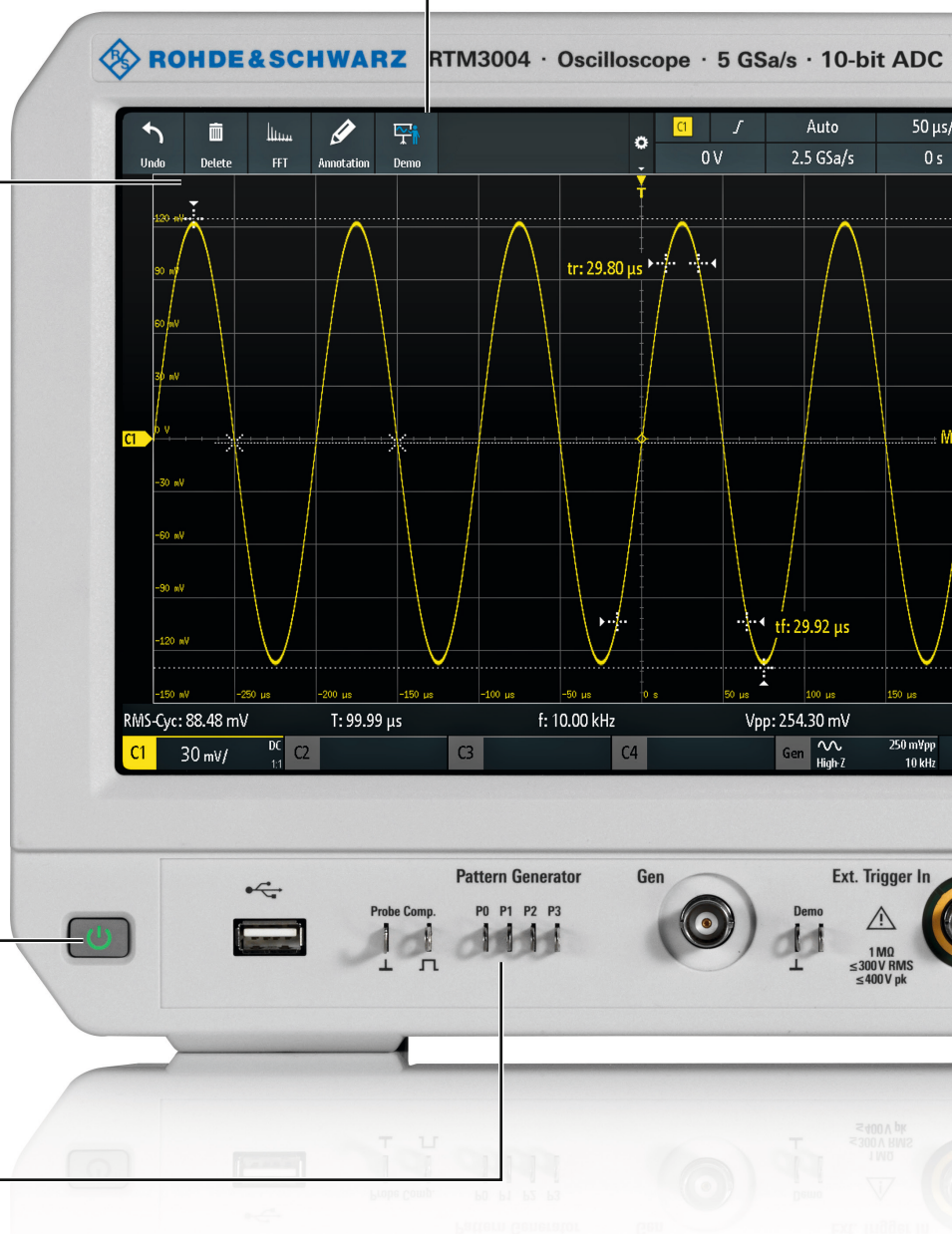
# with gesture support

**10.1" high-resolution capacitive touchscreen with gesture support**
- Gesture support for scaling and zooming
- High resolution: 1280 × 800 pixel resolution
- 12 horizontal grid lines for more signal details

**Documentation of results at the push of a button**
- Documentation as a screenshot or of instrument settings

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

**Color-coded controls indicate the selected channel**
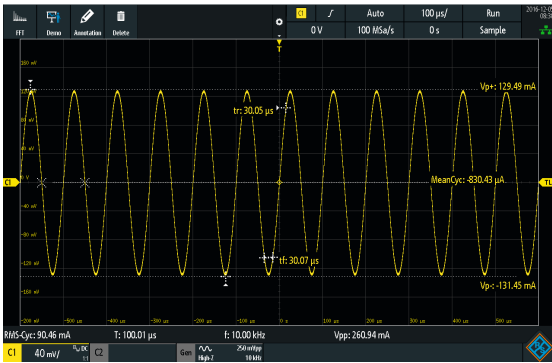
**QuickMeas: results at the push of a button**
- Graphical display of key measurement results for the active signal

**Active probe interface**
- Automatically detects and powers probes
- Rohde & Schwarz probes with probe interface
- More than 30 available probes

# X-in-1 oscilloscope



## Oscilloscope

With a sampling rate of up to 5 Gsample/s and a memory depth of up to 80 Msample, the R&S®RTM3000 oscilloscope excels in its class. A waveform update rate of more than 64 000 waveforms/s ensures a responsive instrument that reliably catches signal faults. Included tools provide quick results, e.g. QuickMeas, mask tests, FFT, math, cursors and automatic measurements (including statistics).
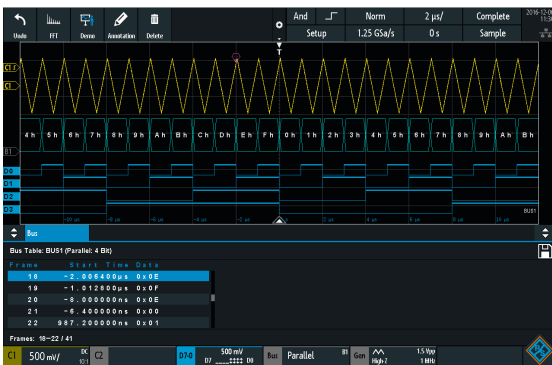


## Logic analyzer

The R&S®RTM-B1 option turns every R&S®RTM3000 into an intuitive-to-use MSO with 16 additional digital channels. The oscilloscope captures and analyzes signals from analog and digital components of an embedded design – synchronously and time-correlated to each other. For example, the delay between input and output of an A/D converter can conveniently be determined using the cursor measurements.
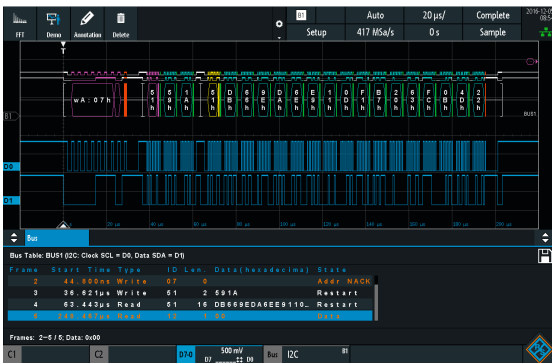


## Protocol analyzer

Protocols such as I$^2$C, SPI and CAN/LIN frequently transfer control messages between integrated circuits. The R&S®RTM3000 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.
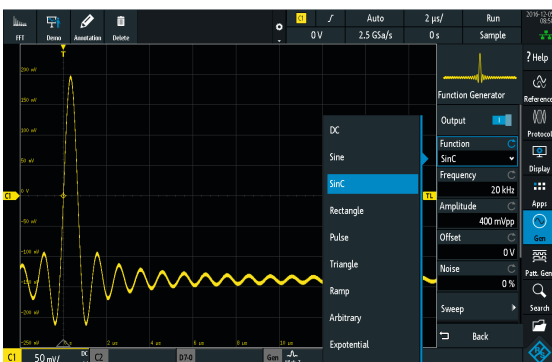


## Waveform and pattern generator

The integrated R&S®RTM-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 arbitrary waveforms and 4-bit signal 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. I$^2$C, SPI, UART and CAN/LIN are provided.

8
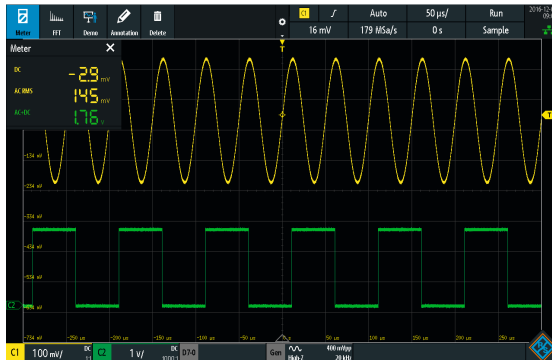
## Digital voltmeter

For simultaneous measurements, the R&S®RTM3000 features a 3-digit voltmeter (DVM) and 6-digit frequency counter on each channel. Measurement functions include DC, AC + DC (RMS) and AC (RMS).



## Frequency analysis mode

Difficult-to-find faults often result from the interaction between time and frequency signals. The FFT function of the R&S®RTM3000 is activated at the push of a button and by simply entering center frequency and span. Thanks to the R&S®RTB2000 oscilloscopes' high-performance FFT functionality, signals can be analyzed with up to 128k points. Other tools include cursor measurements and autoset in the frequency domain.
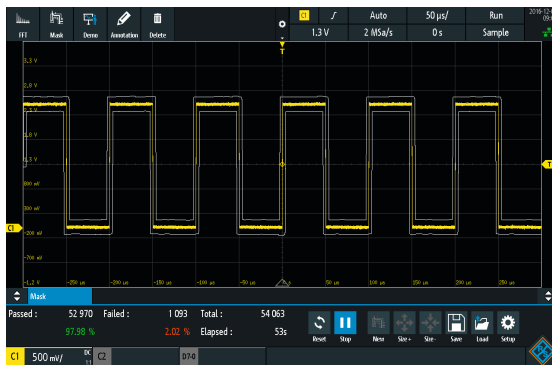


## Mask test mode

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 can generate a pulse output at the AUX-OUT connector on the R&S®RTM3000. This pulse output can be used to trigger actions in the measurement setup.
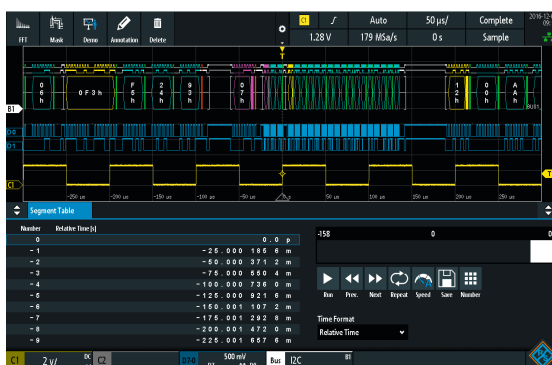


## History and segmented memory mode

The R&S®RTM-K15 history and segmented memory option increases the memory from 40 Msample to 400 Msample. You can scroll through past acquisitions and analyze the data using the oscilloscope tools, e.g. protocol decode and logic channels. Serial protocol and pulse sequences are recorded practically without interruptions.

# The best choice for power

ı **Analyze the input, output and transfer function of switched-mode power supplies**
ı **Measurement wizard for fast results**
ı **Simple and fast documentation**
ı **Analyze harmonic current in line with conventional EN, MIL and RTCA standards**

## See power signal details with up to 10-bit resolution

Even the smallest signal details of a high dynamic signal matter for power measurements. Verification of $R_{DS(on)}$ of a MOSFET is one example. The high ADC resolution of the R&S®RTM3000 oscilloscopes increases the vertical resolution up to 10-bit. Previously unseen signal details become visible and measurable. In the $R_{DS(on)}$ example, this makes it possible to measure the slope of the drain-to-source-voltage while the switch is closed.

## Complete probe portfolio for power measurements

Accurate voltage and current probes with a suitable measurement range are critical for power measurements. Rohde&Schwarz offers a complete probe portfolio for different power measurement applications – ranging from µA to kA and from µV to kV.

Perfect instruments for power measurements thanks to diverse functionality, rugged design and small footprint.
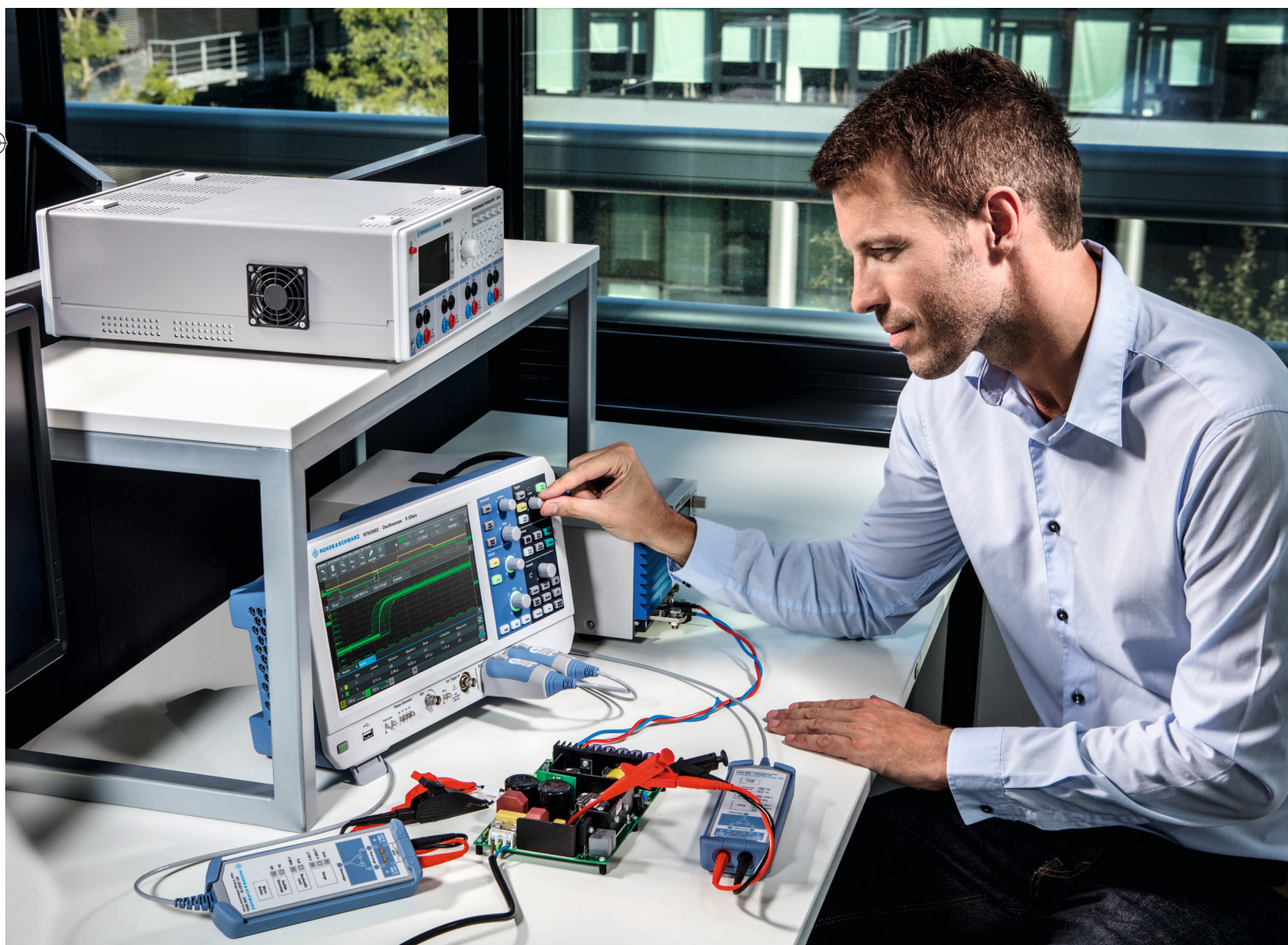
## Specialized measurement functions for characterizing power electronics

Analysis tools support verification and debugging when developing current and voltage supply circuits. The R&S®RTM-K31 power analysis option facilitates analysis of the turn on/off behavior, the internal transfer function of the overall circuit, the safe operating area (SOA), the output signal quality and any loss.

## Standards for limiting the harmonic current

Depending on the application, different standards for limiting the harmonic current must be met when developing switched-mode power supplies. The R&S®RTM-K31 option supports the user during testing of all conventional standards: EN 61000-3-2 classes A, B, C, D, MIL-STD-1399 and RTCA DO-160.

## Easy, clear documentation of power analysis

Results can be added to the test report simply by pressing a button. This report documents the current setup and configuration. The R&S®Oscilloscope Report Creator is used to generate a report (available free of charge on the Rohde & Schwarz website). You can define the level of detail for the report and customize the layout, for example, by adding a company logo. The output format is .pdf.

### Measurement functions of the R&S®RTM-K31 option

| Measurement | Measurement functions |
|---|---|
| Current harmonics | ▮ EN 61000-3-2 class A, B, C, D<br>▮ MIL-STD-1399<br>▮ RTCA DO-160 |
| Input | ▮ inrush current<br>▮ power quality<br>▮ power consumption |
| Power converter control | ▮ modulation analysis<br>▮ slew rate<br>▮ dynamic on-resistance |
| Power path | ▮ safe operating area (SOA mask editor)<br>▮ turn on/off<br>▮ switching loss<br>▮ power efficiency |
| Output | ▮ output ripple<br>▮ transient response<br>▮ output spectrum |



Online help facilitates quick and easy testing.

# Spectrum analysis: identify interactions between time and frequency

> ## Spectrogram: evolution over time
>
> ## Peak markers: automatic positioning

## Fast and precise analysis

Difficult-to-find faults often result from the interaction between time and frequency signals. The R&S®RTM-K18 spectrum analysis and spectrogram option quickly finds such errors. Like on a spectrum analyzer, parameters such as center frequency and resolution bandwidth can be adapted to the specific measurement task. The oscilloscope automatically selects the relevant time domain settings. Optimum performance ensures the fastest multi-domain analysis in this oscilloscope class.

## Parallel operation: correlation between frequency and time

Advanced electronics is based on the seamless interaction between protocol-based interfaces, digital, analog and frequency components. Simultaneous analysis of all components is a must. Time, frequency and protocol information are correlated, and time references can be quickly recognized. Measurement windows help you select specific areas of the recording, which can simplify, for example, the acquisition of frequency switching operations.

## Spectrogram: display of frequency over time

A spectrogram displays the spectrum of frequencies as they vary over time. For easy interpretation, the magnitude can be color-coded. Thanks to the high FFT rate, even fast frequency changes can be displayed. When used in combination with the R&S®RTM-K15 history and segmented memory option, the spectrogram marker shows the time of the acquisition and makes it possible to load the corresponding time and frequency waveforms onto the screen. All R&S®RTM3000 tools can be used to analyze the loaded waveforms.

## Markers: find peaks automatically

Markers can be automatically positioned on the frequency peaks for fast analysis. An adaptable threshold defines the peaks. Parameters such as excursion and maximum peak width can be adjusted for in-depth analysis. Results can be compiled in a table (absolute or relative to a specific reference marker). Selectable delta measurements make it easy to adjust the distances between signal peaks.
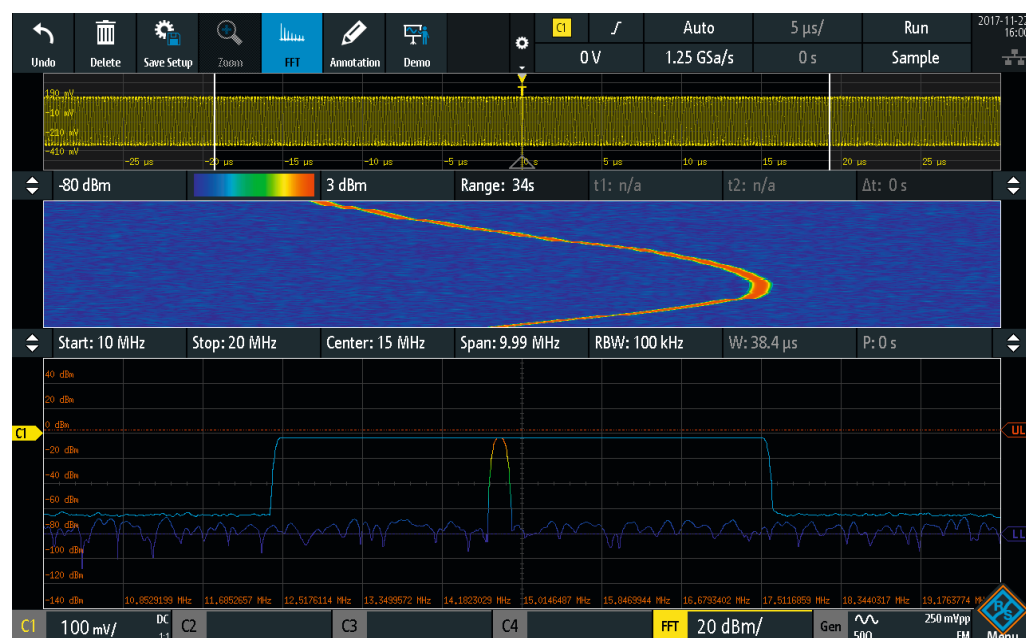


Test signal from three different perspectives: time domain (top), spectrogram (center) and frequency domain (bottom).

# Protocol analysis: efficiently debug serial buses

## Protocol aware triggering and decoding for serial buses

Counting 1s and 0s to decode a serial bus is tedious and error-prone. The R&S®RTM3000 automates this process by decoding the waveforms into a specific protocol. In addition, protocol aware triggering directly triggers on specific parts of a packet or frame.

## Segmented memory for long time captures

Standard segmented memory is ideal for serial protocols. It allows you to capture only relevant packets/frames and ignore the long idle time in between packets. With more than 400 Msample of segmented memory available, you can capture more than 26 000 timestamped packets/frames.

## Table view of packets/frames

A table view allows you to see a high-level representation of all captured packets. You can also export the table.

| Supported buses | |
|---|---|
| Embedded | ▮ I²C<br>▮ RS-232/RS-422/RS-485<br>▮ SPI (2/3/4-wire) |
| Aerospace | ▮ MIL-STD-1553<br>▮ ARINC 429 |
| Automotive, industrial | ▮ CAN/LIN |
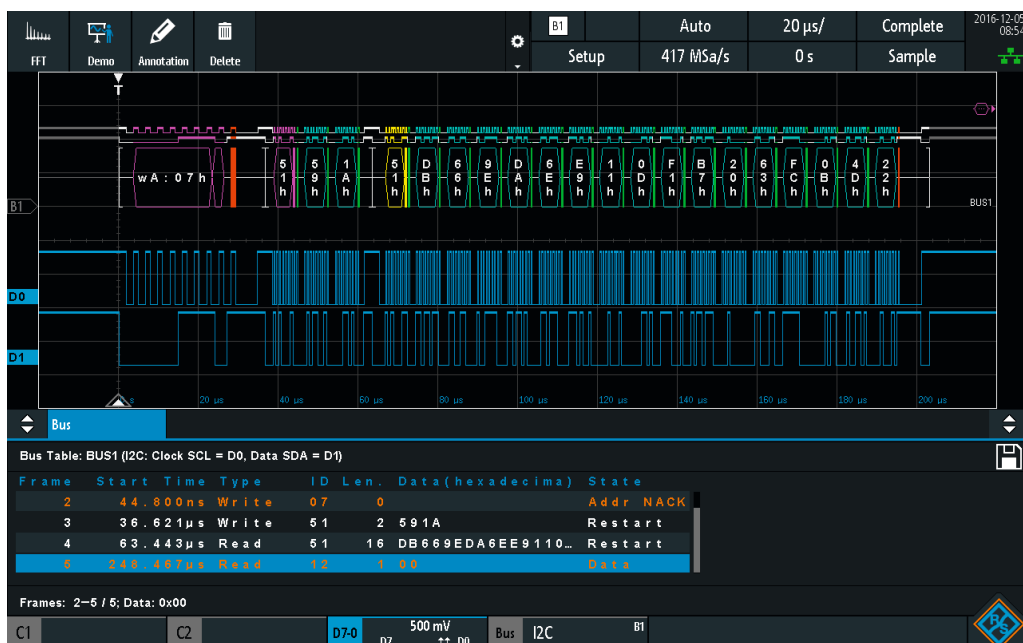


Decoded hexadecimal I²C message shown in honeycomb format and in table.

# The right probe for the best measurement

More than 30: dedicated probes

Micro button: for convenient instrument control

0.01 % accuracy: with R&S®ProbeMeter

## Extensive probe range for all measurement tasks

A complete portfolio of high-quality passive and active probes covers all measurement tasks. With an input impedance of 1 MΩ, the active probes put only a minimum load on a signal source's operating point. The very large dynamic range, even at high frequencies, prevents signal distortion – for example: 60 V ($V_{pp}$) at 1 GHz for the active single-ended probes.

## Complete portfolio for power measurements

The portfolio of dedicated probes for power measurements includes active and passive probes for the different voltage and current ranges – from µA to kA and from µV to kV. Dedicated power rail probes detect even small and sporadic distortions on DC power rails.

## Micro button for convenient instrument control

The situation is all too familiar. You've carefully positioned the probe on the device under test and want to start measurements – but you don't have a free hand. The micro button on Rohde & Schwarz active probes solves this problem. It is conveniently situated on the probe tip, and you can assign it different functions, such as run/stop, autoset and adjust offset.

## R&S®ProbeMeter: integrated voltmeter for precise DC measurements

One connection lets you see the scope waveform and gives you access to a highly accurate voltmeter that shows the DC value regardless of other instrument settings.

▷ For more information, see the product brochure: Probes and accessories, Rohde & Schwarz digital oscilloscopes (PD 3606.8866.12).



Practical design: micro button for convenient instrument control. Diverse probe tips and ground cables are included as standard accessories.

| Probe type | Ideal for measuring | Recommended probes |
|---|---|---|
| Standard passive probe | Single-ended voltages, max. bandwidth of 500 MHz | R&S®RT-ZP05S comes as standard with the R&S®RTM3000 |
| Active broadband probe | Singled-ended voltages, up to 8 GHz bandwidth | R&S®RT-ZS10E, R&S®RT-ZS10, R&S®RT-ZS20 |
| Power integrity probe | Disturbances on power rails with high offsets, greater than 2 GHz bandwidth | R&S®RT-ZPR20 |
| High voltage probe | High single-ended and differential voltages, up to 6 kV | R&S®RT-ZHD007, R&S®RT-ZHD15, R&S®RT-ZHD16, R&S®RT-ZHD60 |
| Current probe | Currents from µAs to kAs | R&S®RT-ZC05B, R&S®RT-ZC10B, R&S®RT-ZC15B, R&S®RT-ZC20B, R&S®RT-ZC30 |
| EMC near-field probe | EMI debugging up to 3 GHz | R&S®HZ-15 |

# And there is so much more ...

- **Efficient reporting capabilities**
- **Localized GUI and online help**
- **Fully upgradable via software licenses**
- **Web server functionality for instrument access**
- **Extensive range of probes and accessories**

## Grows with your needs

The R&S®RTM3000 oscilloscopes flexibly adapt to needed project updates. You simply install the necessary software licenses, e.g. triggering and decoding of serial protocols or the history and segmented memory mode. The waveform and pattern generator and MSO capabilities[1] are built-in and just need to be activated. The bandwidth can be upgraded up to 300 MHz via keycode. All this makes retrofitting really easy.

[1] The R&S®RTM-B1 MSO option additionally contains two logic probes with 16 digital channels.

## Multilingual support: choose among thirteen languages

The R&S®RTM3000 oscilloscope's user interface and online help support thirteen languages (English, German, French, Spanish, Italian, Portuguese, Czech, Polish, Russian, simplified and traditional Chinese, Korean and Japanese). You can change the language in just a few seconds while the instrument is running.

## Protection of data

The secure erase function protects sensitive data. This function removes all user data and settings, including device setups and reference waveforms.

## Connectivity

The R&S®RTM3000 can be directly connected to a PC via the built-in USB host and USB device ports. The USB host transfers screenshots and instrument settings to a USB stick. Media transfer protocol (MTP) implementation ensures seamless integration. The USB device port and the LAN interface enable remote control. The built-in web server functionality allows you to control the oscilloscope and display your screen content to an audience. Data and programming interfaces are included, e.g. for seamless MATLAB® integration.

With the USB MTP implementation, you can easily access live channel data and screenshots and integrate the oscilloscope into your computing environment.
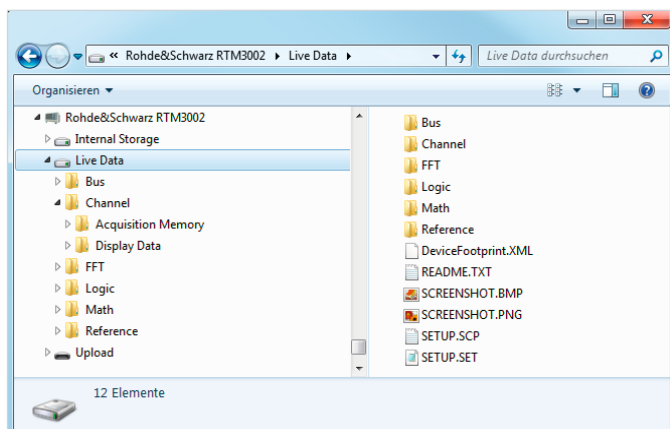
# Oscilloscope portfolio

| R&S® family | 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 |
| 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 | 1.25 Gsample/s per channel (4-channel model); 2.5 Gsample/s per channel (2-channel model); 5 Gsample/s (all channels interleaved) | 1 Gsample/s per channel 2 Gsample/s (2 channels interleaved) | 1.25 Gsample/s per channel; 2.5 Gsample/s (2 channels interleaved) | 2.5 Gsample/s per channel; 5 Gsample/s (2 channels interleaved) |
| Max. memory (per channel/1 channel active) | 125 ksample (4-channel model); 250 ksample (2-channel model); 500 ksample (50 Msample in segmented memory mode [2]) | 1 Msample; 2 Msample | 10 Msample; 20 Msample (160 Msample in segmented memory mode [2]) | 40 Msample; 80 Msample (400 Msample in segmented memory mode [2]) |
| Segmented memory | option | – | option | |
| Acquisition rate | 50 000 waveforms/s | 10 000 waveforms/s | 50 000 waveforms/s | 64 000 waveforms/s (700 000 waveforms/s in fast segmented memory mode [2]) |
| **Trigger** | | | | |
| Options | advanced, digital trigger (14 trigger types) [2] | elementary (5 trigger types) | basic (6 trigger types) | basic (7 trigger types) |
| **Mixed signal option** | | | | |
| No. of digital channels [1] | 8 | 8 | 16 | 16 |
| Sampling rate of digital channels | 1.25 Gsample/s | 1 Gsample/s | 1.25 Gsample/s | two logic probes: 2.5 Gsample/s on each channel; one logic probe: 5 Gsample/s on each channel |
| Max. memory of digital channels | 125 ksample | 1 Msample | 10 Msample | 80 Msample |
| **Analysis** | | | | |
| Cursor meas. types | 4 | 13 | 4 | 4 |
| Stand. meas. functions | 35 | 31 | 31 | 31 |
| Mask test | elementary (tolerance mask around the signal) | | | |
| Mathematics | elementary | | | basic (math on math) |
| Serial protocols triggering and decoding [1] | I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, CAN-FD, SENT (6) | I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN (4) | | I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, I²S, MIL-STD-1553, ARINC 429 (7) |
| Display functions | data logger | – | – | – |
| Applications [1] | high resolution frequency counter, advanced spectrum analysis, harmonics analysis | – | digital voltmeter (DVM) | power, digital voltmeter (DVM), spectrum analysis and spectrogram |
| Compliance testing [1] | – | – | – | – |
| **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** | | | | |
| Size in mm (W × H × D) | 201 × 293 × 74 | 285 × 175 × 140 | 403 × 189 × 142 | 403 × 189 × 142 |
| Weight in kg | 2.4 | 1.7 | 2.5 | 3.3 |
| Battery | lithium-ion, > 4 h | – | – | – |

[1] Upgradeable.  [2] Requires an option.

16

| RTA4000 | RTE1000 | RTO2000 |
|---|---|---|
| 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 | 2/4 | 2/4 (only 4 channels in 4 GHz and 6 GHz model) |
| 500 µV to 10 V | 500 µV to 10 V | 1 mV to 10 V (500 µV to 10 V) [2] |
| 500 µV to 1 V | 500 µV to 5 V | 1 mV to 1 V (500 µV to 1 V) [2] |
| 2.5 Gsample/s per channel; 5 Gsample/s (2 channels interleaved) | 5 Gsample/s per channel | 10 Gsample/s per channel; 20 Gsample/s (2 channels interleaved in 4 GHz and 6 GHz model) |
| 100 Msample; 200 Msample (1 Gsample in segmented memory mode [2]) | 50 Msample/200 Msample | standard: 50 Msample/200 Msample; max. upgrade: 1 Gsample/2 Gsample |
| option | standard | standard |
| 64 000 waveforms/s (700 000 waveforms/s in fast segmented memory mode [2]) | 1 000 000 waveforms/s (2 000 000 waveforms/s in ultra-segmented memory mode) | 1 000 000 waveforms/s (3 000 000 waveforms/s in ultra-segmented memory mode) |
| basic (7 trigger types) | advanced, digital trigger (13 trigger types) | advanced (includes zone trigger), digital trigger (14 trigger types) [2] |
| 16 | 16 | 16 |
| two logic probes: 2.5 Gsample/s on each channel; one logic probe: 5 Gsample/s on each channel | 5 Gsample/s | 5 Gsample/s |
| 200 Msample | 100 Msample | 200 Msample |
| 4 | 3 | 3 |
| 31 | 47 | 47 |
| elementary (tolerance mask around the signal) | advanced (freely configurable, hardware-based) | |
| basic (math on math) | advanced (formula editor) | advanced (formula editor) |
| I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, I²S, MIL-STD-1553, ARINC 429 (7) | I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, I²S, MIL-STD-1553, ARINC 429, FlexRay™, CAN-FD, USB 2.0/HSIC, Ethernet, Manchester, NRZ, SENT, SpaceWire, CXPI, USB Power Delivery, automotive Ethernet 100BASE-T1 (18) | 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, 8b 10b, Ethernet, Manchester, NRZ, SENT, MIPI D-PHY, SpaceWire, MIPI M-PHY/UniPro, CXPI, USB 3.1 Gen1, PCIe 1.1/2.0, USB Power Delivery, automotive Ethernet 100BASE-T1 (26) |
| – | histogram, trend, track [2] | |
| power, digital voltmeter (DVM), spectrum analysis and spectrogram | R&S®RTM applications **+** 16-bit high definition mode, advanced spectrum analysis and spectrogram | R&S®RTE applications **+** jitter, clock data recovery, I/Q data, RF analysis |
| – | – | various options available, for details see data sheet (PD 3607.2684.22) |
| 10.1", color, 1280 × 800 pixel | 10.4", color, 1024 × 768 pixel | 12.1", color, 1280 × 800 pixel |
| optimized for touchscreen operation, parallel button operation | | |
| 403 × 189 × 142 | 427 × 249 × 204 | 427 × 249 × 204 |
| 3.3 | 8.6 | 9.6 |
| – | – | – |

# Specifications in brief

| Specifications in brief | | |
|---|---|---|
| **Vertical system** | | |
| Number of channels | R&S®RTM3002; R&S®RTM3004 | 2; 4 |
| Bandwidth (–3 dB) at 50 Ω | R&S®RTM3002/3004 (with R&S®RTM-B2x2/-B2x3/-B2x5/-B2x10 options) | 100 MHz, 200 MHz, 350 MHz, 500 MHz, 1 GHz |
| Rise time (calculated) | R&S®RTM3002/3004 (with R&S®RTM-B2x2/-B2x3/-B2x5/-B2x10 options) | 3.5 ns, 1.75 ns, 1 ns, 700 ps, 350 ps |
| Input impedance | | 50 Ω ± 1.5 % (meas.), 1 MΩ ± 1 % (meas.) ‖ 14 pF ± 1 pF (meas.) |
| Input sensitivity | max. bandwidth in all ranges | |
| | at 1 MΩ | 500 μV/div to 10 V/div |
| | at 50 Ω | 500 μV/div to 1 V/div |
| DC gain accuracy | offset and position = 0, maximum operating temperature change of ±5°C after self-alignment | |
| | input sensitivity > 5 mV/div | ±1.5 % of full scale |
| | input sensitivity ≤ 5 mV/div | ±2 % of full scale |
| ADC resolution | | 10-bit, up to 16-bit with high resolution decimation |
| **Acquisition system** | | |
| Maximum realtime sampling rate | | 2.5 Gsample/s; 5 Gsample/s, interleaved |
| Acquisition memory | standard; with R&S®RTM-K15 option | 40 Msample (80 Msample interleaved); 400 Msample segmented memory |
| **Horizontal system** | | |
| Timebase range | | selectable between 0.5 ns/div and 500 s/div |
| **Trigger system** | | |
| Trigger types | standard | edge, width, video (PAL, NTSC, SECAM, PAL-M, SDTV 576i, HDTV 720p, HDTV 1080i, HDTV 1080p), pattern, line, serial bus, timeout |
| | option | I²C, SPI, UART/RS-232/RS-422/RS-485, CAN/LIN, ARINC 429, MIL-STD-1553 |
| **MSO option** | | |
| Digital channels | | 16 (2 logic probes) |
| Sampling rate | | 1.25 Gsample/s |
| Acquisition memory | standard; with R&S®RTM-K15 option | 40 Msample (80 Msample interleaved); 400 Msample segmented memory |
| **Waveform generator** | | |
| Resolution, sample rate | | 14-bit, 250 Msample/s |
| Amplitude | high Z; 50 Ω | 20 mV to 5 V ($V_{pp}$); 10 mV to 2.5 V ($V_{pp}$) |
| DC offset | high Z; 50 Ω | ±5 V; ±2.5 V |
| Signal forms frequency ranges | sine | 0.1 Hz to 25 MHz |
| | pulse/rectangle | 0.1 Hz to 10 MHz |
| | ramp/triangle | 0.1 Hz to 1 MHz |
| | noise | max. 25 MHz |
| Arbitrary | sampling rate; memory depth | max. 10 Msample/s; 32k points |
| **General data** | | |
| Screen | | 10.1" WXGA TFT color display (1280 × 800 pixel) |
| Interfaces | | USB host with MTP, USB device, LAN, powerful web server for remote display and operation |
| Audible noise | maximum sound pressure level at a distance of 1.0 m | 28.3 dB(A) |
| Dimensions | W × H × D | 390 mm × 220 mm × 152 mm (15.4 in × 8.66 in × 5.98 in) |
| Weight | | 3.3 kg (7.27 lb) |

# Ordering information

| Designation | Type | Order No. |
|---|---|---|
| **Choose your R&S®RTM3000 base model** | | |
| Oscilloscope, 100 MHz, 2 channels | R&S®RTM3002 | 1335.8794.02 |
| Oscilloscope, 100 MHz, 4 channels | R&S®RTM3004 | 1335.8794.04 |
| Base unit (including standard accessories: 500 MHz passive probe per channel, power cord) | | |
| **Choose your bandwidth upgrade** | | |
| Upgrade of R&S®RTM3002 oscilloscopes to 200 MHz bandwidth | R&S®RTM-B222 | 1335.9003.02 |
| Upgrade of R&S®RTM3002 oscilloscopes to 350 MHz bandwidth | R&S®RTM-B223 | 1335.9010.02 |
| Upgrade of R&S®RTM3002 oscilloscopes to 500 MHz bandwidth | R&S®RTM-B225 | 1335.9026.02 |
| Upgrade of R&S®RTM3002 oscilloscopes to 1 GHz bandwidth | R&S®RTM-B2210 | 1335.9032.02 |
| Upgrade of R&S®RTM3004 oscilloscopes to 200 MHz bandwidth | R&S®RTM-B242 | 1335.9049.02 |
| Upgrade of R&S®RTM3004 oscilloscopes to 350 MHz bandwidth | R&S®RTM-B243 | 1335.9055.02 |
| Upgrade of R&S®RTM3004 oscilloscopes to 500 MHz bandwidth | R&S®RTM-B245 | 1335.9061.02 |
| Upgrade of R&S®RTM3004 oscilloscopes to 1 GHz bandwidth | R&S®RTM-B2410 | 1335.9078.02 |
| **Choose your options** | | |
| Mixed Signal Upgrade for non-MSO models, 400 MHz | R&S®RTM-B1 | 1335.8988.02 |
| Arbitrary Waveform and 4-bit Pattern Generator | R&S®RTM-B6 | 1335.8994.02 |
| I²C/SPI Serial Triggering and Decoding | R&S®RTM-K1 | 1335.8807.02 |
| UART/RS-232/RS-422/RS-485 Serial Triggering and Decoding | R&S®RTM-K2 | 1335.8813.02 |
| CAN/LIN Serial Triggering and Decoding | R&S®RTM-K3 | 1335.8820.02 |
| Audio (I²S, LJ, RJ, TDM) Triggering and Decoding | R&S®RTM-K5 | 1335.8842.02 |
| MIL-STD-1553 Serial Triggering and Decoding | R&S®RTM-K6 | 1335.8859.02 |
| ARINC 429 Serial Triggering and Decoding | R&S®RTM-K7 | 1335.8865.02 |
| History and Segmented Memory | R&S®RTM-K15 | 1335.8907.02 |
| Spectrum Analysis and Spectrogram | R&S®RTM-K18 | 1335.8913.02 |
| Power Analysis | R&S®RTM-K31 | 1335.8920.02 |
| Application Bundle, consists of the following options: R&S®RTM-K1, R&S®RTM-K2, R&S®RTM-K3, R&S®RTM-K6, R&S®RTM-K7, R&S®RTM-K15, R&S®RTM-K18, R&S®RTM-K31, R&S®RTM-B6 | R&S®RTM-PK1 | 1335.8942.02 |
| **Choose your additional probes** | | |
| **Single-ended passive probes** | | |
| 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, 2.5 mm | R&S®RTM-ZP10 | 1409.7550.00 |
| 38 MHz, 1 MΩ, 1:1, 55 V, 39 pF, 2.5 mm | R&S®RT-ZP1X | 1333.1370.02 |
| **Active broadband probes: single-ended** | | |
| 1.0 GHz, 10:1, 1 MΩ, BNC interface | R&S®RT-ZS10L | 1333.0815.02 |
| 1.0 GHz, active, 1 MΩ, Rohde & Schwarz probe interface | R&S®RT-ZS10E | 1418.7007.02 |
| 1.0 GHz, active, 1 MΩ, R&S®ProbeMeter, micro button, Rohde & Schwarz probe interface | R&S®RT-ZS10 | 1410.4080.02 |
| 1.5 GHz, active, 1 MΩ, R&S®ProbeMeter, micro button, Rohde & Schwarz probe interface | R&S®RT-ZS20 | 1410.3502.02 |
| **Active broadband probes: differential** | | |
| 1.0 GHz, active, differential, 1 MΩ, R&S®ProbeMeter, micro button, including 10:1 external attenuator, 1 MΩ, 70 V DC, 46 V AC (peak), Rohde & Schwarz probe interface | R&S®RT-ZD10 | 1410.4715.02 |
| 1.5 GHz, active, differential, 1 MΩ, R&S®ProbeMeter, micro button, Rohde & Schwarz probe interface | R&S®RT-ZD20 | 1410.4409.02 |
| **Power rail probe** | | |
| 2.0 GHz, 1:1, 50 kΩ, ±0.85 V, ±60 V offset, Rohde & Schwarz probe interface | R&S®RT-ZPR20 | 1800.5006.02 |
| **High voltage single-ended passive probes** | | |
| 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 |

| Designation | Type | Order No. |
|---|---|---|
| **High voltage probes: differential** | | |
| 25 MHz, 20:1/200:1, 4 MΩ, 1.4 kV (CAT III), BNC interface | R&S®RT-ZD002 | 1337.9700.02 |
| 25 MHz, 10:1/100:1, 4 MΩ, 700 V (CAT II), BNC interface | R&S®RT-ZD003 | 1337.9800.02 |
| 100 MHz, 8 MΩ, 1 kV (RMS) (CAT III), BNC interface | R&S®RT-ZD01 | 1422.0703.02 |
| 200 MHz, 10:1, ±20 V, BNC interface | R&S®RT-ZD02 | 1333.0821.02 |
| 800 MHz, 10:1, 200 kΩ, ±15 V, BNC interface | R&S®RT-ZD08 | 1333.0838.02 |
| 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 | 1409.7750K02 |
| 10 MHz, AC/DC, 0.01 V/A, 150 A (RMS), Rohde & Schwarz probe interface | R&S®RT-ZC10B | 1409.8210.02 |
| 50 MHz, AC/DC, 0.1 V/A, 30 A (RMS), Rohde & Schwarz probe interface | R&S®RT-ZC15B | 1409.8227.02 |
| 100 MHz, AC/DC, 0.1 V/A, 30 A (RMS), BNC interface | R&S®RT-ZC20 | 1409.7766K02 |
| 100 MHz, AC/DC, 0.1 V/A, 30 A (RMS), Rohde & Schwarz probe interface | R&S®RT-ZC20B | 1409.8233.02 |
| 120 MHz, AC/DC, 1 V/A, 5 A (RMS), BNC interface | R&S®RT-ZC30 | 1409.7772K02 |
| **EMC near-field probes** | | |
| Probe Set for E and H Near-Field Measurements, 30 MHz to 3 GHz | R&S®HZ-15 | 1147.2736.02 |
| **Logic probes** | | |
| 400 MHz Logic Probe, 8 channels | R&S®RT-ZL04 | 1333.0721.02 |
| **Probe accessories** | | |
| Probe Power Supply for R&S®RT-ZC10/20/30 | 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-ZD20/30 probes | R&S®RT-ZA15 | 1410.4744.02 |
| Probe Pouch | R&S®RT-ZA19 | |
| Power Deskew and Calibration Test Fixture | R&S®RT-ZF20 | 1800.0004.02 |
| 3D Positioner with central tensioning knob for easy clamping and positioning of probes (span width: 200 mm, clamping range: 15 mm) | R&S®RT-ZA1P | 1326.3641.02 |
| **Choose your accessories** | | |
| Front Cover | R&S®RTB-Z1 | 1333.1728.02 |
| Soft Bag | R&S®RTB-Z3 | 1333.1734.02 |
| Rackmount Kit | R&S®ZZA-RTB2K | 1333.1711.02 |

## Application packages

| Designation | Consists of | Type | Order No. |
|---|---|---|---|
| **Low-speed serial bus package** | | | |
| R&S®RTM3004 | R&S®RTM3004<br>R&S®RTM-K1<br>R&S®RTM-K2<br>R&S®RTM-K15<br>R&S®RTM-B1 | R&S®RTM3K-LSSB | 1335.9149P02 |
| **High voltage power package** | | | |
| R&S®RTM3002 | R&S®RTM3002<br>R&S®RT-ZHD60 | R&S®RTM3K-HVP | 1335.9132P02 |
| R&S®RTM3004 | R&S®RTM3004<br>R&S®RT-ZHD60 | R&S®RTM3K-HVP | 1335.9132P04 |
| **Power supply package** | | | |
| R&S®RTM3004 | R&S®RTM3004<br>R&S®RT-ZHD07<br>R&S®RT-ZC15B | R&S®RTM3K-PS | 1335.9126P02 |

| Warranty | |
|---|---|
| Base unit | 3 years |
| All other items [1] | 1 year |
| **Options** | |
| 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 |
| Extended Warranty with Accredited Calibration Coverage, one year | R&S®AW1 |
| Extended Warranty with Accredited Calibration Coverage, two years | R&S®AW2 |

[1] For options that are installed, the remaining base unit warranty applies if longer than 1 year. Exception: all batteries have a 1 year warranty.

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