

# RTM3000 Digital Oscilloscope Getting Started



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Getting Started



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# 1 For Your Safety

The R&S RTM3000 digital oscilloscope is designed for measurements on circuits that are only indirectly connected to the mains or not connected at all. It is not rated for any measurement category.

The instrument is rated for pollution degree 2 - for indoor, dry location use where only non-conductive pollution occurs. Temporary conductivity caused by condensation is possible.

The instrument must be controlled by personnel familiar with the potential risks of measuring electrical quantities. Observe applicable local or national safety regulations and rules for the prevention of accidents.

Safety information is part of the product documentation. It warns you about the potential dangers and gives instructions how to prevent personal injury or damage caused by dangerous situations. Safety information is provided as follows:

- The "Basic Safety Instructions" in different languages are delivered as a printed brochure with the instrument.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

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## **WARNING**

### **Risk of injury**

The instrument must be used in an appropriate manner to prevent electric shock, personal injury, or fire:

- Do not open the instrument casing.
  - Do not use the instrument if you detect or suspect any damage of the instrument or accessories.
  - Do not operate the instrument in wet, damp or explosive atmospheres.
  - Do not use the instrument to ascertain volt-free state.
  - Do not exceed the voltage limits given in [Chapter 4.1.1, "Input Connectors"](#), on page 14.
-

**NOTICE****Risk of instrument damage due to inappropriate operating conditions**

An unsuitable operating site or test setup can damage the instrument and connected devices. Before switching on the instrument, observe the information on appropriate operating conditions provided in the data sheet. In particular, ensure the following:

- All fan openings are unobstructed and the airflow perforations are unimpeded. The minimum distance from the wall is 10 cm.
- The instrument is dry and shows no sign of condensation.
- The instrument is positioned as described in the following sections.
- The ambient temperature does not exceed the range specified in the data sheet.
- Signal levels at the input connectors are all within the specified ranges.
- Signal outputs are connected correctly and are not overloaded.

**NOTICE****Instrument damage caused by electrostatic discharge**

Electrostatic discharge (ESD) can damage the electronic components of the instrument and the device under test (DUT). Electrostatic discharge is most likely to occur when you connect or disconnect a DUT or test fixture to the instrument's test ports. To prevent electrostatic discharge, use a wrist strap and cord and connect yourself to the ground, or use a conductive floor mat and heel strap combination.

Electromagnetic interference (EMI) may affect the measurement results.

To suppress generated electromagnetic interference (EMI):

- Use suitable shielded cables of high quality. For example, use double-shielded RF and LAN cables.
- Always terminate open cable ends.
- Note the EMC classification in the data sheet.

## 2 Documentation Overview

This section provides an overview of the R&S RTM3000 user documentation.

### 2.1 Manuals and Instrument Help

You find the manuals on the product page at:

[www.rohde-schwarz.com/manual/rtm3000](http://www.rohde-schwarz.com/manual/rtm3000)

#### Getting started manual

Introduces the R&S RTM3000 and describes how to set up the product. A printed English version is included in the delivery.

#### User manual

Contains the description of all instrument modes and functions. It also provides an introduction to remote control, a complete description of the remote control commands with programming examples, and information on maintenance and instrument interfaces. Includes the contents of the getting started manual.

The *online version* of the user manual provides the complete contents for immediate display on the internet.

#### Instrument help

The help offers quick, context-sensitive access to the functional description directly on the instrument.

#### Basic safety instructions

Contains safety instructions, operating conditions and further important information. The printed document is delivered with the instrument.

#### Instrument security procedures manual

Deals with security issues when working with the R&S RTM3000 in secure areas.

#### Service manual

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists. The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS, <https://gloris.rohde-schwarz.com>).

## 2.2 Data Sheet and Brochure

The data sheet contains the technical specifications of the R&S RTM3000. It also lists the options with their order numbers and optional accessories. The brochure provides an overview of the instrument and deals with the specific characteristics.

See [www.rohde-schwarz.com/brochure-datasheet/rtm3000](http://www.rohde-schwarz.com/brochure-datasheet/rtm3000)

## 2.3 Calibration Certificate

The document is available on <https://gloris.rohde-schwarz.com/calcert>. You need the device ID of your instrument, which you can find on a label on the rear panel.

## 2.4 Release Notes and Open Source Acknowledgment

The release notes list new features, improvements and known issues of the current firmware version, and describe the firmware installation. The open source acknowledgment document provides verbatim license texts of the used open source software.

See [www.rohde-schwarz.com/firmware/rtm3000](http://www.rohde-schwarz.com/firmware/rtm3000). The open source acknowledgment document can also be read directly on the instrument.

## 3 Preparing for Use

### 3.1 Unpacking and Checking the Instrument

1. Inspect the package for damage.

If the packaging material shows any signs of stress, notify the carrier who delivered the instrument.

2. Carefully unpack the instrument and the accessories.
3. Check the equipment for completeness. See section "Delivery contents" on page 9.

4. Check the equipment for damage.

If there is damage, or anything is missing, immediately contact the carrier as well as your distributor. Make sure not to discard the box and packing material.



#### Packing material

Retain the original packing material. If the instrument needs to be transported or shipped later, you can use the material to protect the control elements and connectors.

#### Delivery contents

The delivery package contains the following items:

- R&S RTM3000 digital oscilloscope
- R&S RT-ZP05 probes (2x for R&S RTM3002; 4x for R&S RTM3004)
- Country-specific power cable
- Printed "Getting Started" manual
- Printed "Basic Safety Instructions" brochure

### 3.2 Positioning the Instrument

The instrument is designed for use under laboratory conditions. It can be used in standalone operation on a bench top or can be installed in a rack.

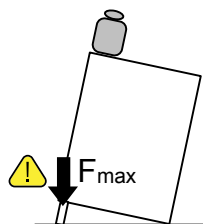
For standalone operation, place the instrument on a horizontal bench with even, flat surface. The instrument can be used in horizontal position, or with the support feet on the bottom extended.

The instrument can be installed in a 19" rack mount using a rack mount kit. The order number of the rack mount kit is given in the data sheet. The installation instructions are part of the rack mount kit.

**CAUTION****Risk of injury if feet are folded out**

The feet can fold in if they are not folded out completely or if the instrument is shifted. This can cause damage or injury.

- Fold the feet completely in or out to ensure stability of the instrument. Never shift the instrument when the feet are folded out.
- When the feet are folded out, do not work under the instrument or place anything underneath.
- The feet can break if they are overloaded. The overall load on the folded-out feet must not exceed 200 N.

**NOTICE****Risk of instrument damage due to overheating**

An insufficient airflow can cause the R&S RTM3000 to overheat, which can impair the measurement results, disturb the operation, and even cause damage.

- Ensure that all fan openings are unobstructed and that the airflow perforations are unimpeded. The minimum distance to a wall is 10 cm.
- When placing several instruments side by side, keep a minimum distance of 20 cm between the instruments. Ensure that the instruments do not draw in the preheated air from their neighbors.
- When mounting the instrument in a rack, observe the instructions of the rack manufacturer to ensure sufficient airflow and avoid overheating.

### 3.3 Starting the Instrument

The R&S RTM3000 can be used with different AC power voltages and adapts itself automatically to it.

The nominal ranges are:

- 100 V to 240 V AC at 50 Hz to 60 Hz
- 1.6 A to 0.7 A
- max. 160 W



**CAUTION****Risk of injury**

Connect the instrument only to an outlet that has a ground contact.

Do not use an isolating transformer to connect the instrument to the AC power supply.

**To start the instrument**

1. Connect the power cable to the AC power connector on the rear panel of the R&S RTM3000.
2. Connect the power cable to the socket outlet.
3. Switch the main power switch at the rear of the instrument to position I.  
The STANDBY key lights up. The key is located in the bottom left corner of the front panel.
4. Press the STANDBY key.  
The instrument performs a system check and starts the firmware.

**Warm-up and prepare the instrument**

Make sure that the instrument has been running and warming up before you start the self-alignment and the measurements. The minimum warm-up time is about 30 min.

**To power off the instrument**

1. Press the STANDBY key.  
All current settings are saved, and the software shuts down. All data transfers and running processes are interrupted.
2. Switch the main power switch at the rear of the instrument to position 0.
3. Disconnect the AC power cable from the AC power supply.

**Overview of power switch and STANDBY key actions**

Action	Condition	Result	STANDBY
Set power switch to I.	STANDBY key was <i>off</i> when switching power switch to 0.	Instrument is in standby mode.	Yellow
	STANDBY key was <i>on</i> when switching power switch to 0.	Instrument performs system check and boots the firmware. It is ready for operation.	Green
Switch STANDBY on.	Power switch is on.		

Action	Condition	Result	STANDBY
Switch STANDBY off.	Power switch is on.	Software shuts down. All instrument settings are saved, running data transfers and processes are interrupted (e.g., self-alignment). Instrument is in standby mode.	Yellow
Set power switch to 0.	Instrument is working, STANDBY is Green.	Software shuts down. All instrument settings are saved, running data transfers and processes are interrupted (e.g., self-alignment). No power on the instrument.	Off
Set power switch to 0.	Instrument is in standby mode, STANDBY is Yellow.	No power on the instrument.	Off

### 3.4 Replacing the Fuse

The instrument is protected by a fuse. You can find it on the rear panel between the main power switch and AC power supply.

Type of fuse: Size 5x20 mm, 250V~, T3.15H (slow-blow), IEC60127-2/5

#### **WARNING**

##### **Risk of electric shock**

The fuse is part of the main power supply. Therefore, handling the fuse while power is on can lead to electric shock. Before opening the fuse holder, make sure that the instrument is switched off and disconnected from all power supplies.

Always use fuses supplied by Rohde & Schwarz as spare parts, or fuses of the same type and rating.

1. Pull the fuse holder out of its slot on the rear panel.
2. Exchange the fuse.
3. Insert the fuse holder carefully back in its slot until it latches.

## 4 Instrument Tour

### 4.1 Front View

Figure 4-1 shows the front panel of the R&S RTM3000. The function keys are grouped in functional blocks to the right of the display.

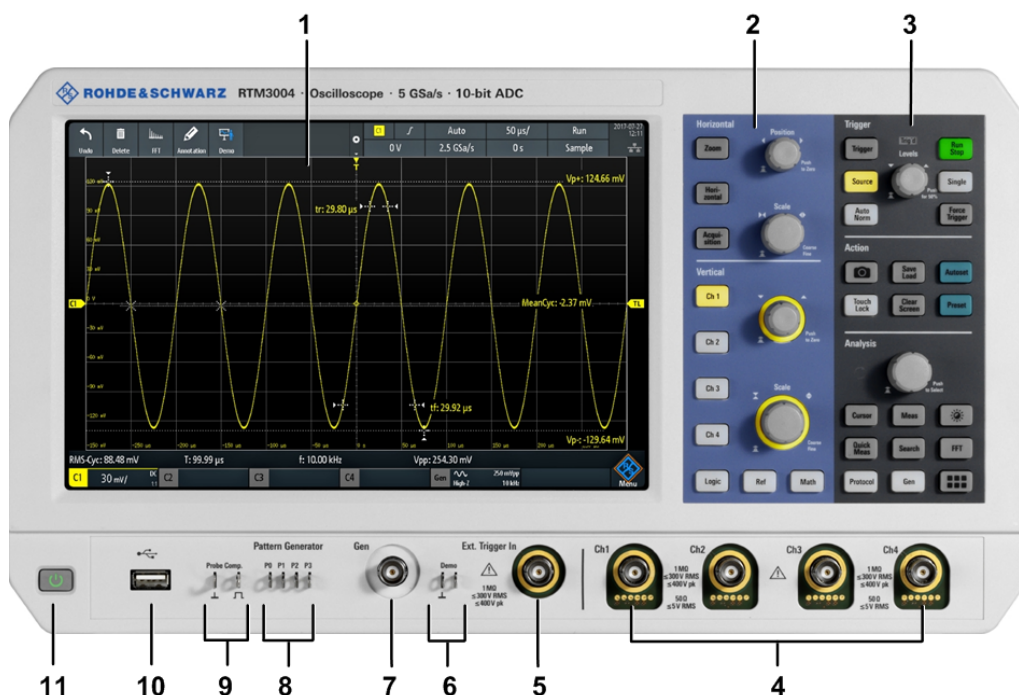
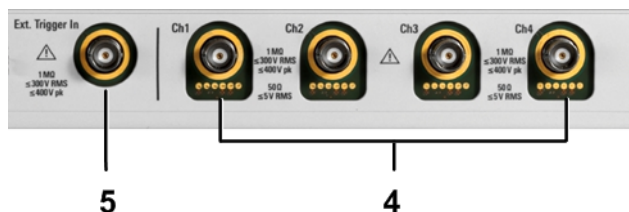


Figure 4-1: Front panel of R&S RTM3000 with 4 input channels

- 1 = Display
- 2 = Horizontal and vertical setup controls
- 3 = Trigger settings, action and analysis controls
- 4 = Analog input channels (BNC)
- 5 = External trigger input
- 6 = Connectors for demo signal output
- 7 = Connector for optional function generator output (BNC, R&S RTM-B6)
- 8 = Connectors for optional pattern generator (R&S RTM-B6)
- 9 = Connectors for probe compensation
- 10 = USB connector
- 11 = STANDBY key

The R&S RTM3002 has 2 input channels, and the R&S RTM3004 has 4 input channels.

### 4.1.1 Input Connectors



#### BNC inputs (4 and 5)

The R&S RTM3000 has two or four channel inputs (4) to connect the input signals. The external trigger input (5) is used to control the measurement by an external signal. The trigger level can be set from -5 V to 5 V.

For channel connectors, the input impedance is selectable, the values are 50  $\Omega$  and 1 M $\Omega$ .

#### **WARNING**

##### Risk of electrical shock - maximum input voltages

The maximum input voltage on *channel inputs* must not exceed:

- 400 V (peak) and 300 V (RMS) at 1 M $\Omega$  input impedance
- 30 V (peak) and 5 V (RMS) at 50  $\Omega$  input impedance

For the *external trigger input*, the maximum input voltage is 400 V (peak) and 300 V (RMS) at 1 M $\Omega$  input impedance.

Transient overvoltages must not exceed 400 V (peak).

For further specifications, refer to the data sheet.

Voltages higher than 30 V (RMS) or 42 V (peak) or 60 V DC are regarded as hazardous contact voltages. When working with hazardous contact voltages, use appropriate protective measures to preclude direct contact with the measurement setup:

- Use only insulated voltage probes, test leads and adapters.
- Do not touch voltages higher than 30 V (RMS) or 42 V (peak) or 60 V DC.

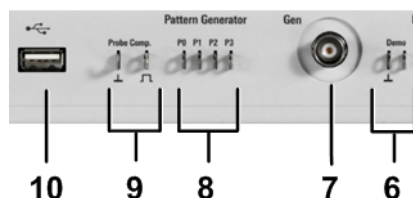
## ⚠ CAUTION

### Risk of injury and instrument damage

The instrument is not rated for any measurement category. When measuring in circuits with transient overvoltages of category II, III or IV circuits, make sure that no such overvoltages reach the R&S RTM3000 input. Therefore, use only probes that comply with DIN EN 61010-031. When measuring in category II, III or IV circuits, always insert a probe that appropriately reduces the voltage so that no transient overvoltages higher than 400 V (peak) are applied to the instrument. For detailed information, refer to the documentation and safety information of the probe manufacturer.

Explanation: According to section AA.2.4 of EN 61010-2-030, measuring circuits without any measurement category are intended for measurements on circuits which are not directly connected to the mains.

## 4.1.2 Other Connectors on the Front Panel



### DEMO (6)

The pins are intended for demonstration purposes.

### GEN: Function Generator (7)



BNC output of the function generator (with option R&S RTM-B6).

### PATTERN GENERATOR (8)

Connectors for the pattern generator P0, P1, P2, P3.

### PROBE COMP. (9)

Probe compensation terminal to support adjustment of passive probes to the oscilloscope channel.

-  Square wave signal for probe compensation.
-  Ground connector for probes.

### USB type A (10)

USB 2.0 type A interface to connect a mouse or a keyboard, or a USB flash drive for storing and reloading instrument settings and measurement data, and to update the firmware.

## 4.2 Side View

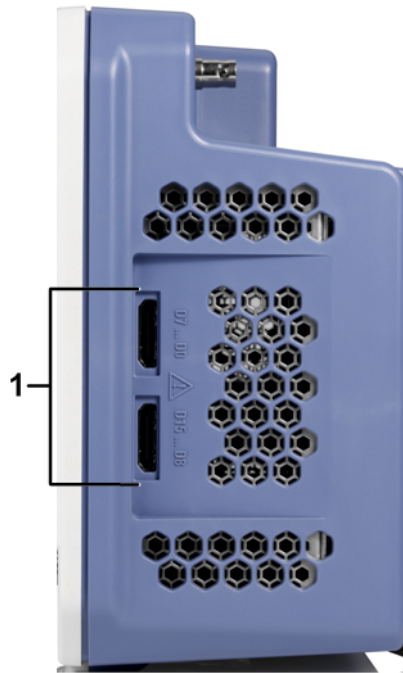


Figure 4-2: Side view of R&S RTM3000

1 = Connectors for logic probe (Mixed Signal Option R&S RTM-B1)

### Logic probe

The connectors for logic channels can be used if the Mixed Signal Option R&S RTM-B1 is installed. The option provides connectors for two logical probes with 8 digital channels each (D0 to D7 and D8 to D15).

The maximum input voltage is 40 V (peak) at 100 k $\Omega$  input impedance. The maximum input frequency for a signal with the minimum input voltage swing and medium hysteresis of 800 mV (V<sub>pp</sub>) is 400 MHz.

## 4.3 Rear View

Figure 4-3 shows the rear panel of the R&S RTM3000 with its connectors.

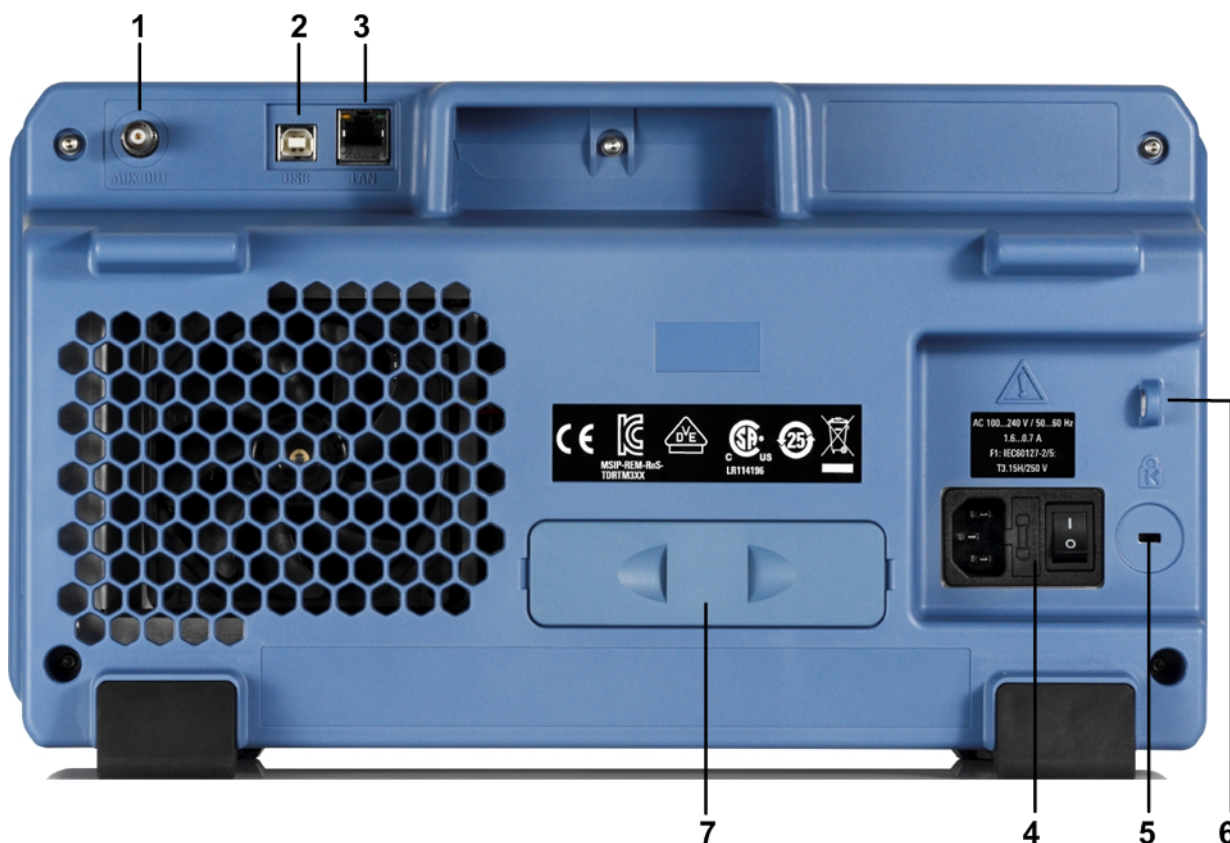


Figure 4-3: Rear panel view of R&S RTM3000

- 1 = Aux Out connector
- 2 = USB connector, type B
- 3 = LAN connector
- 4 = AC power supply connector and main power switch
- 5 = Kensington lock slot to secure the instrument against theft
- 6 = Loop for lock to secure the instrument against theft
- 7 = not used

#### AUX OUT (1)

Multi-purpose BNC output that can function as pass/fail and trigger output, and output of 10 MHz reference frequency.

#### USB type B (2)

USB 2.0 interface of type B (device USB) for remote control of the instrument.

**Note:** Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, use only USB connecting cables with a maximum length of 1 m.

#### LAN (3)

8-pin connector RJ-45 used to connect the instrument to a Local Area Network (LAN). It supports up to 1 Gbit/s.

#### AC supply: mains connector and main power switch (4)

The instrument supports a wide range power supply. It automatically adjusts to the correct range for the applied voltage. There is no line voltage selector.

The AC main power switch disconnects the instrument from the AC power line.