

# R&S® RTB2000

## Digital Oscilloscope

### Getting Started



1333160502

This manual describes the following R&S®RTB2000 models:

- R&S®RTB2002 (1333.1005K02)
- R&S®RTB2004 (1333.1005K04)

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Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol , e.g. R&S®RTB2000 is indicated as R&S RTB2000.

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# 1 Safety Information

The R&S RTB2000 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**

Use the instrument 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.
  - Make sure that the instrument is properly grounded.
  - 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 16.
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**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.

## 2 Documentation Overview

This section provides an overview of the R&S RTB2000 user documentation.

### 2.1 Manuals and Instrument Help

You find the manuals on the product page at:

[www.rohde-schwarz.com/manual/rtb2000](http://www.rohde-schwarz.com/manual/rtb2000)

#### Getting started manual

Introduces the R&S RTB2000 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 RTB2000 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 RTB2000. 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/rtb2000](http://www.rohde-schwarz.com/brochure-datasheet/rtb2000)

## 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/rtb2000](http://www.rohde-schwarz.com/firmware/rtb2000). 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.

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#### **Delivery contents**

The delivery package contains the following items:

- R&S RTB2000 digital oscilloscope
- R&S RT-ZP03 probes (2x for R&S RTB2002; 4x for R&S RTB2004)
- 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.

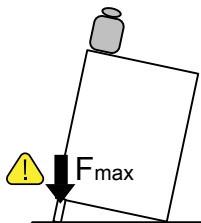
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### **⚠ CAUTION**

#### **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 RTB2000 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 performances 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

### 3.3.1 Powering On

The R&S RTB2000 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
- 0.95 A to 0.5 A
- max. 60 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.

1. Connect the power cable to the AC power connector on the rear panel of the R&S RTB2000.
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.

You can leave the main power switch on to preserve your last instrument settings. To disconnect from power supply, power off the instrument.

### 3.3.2 Starting Up and Shutting Down

#### To start up the instrument

1. Make sure that the R&S RTB2000 is connected to the AC power supply and the main power switch on the rear panel is in position I.
2. Press the [Standby] key. The key is located in the bottom left corner of the front panel.

The instrument performs a system check and starts the firmware. If the previous session was terminated regularly, the oscilloscope uses the last settings.

**Table 3-1: Colors of the [Standby] key**

Green	Instrument is on: firmware is working
Yellow	Standby: instrument is off, main power switch is on



#### 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 20 min.

#### To shut down the instrument to standby state

- Press the [Standby] key.

All current settings are saved, and the software shuts down. Now it is safe to power off the instrument.

### 3.3.3 Powering Off

Powering off is required only if the instrument must be disconnected from all power supplies.

1. If the instrument is running, press the [Standby] key on the front panel to shut down the instrument.
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.

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**NOTICE****Risk of losing data**

If you switch off the running instrument using the rear panel switch or by disconnecting the power cord, the instrument loses its current settings. Furthermore, program data can be lost.

Press the Standby key first to shut down the application properly.

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### 3.3.4 EMI Suppression

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.

## 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~, T2.5H (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 Panel

Figure 4-1 shows the front panel of the R&S RTB2000. The function keys are grouped in functional blocks to the right of the display.

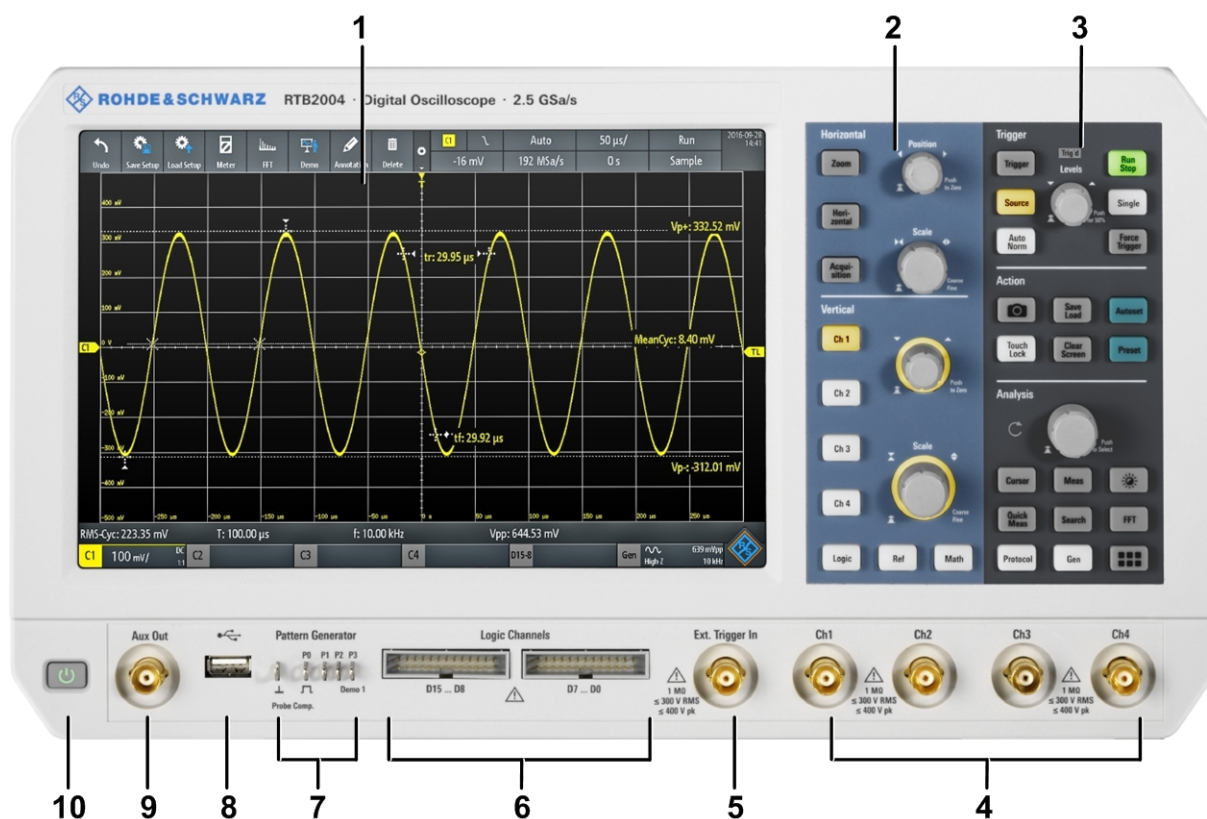
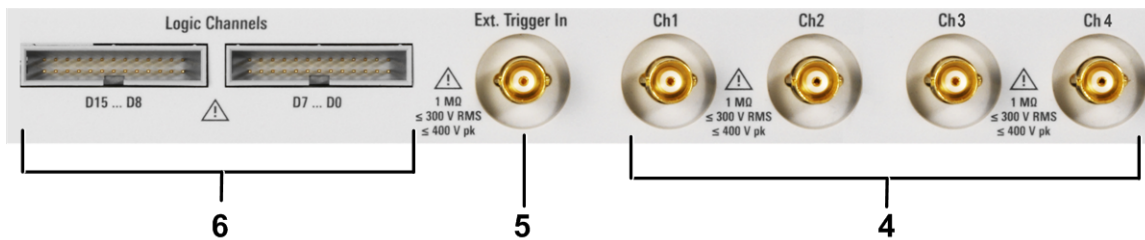


Figure 4-1: Front panel of R&S RTB2004 with 4 input channels

- 1 = Display
- 2 = Horizontal and vertical setup controls
- 3 = Trigger settings, action and analysis controls
- 4 = Analog input channels (2 channels at R&S RTB2002, 4 channels at R&S RTB2004)
- 5 = External trigger input
- 6 = Logic probe connectors (option R&S RTB-B1)
- 7 = Connectors for probe compensation and optional pattern generator (R&S RTB-B6)
- 8 = USB connector
- 9 = Aux Out connector
- 10 = [Standby] key

### 4.1.1 Input Connectors



#### BNC inputs (4 and 5)

The R&S RTB2000 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.

The input impedance of all BNC inputs is 1 MΩ.

#### **⚠ 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).

For the *external trigger input*, the maximum input voltage is 400 V (peak) and 300 V (RMS).

Transient overvoltages must not exceed 400 V (peak).

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**

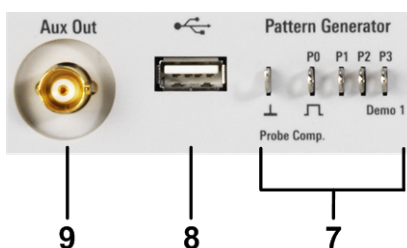
The instrument is not rated for any measurement category. When measuring in circuits with transient overvoltages of category II, III or IV circuits, make sure that no such overvoltages reach the R&S RTB2000 input. Therefore, use only probes that comply with DIN EN 61010-031. When measuring in category 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.

**Logic probe (6)**

The connectors for logic channels can be used if the Mixed Signal Option R&S RTB-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 300 MHz.

**4.1.2 Other Connectors on the Front Panel****[Pattern Generator] (7)**

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

The "Demo 1" signal is intended for demonstration purposes.

**[Probe Comp.] (7)**

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 (8)**

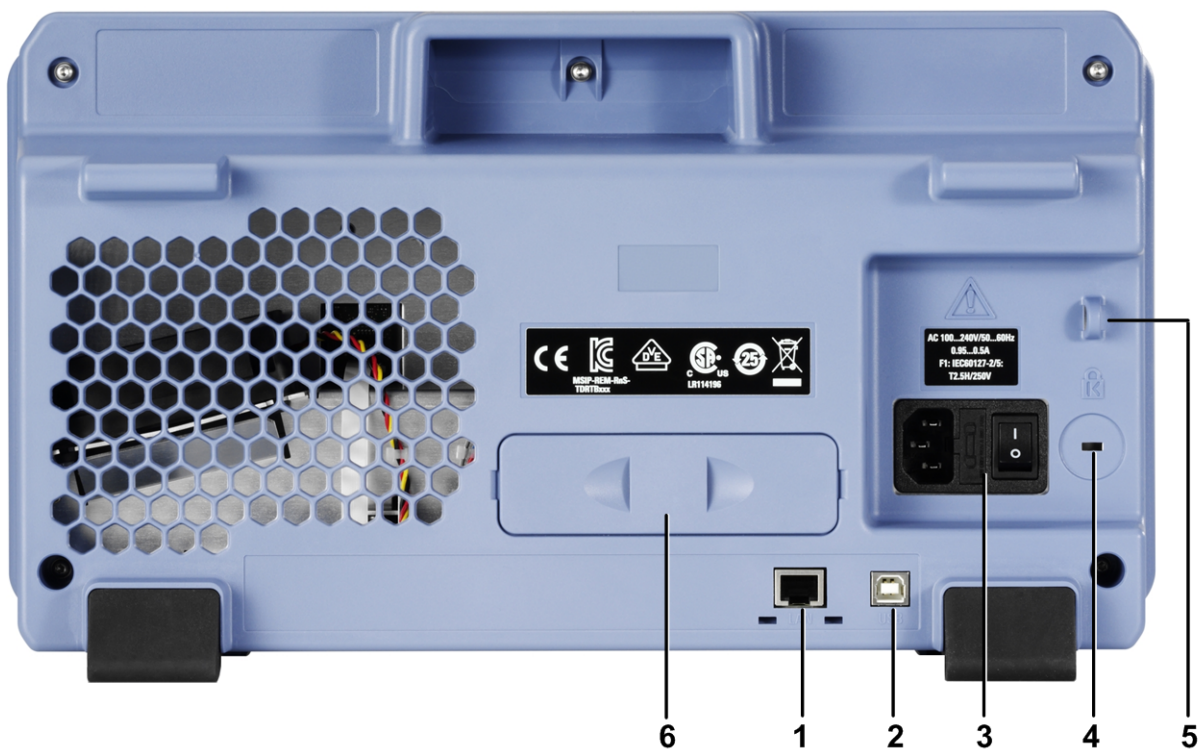
USB 2.0 type A interface to connect a mouse or a keyboard, or a USB flash drive for storing and reloading instrument settings and measurement data, and to update the firmware.

**[Aux Out] (9)**

Multi-purpose BNC output that can function as pass/fail and trigger output, output of 10 MHz reference frequency, and as waveform generator (with option R&S RTB-B6).

## 4.2 Rear Panel

Figure 4-2 shows the rear panel of the R&S RTB2000 with its connectors.



**Figure 4-2: Rear panel view of R&S RTB2000**

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

### **[LAN] (1)**

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

### **[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.

### **AC supply: mains connector and main power switch (3)**

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.