

R&S® RTO2000 Oscilloscope Getting Started



1332971902

Version 11

ROHDE & SCHWARZ
Make ideas real



This manual describes the following R&S®RTO models with firmware version 5.10 and higher:

- R&S®RTO2002 (1329.7002K02)
- R&S®RTO2004 (1329.7002K04)
- R&S®RTO2012 (1329.7002K12)
- R&S®RTO2014 (1329.7002K14)
- R&S®RTO2022 (1329.7002K22)
- R&S®RTO2024 (1329.7002K24)
- R&S®RTO2032 (1329.7002K32)
- R&S®RTO2034 (1329.7002K34)
- R&S®RTO2044 (1329.7002K44)
- R&S®RTO2064 (1329.7002K64)

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1332.9719.02 | Version 11 | R&S®RTO2000

Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol, e.g. R&S®RTO2000 is indicated as R&S RTO.

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1 Safety and regulatory information

The product documentation helps you to use the product safely and efficiently. Follow the instructions provided here and in the [Chapter 1.1, "Safety instructions"](#), on page 5.

Intended use

The R&S RTO 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 product is intended for the development, production and verification of electronic components and devices in industrial, administrative, and laboratory environments. Use the product only for its designated purpose. Observe the operating conditions and performance limits stated in the data sheet.

Where do I find safety information?

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

- In [Chapter 1.1, "Safety instructions"](#), on page 5. The same information is provided in many languages as printed "Safety Instructions". The printed "Safety Instructions" are delivered with the product.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

1.1 Safety instructions

Products from the Rohde & Schwarz group of companies are manufactured according to the highest technical standards. To use the products safely, follow the instructions provided here and in the product documentation. Keep the product documentation nearby and offer it to other users.

Use the product only for its intended use and within its performance limits. Intended use and limits are described in the product documentation such as the data sheet, manuals and the printed "Safety Instructions". If you are unsure about the appropriate use, contact Rohde & Schwarz customer service.

Using the product requires specialists or specially trained personnel. These users also need sound knowledge of at least one of the languages in which the user interfaces and the product documentation are available.

Never open the casing of the product. Only service personnel authorized by Rohde & Schwarz are allowed to repair the product. If any part of the product is damaged or broken, stop using the product. Contact Rohde & Schwarz customer service at <http://www.customersupport.rohde-schwarz.com>.

In these safety instructions, the term "product" covers instruments (oscilloscopes), probes and their accessories.

Lifting and carrying the instrument

Check the data sheet for the maximum weight of the instrument. A single person can only carry a maximum of 18 kg safely depending on age, gender and physical condition. If your instrument is heavier than 18 kg, do not move or carry it by yourself.

Use the instrument handles to move or carry the instrument. Do not use the mounted accessories instead of the handles. Accessories are not designed to carry the weight of the instrument.

To move the instrument safely, you can use lifting or transporting equipment such as lift trucks and forklifts. Follow the instructions provided by the equipment manufacturer.

Choosing the operating site

Only use the product indoors. The product casing is not waterproof. Water that enters can electrically connect the casing with live parts, which can lead to electric shock, serious personal injury or death if you touch the casing. If Rohde & Schwarz provides accessories designed for your product, e.g. a carrying bag, you can use the product outdoors.

You can operate the product up to the altitude specified in the data sheet. The lowest specified altitude for a product of the measurement setup defines the altitude for the complete setup.

The product is suitable for pollution degree 2 environments where nonconductive contamination can occur. For more information on environmental conditions such as ambient temperature and humidity, see the data sheet.

Setting up the product

Always place the product on a stable, flat and level surface with the bottom of the product facing down. If the product is designed for different positions, secure the product so that it cannot fall over.

If the product has foldable feet, always fold the feet completely in or out to ensure stability. The feet can collapse if they are not folded out completely or if the product is moved without lifting it. The foldable feet are designed to carry the weight of the product, but not an extra load.

If stacking is possible, keep in mind that a stack of products can fall over and cause injury.

If you mount products in a rack, ensure that the rack has sufficient load capacity and stability. Observe the specifications of the rack manufacturer. Always install the products from the bottom shelf to the top shelf so that the rack stands securely. Secure the product so that it cannot fall off the rack.

Connecting to power and grounding

The mains power supply input of the instrument complies with overvoltage category II. It has to be connected to a fixed installation used to supply energy-consuming equipment such as household appliances and similar loads. Be aware that electrically powered products have risks, such as electric shock, fire, personal injury or even death.

Take the following measures for your safety:

- Do not use an isolating transformer to connect the instrument to the mains power supply.
- Before switching on the product, ensure that the voltage and frequency indicated on the product match the available power source. If the power adapter does not adjust automatically, set the correct value and check the rating of the fuse.
- Only use the power cable delivered with the product. It complies with country-specific safety requirements. Only insert the plug into an outlet with protective conductor terminal.
- If a product has an exchangeable fuse, its type and characteristics are indicated next to the fuse holder. Before changing the fuse, switch off the instrument and disconnect it from the power source. How to change the fuse is described in the product documentation.

- Only use intact cables and route them carefully so that they cannot be damaged. Check the power cables regularly to ensure that they are undamaged. Also ensure that nobody can trip over loose cables.
- If the product needs an external power supply, use the power supply that is delivered with the product or that is recommended in the product documentation or a power supply that conforms to the country-specific regulations.
- Ensure that you can disconnect the product from the power source at any time. Pull the power plug to disconnect the product. The power plug must be easily accessible. If the product is integrated into a system that does not meet these requirements, provide an easily accessible circuit breaker at the system level.

Performing measurements

Take the following measures for your safety:

- To ascertain voltage-free state, use an appropriate voltage tester. Any measurement setup including an oscilloscope is not suitable for this purpose.
- The maximum input voltage on channel inputs and the external trigger input must not exceed the value specified in the data sheet.
- Observe all voltage and current ratings of the instrument, the probes, and the accessories. Limits and ratings are marked on the products and listed in the data sheets.
Consider that the rated voltage depends on the frequency. The voltage limitation curves or values are provided in the data sheet. Do not exceed the maximum measurement voltage from the probe tip to the probe reference lead.
- Never cause any short circuits when measuring sources with high output currents.
- Use only probes and accessories that comply with the measurement category (CAT) of your measurement task. The measurement category of the products is defined in the data sheet. If you use other than Rohde & Schwarz accessories, make sure that they are suitable for the instrument and the measurement task.
- Set the correct attenuation factor on the instrument according to the probe being used. Otherwise, the measurement results do not reflect the actual voltage level, and you might misjudge the actual risk.
- When working with high voltages and current probes, observe the additional operating conditions specified in this safety instructions.
- The probe pins are extremely pointed and can easily penetrate clothes and the skin. Handle the probe pins with great care. To exchange a probe pin, use

tweezers or pliers to avoid injuries. When transporting the accessories, always use the box supplied with the probe.

- Prevent the probe from receiving mechanical shock. Avoid putting excessive strain on the probe cable or exposing it to sharp bends. Touching a broken cable during measurements can cause injuries.
- Set up all probe connections to the instrument before applying power.

Working with hazardous voltages

Voltages higher than 30 V RMS, or 42 V peak, or 60 V DC are regarded as hazardous contact voltages. Direct contact with them can cause serious injuries.

Make sure that only electrically skilled persons use the products for measurements on hazardous contact voltages. These working conditions require special education and experience to perceive risks and to avoid hazards which electricity can create.

When working with hazardous contact voltages, use protective measures to preclude direct contact with the measurement setup:

- Do not touch exposed connections and components when power is applied.
- Switch off the test circuit while connecting and disconnecting probe leads.
- Use only insulated voltage probes, test leads and adapters.
- Make sure that the input leads fulfill the safety requirements for your measurement.

The delivered input leads might have a jacket wear indicator that indicates a worn jacket by different jacket color. In this case, do not use the input lead. Replace it with a new one.

- Do not use 4 mm banana plugs without protection against contact.

Working with current probes

When working with current probes, you can measure high-frequency currents or currents that contain high-frequency components.

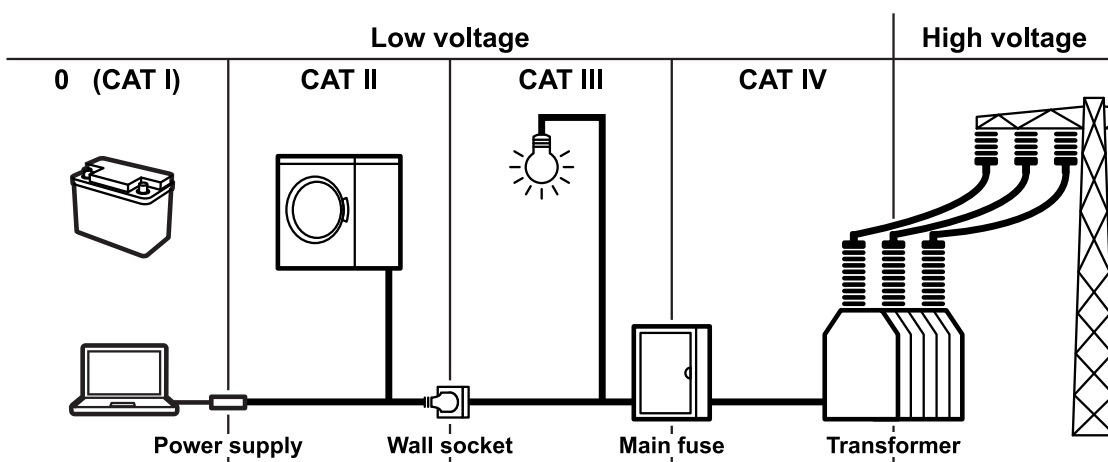
- Switch off the test circuit while connecting the probe.
- Do not attach the clamp to bare unisolated conductors. To avoid injury from a short circuit, measure at a location on an insulated wire where the insulation is sufficient for the circuit voltage.
- Connect the probe only to the secondary side of a breaker. With this measure, you avoid injury, if a short circuit occurs.

- The following effects can cause burns and fire or damage to the measurement site:
 - Eddy current loss can cause heating of the sensor head.
 - Dielectric heating can cause heating of cord insulation and other materials.

Measurement categories

IEC 61010-2-030 defines measurement categories that rate instruments on their ability to resist short transient overvoltages that occur in addition to the working voltage. Use the measurement setup only in electrical environments for which they are rated.

- 0 - Instruments without rated measurement category
For measurements performed on circuits not directly connected to mains, for example, electronics, circuits powered by batteries, and specially protected secondary circuits. This measurement category is also known as CAT I.
- CAT II:
For measurements performed on circuits directly connected to the low-voltage installation by a standard socket outlet, for example, household appliances and portable tools.
- CAT III:
For measurements performed in the building installation, such as junction boxes, circuit breakers, distribution boards, and equipment with permanent connection to the fixed installation.
- CAT IV:
For measurements performed at the source of the low-voltage installation, such as electricity meters and primary overcurrent protection devices.






Cleaning the product

Use a dry, lint-free cloth to clean the product. When cleaning, keep in mind that the casing is not waterproof. Do not use liquid cleaning agents.

Meaning of safety labels

Safety labels on the product warn against potential hazards.




	<p>Potential hazard</p> <p>Read the product documentation to avoid personal injury or product damage.</p>
	<p>Electrical hazard</p> <p>Indicates live parts. Risk of electric shock, fire, personal injury or even death.</p>
	<p>Protective conductor terminal</p> <p>Connect this terminal to a grounded external conductor or to protective ground. This protects you against electric shock should an electric problem occur.</p>

1.2 Labels on the product

Labels on the casing inform about:

- Personal safety, see "[Meaning of safety labels](#)" on page 11
- Product and environment safety, see [Table 1-1](#)
- Identification of the product

Table 1-1: Labels regarding product and environment safety

	Chassis grounding terminal
	Take care when handling electrostatic sensitive devices.
	<p>Labeling in line with EN 50419 for disposal of electrical and electronic equipment after the product has come to the end of its service life.</p> <p>For more information, see the product user manual, chapter "Disposal".</p>

1.3 Warning messages in the documentation

A warning message points out a risk or danger that you need to be aware of. The signal word indicates the severity of the safety hazard and how likely it will occur if you do not follow the safety precautions.

WARNING

Potentially hazardous situation. Could result in death or serious injury if not avoided.

CAUTION

Potentially hazardous situation. Could result in minor or moderate injury if not avoided.

NOTICE

Potential risks of damage. Could result in damage to the supported product or to other property.

1.4 Korea certification class A



이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

2 Key features

The R&S RTO oscilloscope brings various benefits in your daily work. Outstanding key features are:

Best oscilloscope performance:

- Up to 16-bit vertical resolution
- Trigger on any detail you can see
- Quickly find signal faults with 1 Million waveforms/s
- Integrated spectrum analysis

Widest range of capabilities:

- Fast acquisition rate even with industry leading 2 Gsample deep memory
- First zone trigger in time and frequency domain
- Analyze previous acquisitions - always available in history buffer
- Deep toolset for signal analysis

Powerful user interface:

- High-resolution 12.1" capacitive touchscreen with gesture support
- Easily customizable waveform display with SmartGrid
- Fast access to important tools
- Documentation at the press of a button

Engineered for multi-domain challenges:

- Class leading MSO
- Trigger and decode for serial protocols
- Advanced spectrum analysis
- Integrated arbitrary waveform and pattern generator
- Power measurements
- Signal integrity testing with advanced eye and jitter analysis
- Automatic compliance tests
- EMI debugging with oscilloscopes
- IQ and RF analysis
- Extensive probe portfolio for voltage, current and more

For a detailed specification refer to the data sheet.

3 Documentation overview

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

3.1 Manuals and instrument help

You find the manuals on the product page at:

www.rohde-schwarz.com/manual/rto

Getting started manual

Introduces the R&S RTO and describes how to set up and start working with the instrument, and describes basic operations. A printed English version is included in the delivery. Editions in other languages are available on the product website.

Instrument help

The help offers quick, context-sensitive access to the complete information for the firmware basic functionality and applications.

User manual (Instrument)

Describes all instrument functions in detail. 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.

Manuals for compliance test options

For compliance test options, extra test procedure manuals are available. Test fixtures are described in printed manuals, which are delivered with the fixture.

- The following test procedure manuals are available:
 - USB 2.0 Compliance Test Procedures
 - Ethernet Compliance Tests Procedures
 - MIPI D-PHY Compliance Tests Procedures

- eMMC Compliance Tests Procedures
- PCIe Compliance Tests Procedures
- DDR3 Compliance Tests Procedures
- ScopeSuite Automation
- The following test fixture manuals are available:
 - R&S RT-ZF1 USB 2.0 Compliance Test Fixture Set
 - R&S RT-ZF2 Ethernet Compliance Test Fixture Set
 - R&S RT-ZF3 Frequency Converter Board (100BASE-T1)
 - R&S RT-ZF4 10BASE-Te Test Fixture
 - R&S RT-ZF5 Ethernet Probing Fixture
 - R&S RT-ZF6 Frequency Converter Board (1000BASE-T1)
 - R&S RT-ZF7 Automotive Ethernet T&D Fixture
 - R&S RT-ZF7A SMA Adaptor
 - R&S RT-ZF8 Automotive Ethernet Compliance Test Fixture

Safety instructions

Provides safety information in many languages. The printed document is delivered with the product.

Instrument security procedures manual

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

Service Manual

Describes the performance test for checking the rated specifications, module replacement, 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>).

3.2 Data sheet and brochure

The data sheet contains the technical specifications of the R&S RTO. 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.

Application notes, application cards, videos

See www.rohde-schwarz.com/brochure-datasheet/rto

3.3 Release notes, 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. It can also be read directly on the instrument.

See www.rohde-schwarz.com/firmware/rto.

3.4 Application notes, application cards, videos

These documents deal with special applications or background information on particular topics.

See www.rohde-schwarz.com/application/rto and [Oscilloscopes Application Videos - Media Center](#)

4 Preparing for use

Here, you can find basic information about setting up the instrument for the first time or when changing the operating site.

4.1 Lifting and carrying

See: "[Lifting and carrying the instrument](#)" on page 6.

4.2 Unpacking and checking

1. Unpack the product carefully.
2. Retain the original packing material. Use it when transporting or shipping the product later.
3. Using the delivery notes, check the equipment for completeness.
4. Check the equipment for damage.

If the delivery is incomplete or equipment is damaged, contact Rohde & Schwarz.

4.3 Choosing the operating site

Specific operating conditions ensure proper operation and avoid damage to the product and connected devices. For information on environmental conditions such as ambient temperature and humidity, see the data sheet.

See also "[Choosing the operating site](#)" on page 6.

Electromagnetic compatibility classes

The electromagnetic compatibility (EMC) class indicates where you can operate the product. The EMC class of the product is given in the data sheet under "General data".

- Class B equipment is suitable for use in:
 - Residential environments
 - Environments that are directly connected to a low-voltage supply network that supplies residential buildings
- Class A equipment is intended for use in industrial environments. It can cause radio disturbances in residential environments due to possible conducted and radiated disturbances. It is therefore not suitable for class B environments. If class A equipment causes radio disturbances, take appropriate measures to eliminate them.

4.4 Setting up the product

When setting up the instrument, follow the safety instructions:

- ["Setting up the product"](#) on page 7
- ["Intended use"](#) on page 5

4.4.1 Placing the product on a bench top

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

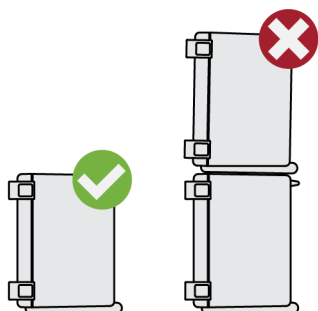
To place the product on a bench top

1. Place the product on a stable, flat and level surface. Ensure that the surface can support the weight of the product. For information on the weight, see the data sheet.
2. **CAUTION!** Foldable feet can collapse. See ["Setting up the product"](#) on page 7.

Always fold the feet completely in or out. With folded-out feet, do not place anything on top or underneath.

Setting up the product

3. **CAUTION!** The product can fall over and cause injury. The top surface is too small for stacking. Never stack another product on top of the product.



As an alternative, you can mount several products in a rack.

4. **NOTICE!** Overheating can damage the product.
Prevent overheating as follows:
 - Keep a minimum distance of 10 cm between the fan openings of the product and any object in the vicinity.
 - Do not place the product next to heat-generating equipment such as radiators or other products.

4.4.2 Mounting the product in a rack

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

To prepare the rack

1. Observe the requirements and instructions in "[Setting up the product](#)" on page 7.
2. **NOTICE!** Insufficient airflow can cause overheating and damage the product. Design and implement an efficient ventilation concept for the rack.

To mount the R&S RTO in a rack

1. Use an adapter kit that fits the dimensions of the R&S RTO to prepare the instrument for rack mounting. For information on the dimensions, see data sheet.
 - a) Order the rack adapter kit designed for the R&S RTO. For the order number, see data sheet.

Considerations for test setup

- b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.
2. Push the product onto the shelf until the rack brackets fit closely to the rack.
3. Tighten all screws at the rack brackets with a tightening torque of 1.2 Nm to secure the product at the rack.

To unmount the product from a rack

1. Loosen the screws at the rack brackets.
2. Remove the product from the rack.
3. If placing the product on a bench top again, unmount the adapter kit from the product. Follow the instructions provided with the adapter kit.

4.5 Considerations for test setup

Observe safety instructions, see "[Performing measurements](#)" on page 8.

Cable selection and electromagnetic interference (EMI)

Electromagnetic interference (EMI) can affect the measurement results.

To suppress electromagnetic radiation during operation:

- Use high-quality shielded cables, for example, double-shielded RF and LAN cables.
- Always terminate open cable ends.
- Ensure that connected external devices comply with EMC regulations.

Measuring accessories

Use only probes and measuring accessories that comply with IEC 61010-031.

Signal input and output levels

Information on signal levels is provided in the data sheet. Keep the signal levels within the specified ranges to avoid damage to the product and connected devices.

Preventing electrostatic discharge (ESD)

Electrostatic discharge is most likely to occur when you connect or disconnect a DUT.

- ▶ **NOTICE!** Risk of electrostatic discharge. Electrostatic discharge can damage the electronic components of the product and the device under test (DUT).

Ground yourself to prevent electrostatic discharge damage:

- a) Use a wrist strap and cord to connect yourself to ground.
- b) Use a conductive floor mat and heel strap combination.

During operation, if the firmware observes a serious unexpected disturbance (e.g. due to ESD), it resets some hardware components and initiates a new alignment to ensure proper instrument functioning. Then it restores the user settings to the state before the disturbance.

4.6 Connecting to power

For safety information, see "[Connecting to power and grounding](#)" on page 7.

The R&S RTO 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 and 400 Hz, with maximal 10% voltage fluctuation on line
- max. 5.5 A to 2.3 A

1. Plug the AC power cable into the AC power connector on the rear panel of the product. Only use the AC power cable delivered with the product.
2. Plug the AC power cable into a power outlet with ground contact.

The required ratings are listed next to the AC power connector and in the data sheet.

4.7 Switching on or off

The instrument is switched on or off with the power switch and the [Power] key. The [Power] key is located in the bottom left corner of the front panel. The power switch is located at the rear panel of the instrument.

Table 4-1: Overview of power states

Status	LED	Power switch
Off	● (unlighted)	[0] (off)
Standby	● orange	[I] (on)
Ready	● green	[I] (on)

To switch on the product

The product is off but connected to power.

1. Set the switch on the power supply to position [I].

The power key on the front panel lights up.

2. Press the [Power] key on the front panel.

The instrument performs a system check, boots the operating system, and then starts the R&S RTO firmware.

The [Power] key turns green and the illuminated keys on the front panel light up. If the previous session was terminated regularly, the oscilloscope uses the last settings.


Before you start measurements, be sure to comply with the warm-up phase specified in the data sheet.

To shut down the product

The product is in the ready state.

- ▶ Press the [Power] key.

All current settings are saved, and the software shuts down. The [Power] key turns orange. The standby power supplies only the power switch circuits.

The  "Exit" icon in the "Menu" shuts down only the firmware application. To shut down the instrument completely, use the [Power] key.

To disconnect from power

The product is in the standby state.

1. **NOTICE!** Risk of data loss. If you disconnect the product from power when it is in the ready state, you can lose settings and data. Shut it down first.
Set the switch on the power supply to position [0].
The LED of the [Power] key is switched off.
2. Disconnect the product from the power source.

4.8 Connecting external devices

The following interfaces for external devices are provided:

- USB connectors at the front and rear panel of the instrument
- Monitor connectors DVI-D and DisplayPort at the rear panel of the instrument
- [Connecting USB devices](#)..... 23
- [Connecting an external monitor](#)..... 25

4.8.1 Connecting USB devices

The USB interfaces on the front and rear panels allow you to connect USB devices directly to the instrument. The number of USB connectors can be increased by using USB hubs. Due to the large number of available USB devices, there is almost no limit to the expansions that are possible with the R&S RTO.

The following USB devices can be useful, for example:

- USB flash drives to save screenshots and measurement results, and for easy installation of firmware applications
- Keyboard and/or mouse to simplify the operation and the entry of data, comments, filenames, etc.

You can connect or disconnect all USB devices during operation of the instrument.

Installing USB devices on R&S RTO is easy under the Windows operating system, because all USB devices are plug&play. After a device is connected to the USB interface, Windows automatically searches for a suitable device driver.

Connecting external devices

If the operating system does not find a suitable driver, it prompts you to specify a directory that contains the driver software. If the driver software is on a storage media, connect the appropriate drive to the instrument before proceeding. If the instrument is integrated in a network, you can also install driver data stored in a network directory.

When a USB device is disconnected from the R&S RTO, Windows immediately detects the change in hardware configuration and deactivates the corresponding driver.

The properties of external USB devices are configured in the operating system, not in the R&S RTO software. It is recommended that you use mouse and keyboard to access and modify the settings of the Windows operating system.

To access Windows, press the Windows key on the external keyboard, or select "Menu" > "Minimize Application" on the R&S RTO menu.

Connecting a USB flash drive

If the installation of a USB flash drive is successful, Windows informs you that the device is ready to use. The device is made available as a new drive ("D:") and is displayed in Windows Explorer. The name of the drive depends on the manufacturer.

Connecting a keyboard

The keyboard is detected automatically when it is connected. The default input language is English – US.

To configure the keyboard properties:

1. Tap the "Find" icon (magnifier) on the Windows taskbar.
2. Type *keyboard*.
3. Select "Edit language and keyboard options".

Connecting a mouse

The mouse is detected automatically when it is connected. To configure the mouse properties:

1. Tap the "Find" icon (magnifier) on the Windows taskbar.
2. Type *mouse*.

3. Select "Mouse settings".

4.8.2 Connecting an external monitor

You can connect an external monitor or projector to the R&S RTO. The following connectors are available:

- "DVI-D" on page 30
- "DisplayPort" on page 29

Before connecting an external monitor, ensure that the monitor and the R&S RTO are connected to a ground contact. Otherwise the instrument can be damaged.

After connecting an additional monitor or projector to the instrument, configure it for usage. The relevant settings are Windows settings but you can configure the displays directly in the instrument setup.

1. Check the input type of the monitor or projector. Make sure to select the correct cable. To use a VGA monitor, you need an active DVI-D to VGA adapter.
2. Open "Menu" > "Settings" > "Display".
3. Select the "Monitors" tab.
4. Select how to display the screen.
5. To access Windows display settings, tap "Additional settings".

The touchscreen of the R&S RTO has a screen resolution of 1280 x 800 pixel. Many external monitors have a higher screen resolution. If the screen resolution of the monitor is set higher than the instrument's resolution, the application window uses a 1280 x 800 area of the monitor display. For full screen display, adjust the monitor's screen resolution using "Additional display settings".

5 Instrument tour

This chapter describes the front and rear panels of the instrument including all function keys and connectors.

5.1 Front panel

The front panel of the R&S RTO is shown in [Figure 5-1](#). The function keys are grouped in functional blocks to the left and the right of the touchscreen. Below the screen, various connectors are located.



Figure 5-1: Front panel of R&S RTO2044 with 4 input channels

- 1 = Touchscreen
- 2 = [Setup] controls
- 3 = [Horizontal] controls
- 4 = [Trigger] controls

- 5 = [Analysis] keys
- 6 = [Navigation] controls
- 7 = [Waveform Generator] keys
- 8 = [Vertical] controls
- 9 = Input channels
- 10 = [Aux Out] connector
- 11 = Connectors for probe compensation and grounding
- 12 = USB connectors
- 13 = [Power] key

5.1.1 Input connectors

The R&S RTO has two or four channel inputs to connect the input signals using active and passive probes.

The input connectors are provided with a special Rohde & Schwarz active probe interface, and they are BNC compatible. Thus, the instrument can automatically detect passive probes with standard BNC connector and active Rohde & Schwarz probes having the Rohde & Schwarz probe interface.

The input impedance is selectable, the values are 50 Ω and 1 M Ω .

The maximum input voltage is 200 V peak, 150 V RMS at 1 M Ω input impedance and 5 V RMS at 50 Ω input impedance.

5.1.2 Other front panel connectors

Besides the input connectors, the instrument has USB connectors and probe compensation connectors at the front panel.

[USB]

Two USB type A connectors that comply with standard USB 2.0. They are used to connect devices like keyboard, mouse and USB flash drive.

Note: Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, do not use USB connecting cables exceeding 1 m.

Probe Compensation

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



Protective earth conductor, 4 mm banana jack to connect ground of DUT and test fixtures, and wrist strap.

Rear panel

- Square wave signal for probe compensation, 1 kHz and 1 V_{pp}.
- ⊥ Ground connector for probes.

[Aux Out]

Output of the internal calibration signal, if the signal is configured to external destination.

5.2 Rear panel

Figure 5-2 shows the rear panel of the R&S RTO.

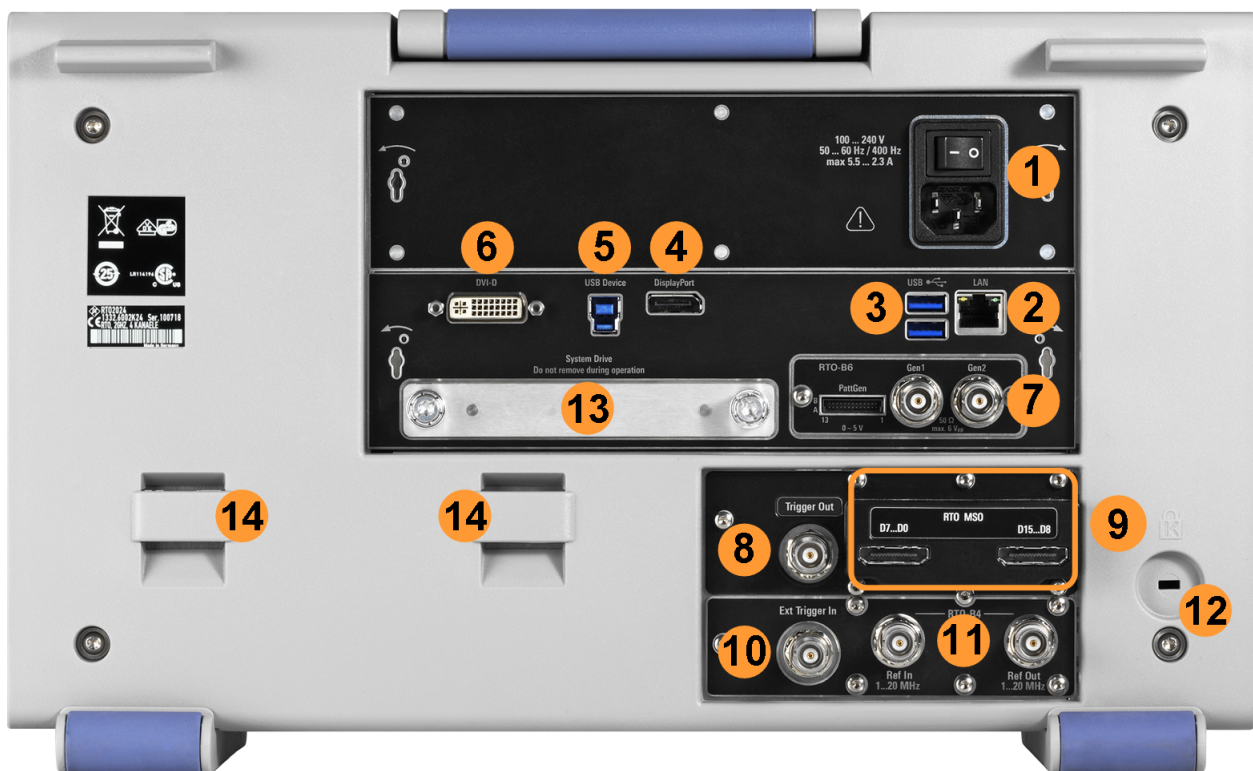


Figure 5-2: Rear panel of R&S RTO

- 1 = AC power supply connector and main power switch
- 2 = LAN connector
- 3 = USB connectors, type A
- 4 = DisplayPort connector
- 5 = USB Device connector, type B
- 6 = DVI-D connector for external monitor
- 7 = Option slot for R&S RTO-B6 (waveform generator, shown in figure) or R&S RTO-B7 (pulse source)
- 8 = External trigger output

Rear panel

- 9 = Option slot for R&S RTO-B1 (MSO, shown in figure) or R&S RTO-B1E (for R&S RT-ZVC) , or R&S RTO-B10 (GPIB)
- 10 = External trigger input
- 11 = Optional OCXO with input and output of the reference signal (option R&S RTO-B4)
- 12 = Kensington lock slot to secure the instrument against theft
- 13 = Optional exchangeable hard disk: solid state disk (option R&S RTO-B18) or standard hard disk drive (option R&S RTO--B19)
- 14 = Lugs to attach the accessory bag

AC power supply connector and main power switch

Connection to the AC power line. The R&S RTO can be used with different AC power voltages and adapts itself automatically to it. The nominal voltage and frequency ranges are displayed on the rear panel and quoted in the data sheet.

If grounding is *not* ensured by the mains system, ground the oscilloscope using the protective earth conductor on the front panel and an appropriate cable.

The AC main power switch also interrupts the power supply of the OCXO (option OCXO Reference Frequency, R&S RTO-B4).

When you power up the instrument, be sure to comply with the warm-up phase specified in the data sheet before you start measurements.

USB

Two USB type A connectors that comply with standard USB 3.1 gen 1. They are used to connect devices like keyboard, mouse and flash drive to store and reload instrument settings and measurement data.

Note: Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, do not use USB connecting cables exceeding 1 m.

LAN

8-pin RJ-45 connector used to connect the instrument to a Local Area Network (LAN). It supports up to 1000 Mbit/s (10/100/1000BASE-T Ethernet).

USB Device

USB 3.0 interface of type B (device USB), to be used for remote control of the instrument.

DisplayPort

DisplayPort connector for an external monitor or projector. It supports DisplayPort version 1.1a.

DVI-D

Digital connector for an external monitor or projector. The monitor shows the complete content of the instrument's screen.

Ext Trigger In

The BNC connector for external trigger input is used to control the measurement by an external signal. The input impedance can be selected in the trigger configuration, the values are 50 Ω and 1 M Ω . The trigger level can be set from -5 V to 5 V. The maximum input voltage is 30 V RMS at 1 M Ω input impedance and 7 V RMS at 50 Ω input impedance.

Trigger Out

The BNC connector for external trigger output is used to provide the internal trigger signal of the oscilloscope to trigger other instruments for synchronized measurements.

When a trigger occurs, the R&S RTO creates a pulse of 5 V with a source impedance of 50 Ω and delivers it to the external trigger output. The instrument can also send the pulse on mask test violation or violation of measurement limits and margins.

If the connector is terminated with 50 Ω , the signal level is 2.5 V (50 mA). With 1 M Ω termination, the level is 5 V. A short-circuit of the connector to ground creates current of 100 mA.

To enable the trigger out signal, select "Trigger" menu > "Ctrl/Action". Here you also adjust polarity, delay, and length of the pulse. The default is a positive pulse of 100 ns. The minimum delay is 800 ns.

Mixed signal option R&S RTO-B1 / digital extension port R&S RTO-B1E

The mixed signal option R&S RTO-B1 provides logic analyzer functionality and 16 digital channels. It also can connect the R&S RT-ZVC multi-channel power probe. The connectors are used to connect two logical probes with 8 digital channels each (D0 to D7 and D8 to D15), or two flat interface cables of R&S RT-ZVC.

The digital extension port R&S RTO-B1E provides the connectors for the R&S RT-ZVC multi-channel power probe without MSO. The connectors are used to connect two flat interface cables of R&S RT-ZVC.

One of the options can be installed in the option slot at the rear panel.

The maximum input voltage is 40 V peak at 100 k Ω input impedance. The maximum input frequency for a signal with the minimum input voltage swing of 500 mV (V_{pp}) is 400 MHz. For detailed specifications, refer to the data sheet.

OCXO option R&S RTO-B4

Optional [Ref In] (left) and [Ref Out] (right) connectors coming with option R&S RTO-B4 OCXO 10 MHz.

The input frequency ranges from 1 MHz to 20 MHz in 1 MHz steps. The input impedance is 50 Ω .

The output frequency of the OCXO is 10 MHz, the impedance is 50 Ω . For detailed specifications, refer to the data sheet.

Waveform generator option R&S RTO-B6

The waveform generator generates various function and arbitrary waveforms, sweeps, and parallel patterns. For detailed specifications, refer to the data sheet.

The option can be installed in the option slot at the rear panel.

The module provides the following connectors:

- [Gen1, Gen2] BNC connectors
- [PattGen] Connector for the pattern generator

Pulse source option R&S RTO-B7

The pulse source outputs a symmetrical differential pulse signal. For detailed specifications, refer to the data sheet.

The option can be installed in the option slot at the rear panel.

The module has four connectors.

- Out, $\overline{\text{Out}}$: 2.92 mm connectors (K type) for pulse signal output
- Ref, $\overline{\text{Ref}}$: 2.92 mm connectors (K type) for reference signal output

GBIP option R&S RTO-B10

The GBIP option provides a GBIP interface and connector for remote control. For detailed specifications, refer to the data sheet.

5.3 Keys and controls

5.3.1 Power key

The [Power] key is located on the lower left corner of the front panel. It starts up and shuts down the instrument's software.

The light of the key shows the instrument state:

- Standby, the main power switch is on, the software is shut down: orange.
- The instrument is ready for operation: green.

See also: [Chapter 4.7, "Switching on or off"](#), on page 22.

5.3.2 Setup controls

Setup keys set the instrument to a defined state, change basic settings, and provide saving and help functions. The intensity rotary knob adjusts the display contrast for several display elements.

[Autoset]

The instrument analyzes the enabled channel signals, and adjusts appropriate horizontal, vertical, and trigger settings to display stable waveforms.

[Preset]

Resets the instrument to a default state. All measurements, mask tests, zoom, and most individual settings are deleted, and all channels except for channel 1 are disabled. You can define preset configurations and save them to a file. The [Preset] key can be configured to set either factory defaults or a user-defined preset configuration.

[Save Recall]

Opens and closes the "File" dialog box, where you can:

- Save instrument settings (user settings)
- Load instrument settings which were saved before
- Save waveform data and measurement results
- Define a naming pattern for autonaming of files

[Setup]

Opens and closes the "Setup" dialog box, where you can:

- Access Windows configuration and install firmware updates
- Configure the touchscreen
- Check and install option keys for software options
- Check availability of hardware options
- Configure remote settings, LAN settings, and GPIB

Camera 

Starts a saving action, or opens a report. By default, the key saves a screenshot of the waveform display. You can assign the function to the key.

Quick Action

Starts an external application, opens the graphical recall, or deletes the all measurement results, waveforms, and the history. The function is assigned to the key in "File" menu > "Frontpanel Setup" > "Hardkeys". By default, the key opens the setup dialog box.

[Help]

Opens the appropriate help topic for the active tab. If no dialog box is open, the contents page of the help appears.

[Display]

Opens and closes the "Display" dialog box to configure the appearance of the waveforms, the diagram layout, color tables, and the XY-diagram. You can also assign name labels to the waveforms.

[Touch Lock]

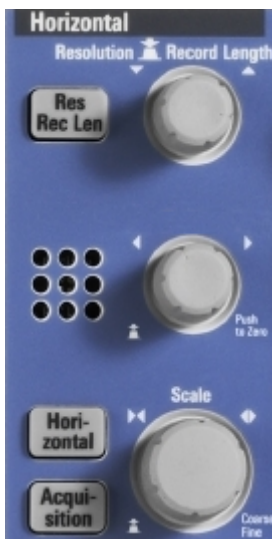
Locks the touchscreen to prevent unintended use. When the touchscreen is off, the key is illuminated. Press again to unlock the touchscreen.

[Intensity]

Adjusts the intensity of the waveforms on the screen, or the background transparency of dialog boxes, or the transparency of result boxes. If a dialog box is open, turning the knob changes the transparency of dialog boxes. If a result box is open, the transparency of result boxes is changed. Otherwise the waveform intensity is adjusted. Press the knob to toggle between the three settings. The controlled parameter and its value are shown in the input box in the lower right corner of the screen.

5.3.3 Horizontal controls

The keys and rotary knobs in the Horizontal functional block adjust the acquisition settings and horizontal parameters. These settings are effective for all channel waveforms.



[Res Rec Len], [Horizontal]

Open and close the "Setup" tab in the "Horizontal" dialog box, where you can:

- Adjust the time scale, and acquisition time
- Adjust the horizontal position, and reference point
- Adjust the resolution and the record length
- Enable the roll mode

[Acquisition]

Opens and closes the "Acquisition" tab in the "Horizontal" dialog box, where you can define the acquisition processing (acquisition mode and waveform arithmetic).

[Resolution / Record Length]

The rotary knob changes the resolution or the record length. Press the knob to toggle the setting. The controlled parameter and its value are shown in the input box in the lower right corner of the screen.

For resolution, turn clockwise to increase the resolution: the time between two acquisition points gets shorter. Record length and sample rate increase while the acquisition time remains constant.

For record length, turn clockwise to increase the record length, and the resolution increases too - the time between to acquisition points gets shorter.

[Position]

The rotary knob changes the horizontal position of the waveform or the position of the reference point on the screen.

You can select if the knob changes the position or the reference point in "File" menu > "Frontpanel Setup" > "Knobs". To set the value to zero, press the knob. The current value is shown in the input box in the lower right corner of the screen.

"Horizontal position" defines the time distance of the reference point from the zero point of the diagram. Turn clockwise to move the waveform to the right.

"Reference point" defines the position of the reference point on the screen. Turn clockwise to move it to the right. The reference point marks the rescaling center of the time scale. It is indicated by a gray triangle outline at the top of the diagram. If you modify the time scale, the reference point remains fixed on the screen, and the scale is stretched or compressed to both sides of the reference point.

[Scale]

The rotary knob adjusts the time scale for all signals. The time scale is also known as timebase.

Turn clockwise to stretch the waveforms. Doing so, the scale value *time/div* decreases.

Press the knob to toggle between coarse and fine scale adjustment.

5.3.4 Vertical controls

The keys and knobs in the Vertical functional block select a signal and adjust the vertical scale and position of the selected signal.



[Ch <n>]

Turns on, selects, and configures a channel. If the channel is active, the key lights up in the corresponding channel color .

The effect of the keypress depends on state of the channel:

- If channel is off: Pressing the key turns on the channel and selects it.
- If the channel is on, but not selected: Pressing the key selects the channel waveform.
- If the waveform is selected: Pressing the key opens the "Vertical" dialog box for the appropriate channel.

The vertical rotary knobs are focused on the selected waveform. They are illuminated in the color of the selected waveform.

[Logic]

Opens the dialog box for configuration of parallel buses and digital channels. The key lights up if you enable at least one parallel bus. You can switch off the selected bus using the [Signal Off] key.

[Ref]

Opens the "Reference" dialog box, where you can configure and display reference waveforms. Press the key repeatedly to switch the reference waveform.

If a reference waveform is selected, the vertical rotary knobs are illuminated in white or light gray (default colors), depending on the selected waveform.

[Math]

Opens the "Math" dialog box, where you can configure the calculation of mathematical waveforms using various mathematic operations on other waveforms. Press the key repeatedly to switch the math waveform.

If a math waveform is selected, the vertical rotary knobs are illuminated in brown (default color), the brightness of the color depends on the selected waveform.

[Position] (upper knob)

The upper rotary knob changes the vertical position or the offset of the selected waveform. The horizontal axis and the selected waveform are moved vertically. The knob lights up in the color of the selected waveform.

You can select if the knob changes the position or the offset in "Menu" > "Settings" > "Frontpanel" > "Knobs" dialog.

- Position indicates the vertical location in divisions.
- Offset moves the vertical center of the selected channel to the offset value.

[Scale]

This rotary knob adjusts the vertical scale for the selected waveform. The knob lights up in the color of the selected waveform.

Turn clockwise to stretch the waveform. Doing so, the scale value V/div decreases.

Press the knob to toggle between coarse and fine scale adjustment.

[Signal Off]

Turns off the selected signal and selects the next channel, math, or reference waveform.

The key is illuminated in the color of the selected signal and changes the color according to the new selection.

5.3.5 Trigger controls

The keys and knob in the Trigger functional block adjust the trigger and start or stop acquisition.

**[Trigger]**

Opens and closes the "Trigger" dialog box, where you can:

- Select a trigger type and configure it.
- Set general trigger parameters and control the acquisition run.
- Qualify the trigger event with logic patterns.
- Configure a sequence of subsequent trigger events.
- Set up the zone trigger if option R&S RTO-K19 is installed.

[Levels]

The rotary knob sets the trigger level for all trigger types. Turn clockwise to move up the trigger level. If the selected trigger type requires two trigger levels - upper and lower level - press the knob to toggle between the two levels.

[Source]

Opens a dialog box where you can select the trigger source. Press the key again to switch the source. The key lights up in the color of the selected trigger source.

[Slope]

Toggles the trigger slope or trigger polarity, dependent on the trigger type. The current setting is shown on the trigger label, which is in the upper part of the signal bar.

[Mode]

Toggles the trigger mode between Auto and Normal. The current setting is shown on the trigger label.

[Run Stop]

Starts and stops the continuous acquisition. A green light indicates a running acquisition. A red light shows that acquisition is stopped.

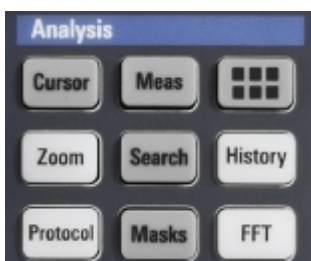
[Single]

Starts a defined number of acquisitions. A green light indicates a running acquisition. A red light shows that acquisition is stopped. Press the key again to stop running acquisitions.

To set the number of acquisitions, press the [Trigger] key, select the "Ctrl/Action" tab, and set "Average count (N-single count)".

5.3.6 Analysis keys

The keys in the Analysis functional block provide direct access to measurement and analyzing functions. If you press [Cursor], [Zoom] or [Meas], the action starts on first keypress, and a second keypress opens the corresponding dialog box. If you press another function key, the dialog box opens.



[Cursor]

Displays vertical and horizontal cursors in the active diagram and opens the "Cursor Results" box.

Cursors are markers which are placed at points of interest on a waveform. The instrument measures the cursor positions and delta values between parallel cursors.

If you press the key while a cursor measurement is enabled, the "Cursors" dialog box opens.

In the "Cursors" dialog box, you can:

- Configure up to 4 cursor sets
- Define style and labels of the cursors
- Connect the cursor to the waveform and couple the cursors

[Meas]

Starts the default automatic measurement for the active waveform and opens the "Measurement" result box.

If you press the [Meas] key while a measurement is enabled, the "Measurements" dialog box is displayed, where you can:

- Configure amplitude and time measurements, eye, spectrum, and histogram measurements
- Configure gated measurement
- Configure long term and statistic measurements
- Configure actions to be executed if specified limits are exceeded

App Cockpit 

Opens the "App Cockpit" dialog box, where you can start an application or analysis function directly, without knowing its position in the menu or toolbar.

[Zoom]

Displays a zoom diagram for the active diagram. The key is illuminated if at least one zoom is active. If you press the key while the zoom function is on, the "Zoom" dialog box opens, where you can configure several zoom areas for detailed signal observation.

[Protocol]

Opens the "Protocol" dialog box which contains the configuration of serial buses and the settings for decoding the signals.

The key lights up if the decoding of a serial bus is active. You can switch off the decoded bus using the [Signal Off] key.

[Search]

Opens and closes the "Search" dialog box, where you can:

- Configure trigger events to be searched for
- Limit the search by gating
- Configure the presentation of search results

[Masks]

Opens and closes the "Masks" dialog box. Masks are used for error detection and compliance tests of digital signals.

You can:

- Configure masks and masks segments
- Define mask test parameters
- Configure actions triggered by mask violation
- Configure the mask display

[History]

The sample memory contains several stored acquisitions before the current one, which is shown in the display. Press the key to open the quick access "History" dialog box, where you can view the stored acquisitions and use them for further analysis. Press the key again to open the main "History" dialog box with more settings and information.

The key is illuminated as long as a history acquisition or replay is displayed.

[FFT]

Opens and closes the FFT setup.

The key lights up if an FFT is active. You can switch off the FFT math waveform using the [Signal Off] key.

5.3.7 Navigation controls

The rotary knob and the navigation keys provide an alternative way to navigate in dialog boxes and to enter numeric data.

See also: [Chapter 6.8, "Using dialog boxes"](#), on page 67



[Navigation] rotary knob

The [Navigation] knob has various functions:

- In numeric entry fields: turn to increase or decrease the value.
- In tables: press to activate the edit mode, turn clockwise to increase the value or turn counterclockwise to decrease it, and press to enter the value and move to the next cell.
- To set cursor positions, histogram areas, and mask points in input boxes: press to toggle the parameter, turn clockwise to increase the value or turn counterclockwise to decrease it.
- To move zoom area, cursor line, or gate in diagrams: Turn to move the element that has the focus, and press to toggle the focus.

[Esc]

Closes a dialog box or input box.

[Undo]

Reverses the last setting actions step by step. Undo is not possible after load and recall actions, and after creating a reference waveform.

[Redo]

Recovers the undo steps in reverse order.

[OK]

The [OK] key has various functions:

- In dialog boxes and opened selection lists: the key applies the selected value.

- In tables: the key activates the edit mode. If the table cell is in edit mode, the key confirms the value, quits the edit mode and moves to the next cell.

Field left, Field right

In dialog boxes and tables, the keys move the focus.

In diagrams, they switch the focus between zoom areas, cursor lines, and gates.

Checkmark [✓]

The checkmark key [✓] has different functions depending on the focus:

- In usual dialog box: if the focus is on a selection list, the key opens the list and applies the selected value.
- In tables: activates the edit mode.

Tab

The tab key has various functions:

- In dialog boxes with only horizontal tabs, the key switches the horizontal tabs.
- In dialog boxes with horizontal and vertical tabs, the key switches the tab that has the focus.
- In a table or diagram, the key moves the focus in the same way as the [▶] key.

Up arrow [▲], Down arrow [▼]

The up and down arrow keys have the following effects:

- In numeric edit fields: increase or decrease the parameter value.
- In tables: scroll vertically through the rows.
- In dialog boxes, for option buttons in a column: select an option. In an open selection list, the keys scroll the list.

Left arrow [◀], Right arrow [▶]

The left and right arrow keys have the following effects:

- In edit fields: move the cursor.
- In tables: scroll horizontally through the columns.
- In dialog boxes, for option buttons in a row: select an option.

6 Operating the instrument

There are three ways to operate the R&S RTO.

Manual operation

Use the touchscreen, keys and rotary knobs, or an optional mouse and/or keyboard. The principles of manual operation are explained in this section.

Remote control

Create programs to automatize repeating settings, tests, and measurements. The instrument is connected to a computer that runs the program.

This way of operation is described in the user manual, chapter "Remote Control Commands".

Remote operation

The remote desktop connection of Windows can be used for instrument control and file transfer. Even on computers with non-Windows operating systems, a remote desktop connection is possible using RDP applications.

For details, refer to the user manual, chapter "Remote Desktop Connection".

Remote monitoring and control of the instrument from a connected computer is also possible with a standard web browser and a LAN connection.

For details, refer to the user manual, chapter "Web Control".

Alternatively, you can use Virtual Network Computing (VNC), which requires installation of the VNC server on the R&S RTO. Installation and configuration are described in the application note "Remote Monitoring and Control of the R&S RTO with a Web Browser", available on the Rohde & Schwarz internet site.

6.1 Means of manual interaction

The R&S RTO provides the following means of manual interaction, which you can use alternatively or complementary:

- Touchscreen:

Using the touchscreen is the direct interaction way. Use your finger to place waveforms on the screen, mark areas for zoom and histograms, set parameters in dialog boxes, enter data, and much more. The control elements and actions on the screen are based on common concepts, and you will easily become familiar with the user interface.

Tapping the screen works like clicking mouse buttons:

- Tap = click: Selects a parameter or provokes an action.
- Double-tap = double-click has the same effect as touch and hold = right-click: Opens the on-screen keyboard or keypad, or a specific editor if available

Use gestures to scale the waveform:

- Spread or pinch two fingers horizontally to change the horizontal scale (timebase).
- Spread or pinch two fingers vertically to change the vertical scale of the active waveform.
- Function keys and rotary knobs:
The front panel provides nearly all functions and controls to operate the instrument in the classic ways, without touchscreen. As an exception, the signal bar cannot be used with front panel controls.
- Optional mouse and/or keyboard:
These devices work conform to Windows standards. The navigation keys on the front panel correspond to the keys on the keyboard.

The usage of the touchscreen and navigation keys is described in detail in the following sections.

6.2 Touchscreen display

6.2.1 Information on the display

The touchscreen of the instrument shows the waveforms and measurement results, and also information and everything that you need to control the instrument. All waveform-related display elements are shown in [Figure 6-1](#). An overview of control elements - like dialog box, toolbar - is given in [Chapter 6.2.2, "Control elements on the touchscreen"](#), on page 49.

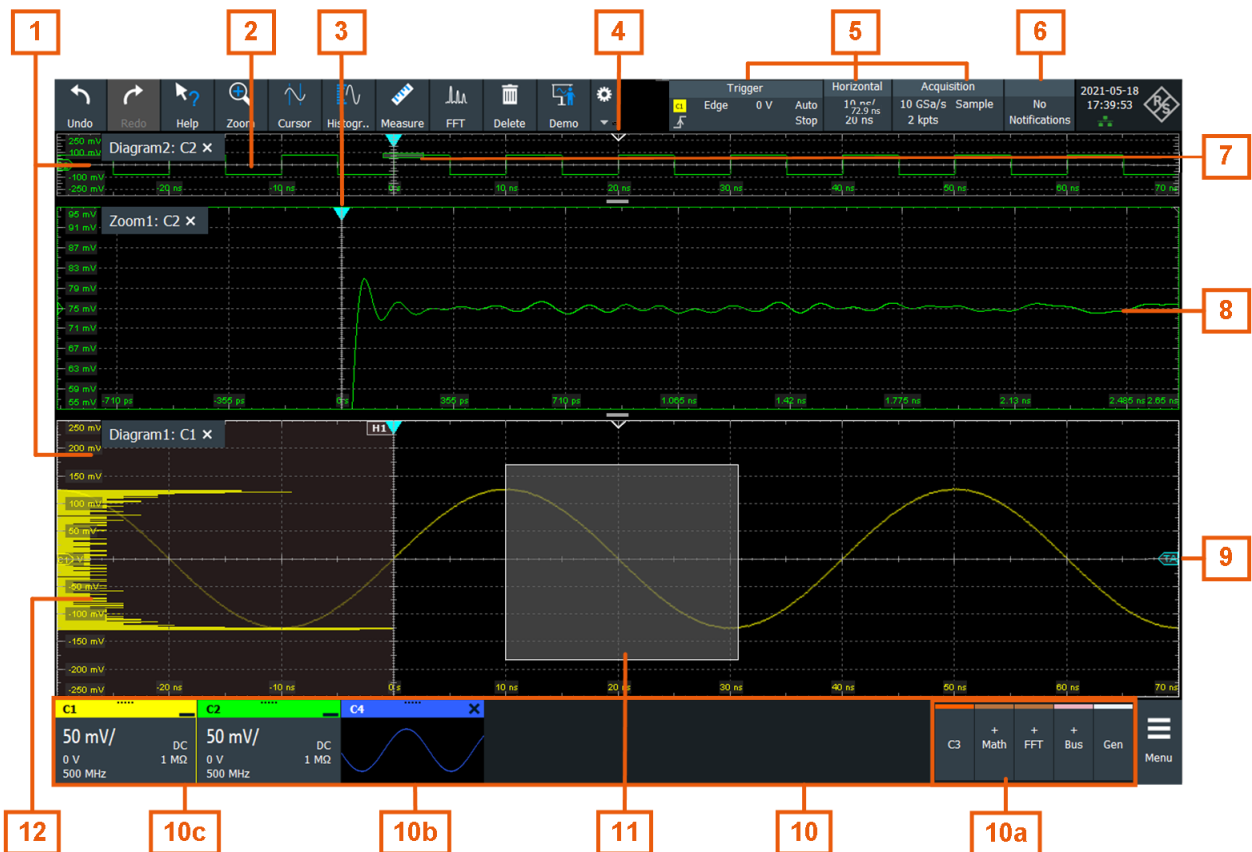


Figure 6-1: Display information

- 1 = Diagram
- 2 = Grid
- 3 = Trigger position
- 4 = Reference point (distance from trigger position to reference point = horizontal position)
- 5 = Trigger, horizontal and acquisition label
- 6 = Notifications
- 7 = Zoom area
- 8 = Zoom diagram
- 9 = Trigger level
- 10 = Signal bar with inactive waveforms (10a), minimized live waveform (10b) and signal icon with vertical settings (10c)
- 11 = Histogram area
- 12 = Histogram

Diagram

A diagram shows one or more waveforms: channel, reference, and math waveforms together with histograms, masks etc. Zoom details, XY-waveforms, spectra and other special waveforms are shown in separate diagrams.

By default, the diagram name contains the diagram number and the short names of the waveforms shown inside. To change the diagram name, touch and hold the tab name. The on-screen keyboard opens to enter the new name. Names must be unique.

To arrange the diagrams on the screen, the Rohde & Schwarz SmartGrid function helps you to find the target place simply and quickly. For details, see [Chapter 6.5, "Rohde & Schwarz smartgrid"](#), on page 55. You can also adjust the diagram size by dragging the diagram border.

Grid

The grid shows the vertical and horizontal divisions. The division lines are labeled with the correspondent values. The grid labels have the color of the waveform to which they belong. If several waveforms are shown in one diagram, the grid has the color of the selected waveform.

Trigger position and trigger level

The blue markers show the horizontal position of the trigger and the vertical trigger level. You can touch and move the trigger markers in the diagram to set the positions. The trigger point is the zero point of the diagram.

The trigger position can be moved outside the diagram. A red trigger position marker indicates that the trigger position is not visible.

Trigger, Horizontal, Acquisition

The "Trigger", "Horizontal" and "Acquisition" labels show the main timebase and trigger settings. If you tap a label, the relevant dialog box opens.

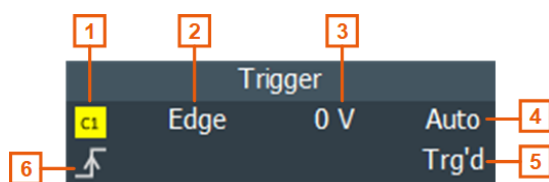


Figure 6-2: Trigger label on the toolbar

- 1 = Trigger source
- 2 = Trigger type
- 3 = Trigger level
- 4 = Trigger mode
- 5 = Trigger state
- 6 = Trigger slope

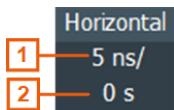


Figure 6-3: Horizontal label on the toolbar

- 1 = Time scale
- 2 = Horizontal position

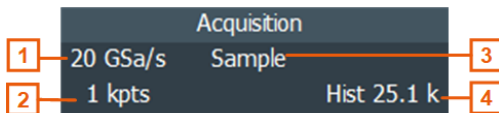


Figure 6-4: Acquisition label on the toolbar

- 1 = Sample rate
- 2 = Record length
- 3 = Decimation
- 4 = Number of acquired waveforms

Reference point

The reference point marks the rescaling center. If you modify the time scale, the reference point remains fixed on the screen, and the scale is stretched or compressed to both sides of the reference point.

You can define the position of the reference point ("Menu" > "Horizontal" > "Reference point"), and also its time distance from the trigger point of the diagram (Position knob).

Notification

The "Notification" button on the toolbar points to the status messages of the instrument. To open the message box, tap the button. See also: [Chapter 6.10, "Instrument information and notifications"](#), on page 71.

Zoom diagram and zoom area

Zoomed waveforms are shown in separate zoom diagrams, in addition to the waveform diagrams. On the original waveform diagram, a rectangle indicates the zoomed section of the waveform - this is the zoom area. You can modify the zoom area by dragging the rectangle as a whole, and by dragging its edges. To toggle between these modes, tap the zoom area. You can also set exact positions.

The frames of the zoom area and of the associated zoom diagram have the same color, different zooms are marked with different colors. So it is easy to assign zoom area and zoom diagram.

As for waveform diagrams, you can change the name of the zoom diagram. A zoom in a zoom and coupled zooms are also possible.

All zooming possibilities are described in detail in the user manual, chapter "Zoom".

Signal bar

The signal bar is the control center for all waveforms. All enabled waveforms are shown on the left side of the signal bar. Inactive waveforms are shown on the right side of the toolbar. Tap an inactive waveform to enable it.

Each waveform is represented by a signal icon. If the waveform is shown in a diagram, the signal icon displays its main vertical and acquisition settings. If you tap the "Minimize" icon on the signal icon, the waveform switches from the diagram area to the signal icon: the icon shows the real-time preview of the waveform. If you tap a signal icon, the dialog box with vertical settings for this waveform opens. See [Chapter 6.4, "Working with waveforms"](#), on page 52 for a detailed description.

In [Figure 6-1](#), the signal icons C1 and C2 show the main settings, and the waveforms are displayed in diagrams. Other waveforms are minimized and shown in the signal icon.

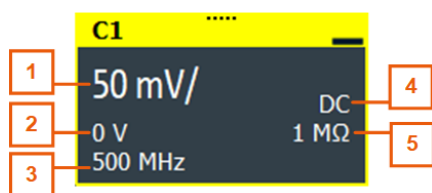


Figure 6-5: Signal label

- 1 = Vertical scale
- 2 = Offset
- 3 = Bandwidth
- 4 = Coupling
- 5 = Termination

If the signal bar contains many icons and not all icons are visible, touch one of the icons and scroll left or right until the required icon appears.

You can also switch off the signal bar: "Menu" > "Settings" > "Appearance" > "Diagram" > "Show signal bar".

Histogram and histogram area

A histogram shows the frequency of occurrence of voltage or time values in a bar chart directly in the diagram. The rectangular histogram area indicates the part of the waveform that is considered in the histogram. The vertical histogram counts the voltage values, and the horizontal histogram counts time values. You can switch between vertical and horizontal mode, and modify the histogram area by dragging the rectangle as a whole, by dragging its edges, or by setting exact positions.

6.2.2 Control elements on the touchscreen

The touchscreen provides everything you need to control the instrument, to analyze waveforms, and to get measurement results. [Figure 6-6](#) shows the control elements on a glance.

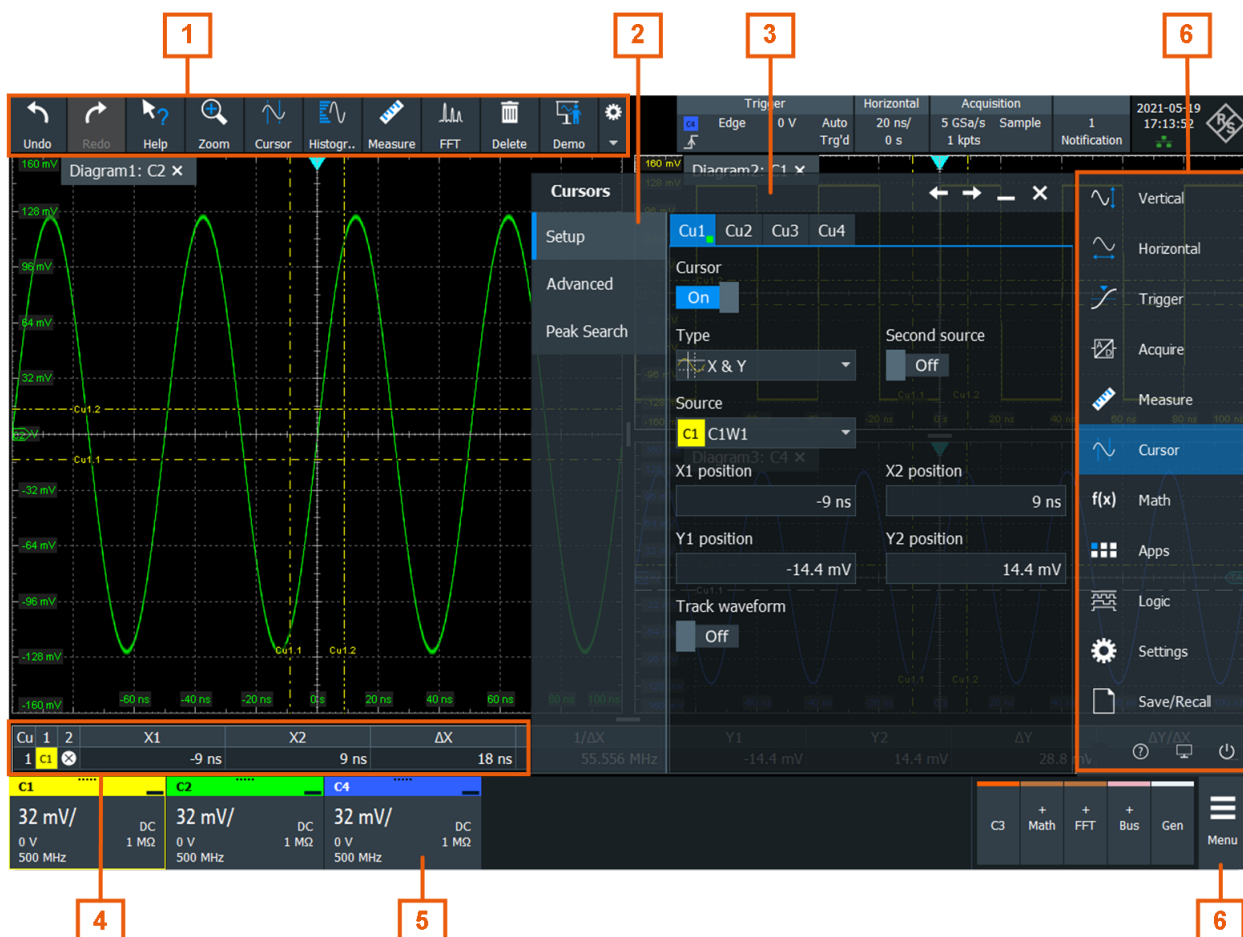


Figure 6-6: Control elements on the touchscreen

- 1 = Toolbar
 - 2 = Tab in a dialog box
 - 3 = Dialog box
 - 4 = Result table (docked)
 - 5 = Signal bar
 - 6 = Menu
- Not shown = Input box

Toolbar (1)

The icons on the toolbar provide quick and easy access to the most important functionality. For a detailed description, refer to [Chapter 6.6, "Toolbar"](#), on page 56.

If you adjust the settings of an analyzing function, e.g., cursor measurement, the toolbar assist is shown instead of the icons. The toolbar assist provides the most important settings of the current action. If you need more settings, "Advanced Setup" opens the corresponding dialog box.

Dialog box (2, 3)

The tabs of the dialog boxes contain all task-oriented settings and operations, and black buttons for calling related tabs. The usage of dialog boxes is described in [Chapter 6.8, "Using dialog boxes"](#), on page 67.

Result table (4)

If you perform cursor or automatic measurements, mask testing, or a search, the result table shows the results of the action. The position of the result table is adjustable. It can be docked (default for measurements), floating, minimized to a result icon on the signal bar, or displayed in a separate diagram on the screen.

For details, see ["To define the default position of measurement results"](#) on page 65.

Signal bar (5)

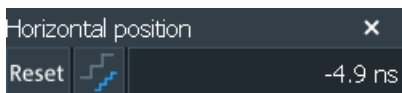
The signal bar shows all enabled waveforms as described in ["Signal bar"](#) on page 48.

Menu (6)

The menu provides access to the complete functionality of the R&S RTO.

Input box


The input box appears if you adjust a value using one of the rotary knobs, or if you drag an element on the screen, for example, a cursor line. The input box shows the current value of the modified parameter. You can enter the exact numerical value, change the step size, and - if available - autoselect the value directly in the input box. The box title shows the name of the currently adjusted parameter. The input box is helpful when using the multi-function rotary knobs, for example, horizontal or vertical [Position] knobs.



See also: [Chapter 6.9, "Entering data"](#), on page 68.

6.3 App cockpit

The app cockpit provides fast access to all available applications.

- ▶ To open the app cockpit:
 - Open "Menu" > "Apps".
 - Press the  app key on the frontpanel.



6.4 Working with waveforms

The R&S RTO can create and display many waveform types. The most important are:

- **Channel waveforms:**
Up to three waveforms per input channel can be shown. For a four-channel instrument, 12 channel waveforms are available.
- **Reference waveforms:**
Four waveforms can be used as reference for comparison and analysis.
- **Math waveforms:**
Eight mathematic waveforms can be created with mathematic operations performed on channel, reference, and other math waveforms.
- **Zoom waveforms:**

Show the details of waveforms.

- XY-waveforms:
Four XY-waveforms can be created. Each XY-waveform is built from the voltage values of two source waveforms.
- Digital waveforms:
The Mixed Signal Option R&S RTO-B1 provides 16 digital channels grouped in two logic probes (pods) with 8 channels each.

Waveform handling

The R&S RTO can show and analyze many waveforms. To handle this multitude while keeping track of it, the R&S RTO provides intelligent support:

- The color system helps to distinguish the waveforms. The color of the vertical rotary knobs indicates the signal that is focused (selected). The color of each waveform can be changed, the color of its signal icon and of the illuminated keys is adjusted to the new color. Alternatively, a color table can be assigned to a waveform.
Settings: "Menu" > "Settings" > "Appearance" > "Colors" tab.
- Waveforms can be minimized to signal icons showing a small real-time signal view. Thus, more space in the diagram area is available without switching off waveforms.
- Diagrams are displayed on tabs – you can arrange them side by side or one above the other. To change the diagram name, double-tap the tab name.
- The Rohde & Schwarz SmartGrid function helps to arrange the diagrams.

Waveform states

Depending on its place on the screen and the effect of settings, a waveform has one of the following states:

- Off
- Active:
The waveform is shown in a diagram
- Selected:
One of the active waveforms that has the focus. In each diagram, one of the assigned waveforms is selected – it appears "on top" in the diagram, and the grid labels have the color of the selected waveform. Some of the toolbar functions, like cursor and histogram measurements are performed on the selected waveform. All waveform-specific settings are applied to the selected waveform of the selected diagram.

The vertical [Position] and the [Scale] knobs are illuminated with the color of the selected waveform.

In [Figure 6-1](#), C1 is the selected waveform: The frame of the diagram and the signal icon are highlighted.

- **Minimized:**
The waveform is shown as real-time signal view in its signal icon.

To switch a waveform on

A channel waveform is activated as soon as you connect the probe. You can switch it on and off according to your needs.

- ▶ Choose one of the following ways:
 - Press the channel key.
 - In the "Vertical" dialog box, select the channel and tap "Channel" > "On".The waveform is now active, selected, and is shown in the diagram.

To select a waveform

- ▶ Choose one of the following ways:
 - Tap the waveform in the waveform diagram.
 - To select a channel, reference, or math waveform, press the corresponding key.
 - Tap the signal icon.

Note: Zoom waveforms in zoom diagrams cannot be selected.

To minimize a waveform

- ▶ Choose on of the following ways:
 - Tap the "Minimize" icon in the upper right corner of the waveform's signal label in the signal bar.
 - Drag the waveform from the diagram to the signal bar.

The waveform disappears from the diagram and the minimized signal view is shown in the signal icon.

- ▶ To set the waveform back to its previous diagram immediately, use "Undo".

To arrange a waveform using the SmartGrid

See [Chapter 6.5, "Rohde & Schwarz smartgrid"](#), on page 55.

To switch off a waveform

► Do one of the following:

- Select the waveform, and then press the [Signal Off] key.
- To switch off a minimized waveform, tap the "Close" icon in the upper right corner of the minimized signal view.
- Disable "Channel" in the "Vertical" > "Setup" tab.
- Tap the "Delete" icon (Recycle bin) in the toolbar, and then the waveform. If several waveforms overlap or lie close together, the upper (selected) waveform is switched off.

6.5 Rohde & Schwarz smartgrid

The Rohde & Schwarz SmartGrid helps to create and arrange the diagrams on the screen with drag&drop. The diagram layout depends on the position where you drop the signal icon, in relation to an existing diagram.

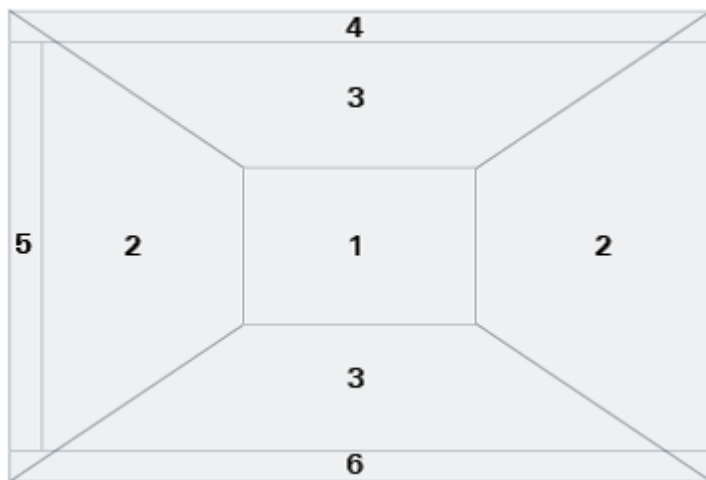


Figure 6-7: SmartGrid positions

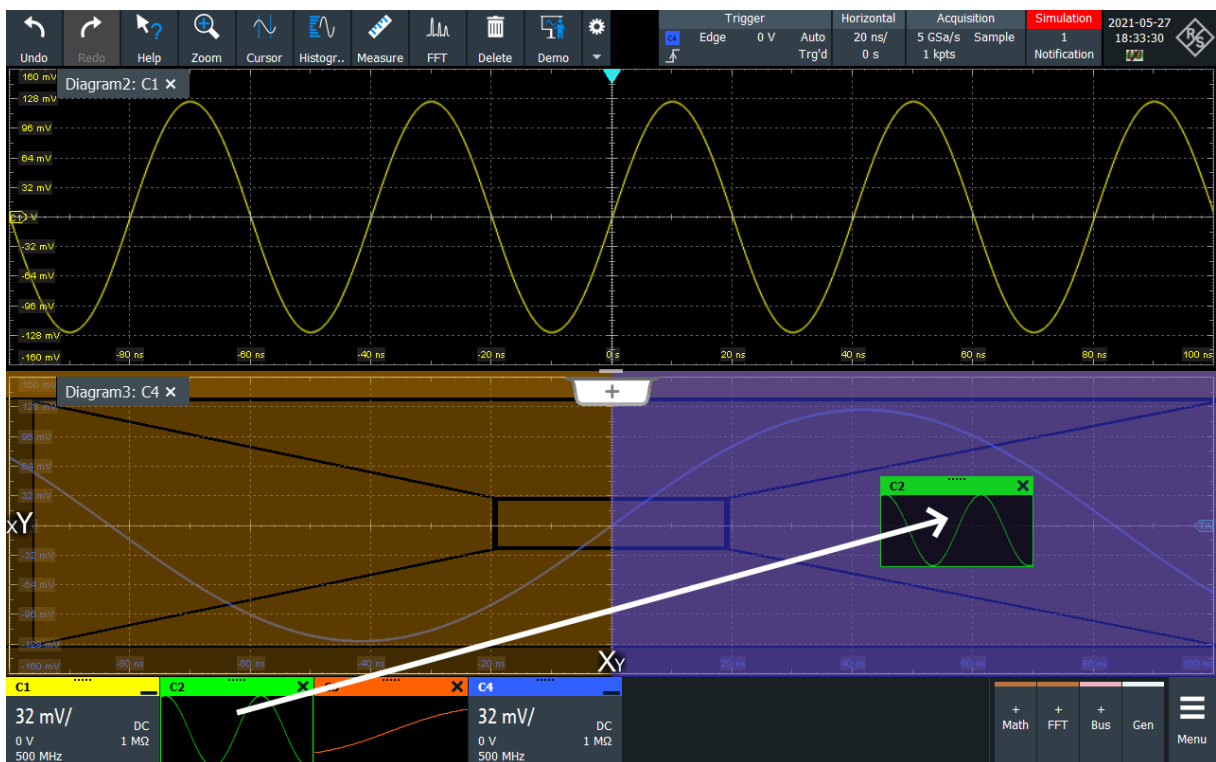
- 1 = In the existing diagram, overlay of signal
- 2 = New diagram on the left or right
- 3 = New diagram above or below
- 4 = New diagram on top of the existing diagram
- 5 = XY-diagram
- 6 = YX-diagram

The diagram configuration is deleted when you use [Preset] and *RST.

To arrange a waveform using the SmartGrid

You can arrange waveforms in one of the existing diagrams, or in a new diagram.

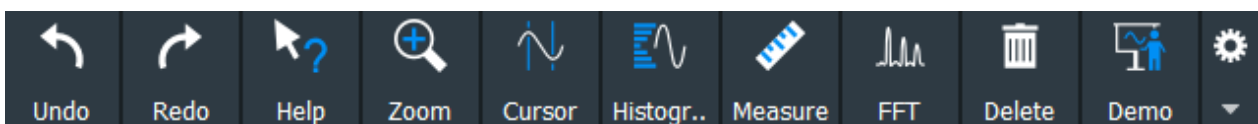
1. Drag the signal icon to the diagram area, and move it around.
The Rohde & Schwarz SmartGrid appears and a blue area shows where the waveform will be placed.
2. Drop the waveform in the target area.
The waveform appears in an existing or in a new diagram, and it is selected for further actions.



3. To change the size of a diagram, tap the handle between two diagram frames and drag it to the required position.

6.6 Toolbar

The toolbar provides direct access to important control and measurement functions.



By default, the toolbar shows the most frequently used functions. You can configure the content of the toolbar, see [Chapter 6.6.2, "Configuring the toolbar"](#), on page 58.

6.6.1 Using the toolbar

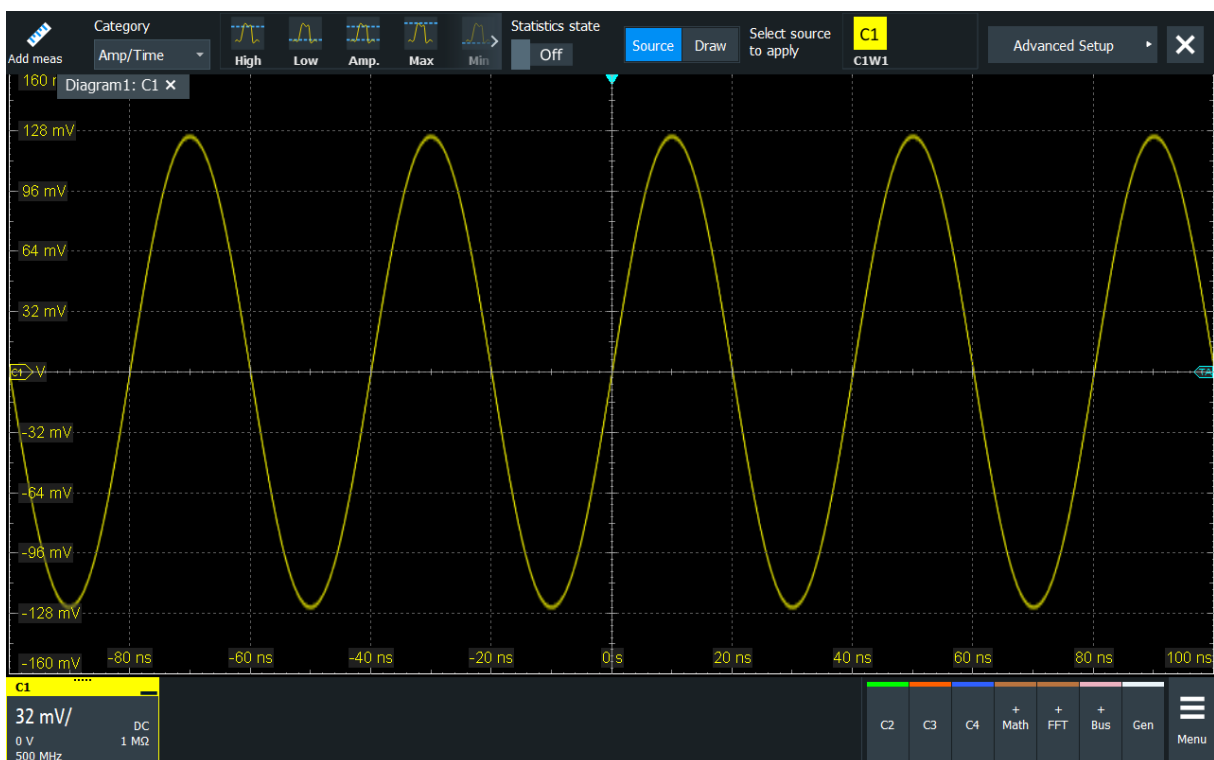
Using the toolbar is easy and straightforward.

Some of the toolbar functions are one-click actions. These actions are performed immediately when you tap the icon.

Other toolbar functions are analyzing functions. These actions are interactive actions.

To use analyzing functions (interactive actions)

1. If several waveforms are shown in the diagram, select the waveform that you want to analyze.
See: ["To select a waveform"](#) on page 54
2. Tap the icon of the function in the toolbar.
3. Check and adjust the settings in the toolbar assist.



4. To define the analyzed area, do one of the following:

- Tap the required diagram.
- Drag a rectangle on the diagram.

6.6.2 Configuring the toolbar

You can configure the content of the toolbar so that only the required functions are displayed. Furthermore, date and time can be hidden. The toolbar configuration is part of the user preferences. It is retained when you switch off and on the instrument, and you can save it in the user preferences and user-defined preset.

1. To open the toolbar configuration, tap the icon in the toolbar:

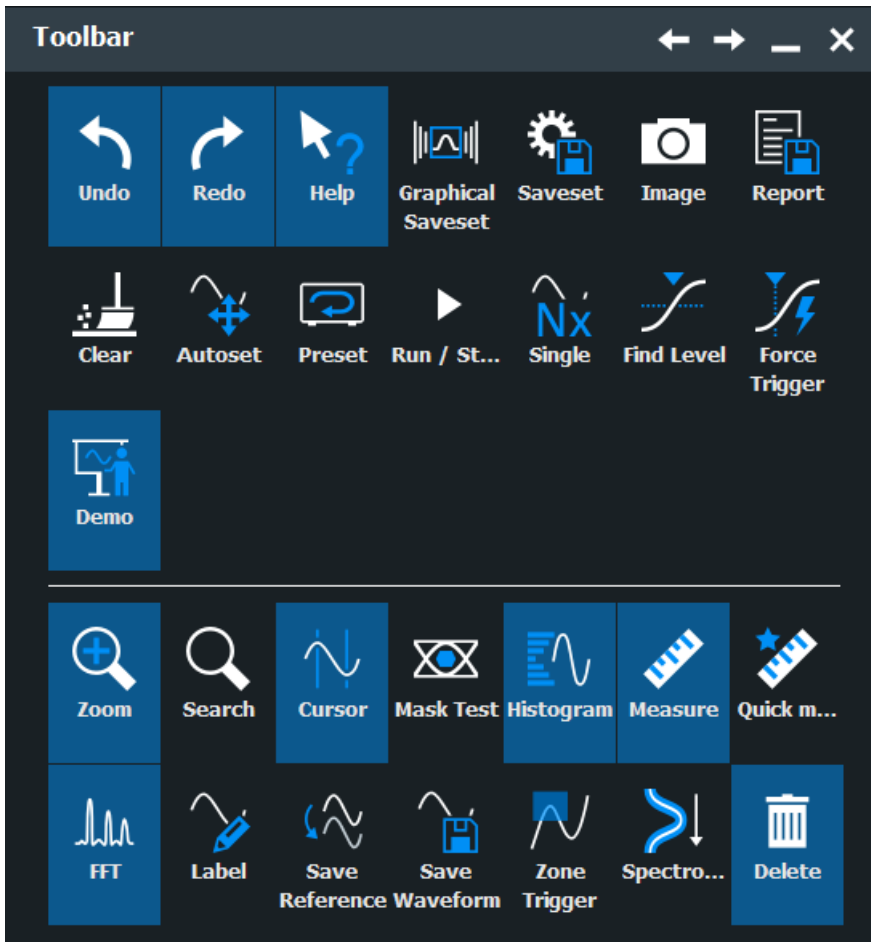


2. Select the required toolbar functions:
 - Disable the functions that you do not need.
 - Enable the functions that you want to add to the toolbar.

A detailed description of the toolbar functions is given in [Chapter 6.6.3, "Toolbar functions"](#), on page 58.

6.6.3 Toolbar functions

This section describes all toolbar functions in detail.



One-click actions	Interactive actions
Undo	Zoom
Redo	Search
Help	Cursor
Graphical Saveset	Mask Test
Saveset	Histogram
Image	Measure
Report	Quick meas
Clear	FFT
Autoset and Preset	Label
Run / Stop and Single	Save Reference
Find Level	Save Waveform

One-click actions	Interactive actions
Force Trigger	Zone trigger
Demo	Spectrogram (option R&S RTO-K18)



You can configure the content of the toolbar, see [Chapter 6.6.2, "Configuring the toolbar"](#), on page 58.

The following list describes at first the default toolbar functions and then the additional functions.



Undo

Undoes the last setting actions step by step. Some actions cannot be revoked: locking the touchscreen with [Touch Lock], and saving data. The undo stack is deleted during the following actions: Reloading settings from file, and reference waveform actions (save, load and preset with active reference waveform).



Redo

Recovers the undo steps in reverse order.



Help

Enables the tooltip display. A short description appears when you tap a parameter in a dialog. To open the corresponding help topic, tap the "Show Help" button in the lower right corner of the tooltip. See also: [Chapter 6.11, "Getting information and help"](#), on page 72.



Graphical Saveset

Opens a window to select and load instrument settings that were previously stored in a saveset. A graphical preview helps you to find the required settings.



Saveset

Saves the current instrument settings in a saveset.

You can reload the saveset using the "Graphical Saveset" toolbar icon, or using "Menu" > "Save/Recall" > "Recall" tab > "Saveset with preview".

The filename is created according to the autonaming pattern, defined in "Menu" > "Settings" > "Save/Recall" > "Autonaming" tab.

**Image**

Saves a screenshot of the current display using the settings defined in "Menu" > "Save/Recall" > "Save" tab > "Screenshot".

**Report**

Creates a report of the current measurement settings and results using the settings defined in "Menu" > "Save/Recall" > "Save" tab > "Report".

**Clear**

Deletes all measurement results including long term measurement and statistics, all waveforms, and the history.

**Autoset and Preset**

Performs an autoset, or a preset to a default state. The icons have the same functionality as the corresponding keys on the front panel. They are useful when you control the instrument remotely.

**Run / Stop and Single**

Starts and stops the continuous acquisition, or starts a defined number of acquisition cycles. The icons have the same functionality as the corresponding keys on the front panel. They are useful when you control the instrument remotely.

**Find Level**

Analyses the signal and sets the trigger level to the middle of the signal peaks.

**Force Trigger**

Starts an immediate single acquisition. If the acquisition is running in normal mode and no valid trigger occurs, use "Force Trigger" to confirm that a signal is available. Then you can use the displayed waveform to determine how to trigger on it.

**Demo**

Opens the "Demo" dialog, where you can find examples of operating the R&S RTO.

**Zoom**

The zoom icon on the toolbar shows the last selected zoom type. A short tap on the icon activates the selected zoom.

To use another zoom type, select it in the toolbar assist.



Standard zoom ← Zoom

Displays a magnified section of the diagram in an additional zoom diagram. It is a display zoom, instrument settings are not changed.

Tap the icon and drag a rectangle on the diagram to mark the zoom area. An additional zoom diagram appears. You can use the tool repeatedly on the zoom diagram to get a more detailed view.

Touch and hold the zoom area to open the "Zoom" dialog box.



Hardware zoom ← Zoom

Changes the instrument settings - horizontal and vertical scales as well as trigger level and offset - to display a part of the diagram in greater detail.

Tap the icon and drag a rectangle on the diagram to mark the area to be zoomed. The diagram changes and shows the magnified area. To return to the previous display, use the "Undo" function.



Coupled zoom ← Zoom

Creates a coupled zoom area and its related zoom diagram. If you change the size of one zoom area, the size of all coupled zoom areas is changed as well.

First, create a zoom using the "Standard" zoom. Then tap "Coupled zoom" and tap the existing zoom area. The zoom area is duplicated. Drag the duplicate to the required position.



Fingertip zoom ← Zoom

Magnifies the waveforms around your fingertip.

Tap the icon and put your finger on the waveform. The touched part of the waveform is displayed in a magnifier. Drag your finger on the screen to move the magnifier. You can change the zoom factor using the [Navigation] knob.



Search

Performs a search according to the settings in the "Search Setup" dialog box. Tap the icon and then tap the diagram with the waveform to be searched, or drag a rectangle to define a search gate. The search is performed on the selected waveform.

Performs a search. Tap the icon and adjust the settings in the sidebar. Tap the diagram with the waveform to be searched, or drag a rectangle to define a search gate. The search is performed on the selected waveform.



Cursor

The cursor icon shows the last selected cursor type. A short tap on the icon activates the selected cursor.

To use another cursor type, select it in the toolbar assist, and adjust the settings. Tap the diagram where you want to set the cursors, or draw a rectangle in the diagram to position the cursor lines. The resulting cursor lines measure the selected waveform, and the results are shown. You can adjust the cursor source, type and position in the result box. Move the cursor lines by dragging them in the diagram, or by turning the navigation knob. Pressing the knob switches the parameter to be changed.



Mask Test

Starts the on-screen mask definition and the testing against the defined mask.

Tap the icon and then tap the points that build the mask. To finish the shape definition, tap "Finish segment" in the toolbar assist. To create a rectangular mask, draw a rectangle on the screen. You can add more segments to the test, and add another test. You can also move the mask segments on the screen.

To configure the mask test settings, tap the  icon in the "Mask" result box.



Histogram

The histogram icon on the toolbar shows the last selected histogram type. A short tap on the icon activates the selected histogram.

To use another histogram type, select it in the toolbar assist, and adjust the source.

Tap the icon and then drag a rectangle on the diagram to mark the histogram area. The histogram for the selected waveform appears.

To change settings, touch and hold the histogram area, and the histogram toolbar assist opens.



Measure

Starts an automatic measurement.

You can run up to 8 automatic measurement groups in parallel. The "Automatic measurement" icon starts the measurement groups one after the other.

A measurement group consists of minimum one measurement, and can consist of many measurements of the same category. Tap the icon, and select the category and the measurements in the toolbar assist. Tap the diagram with the waveform to be measured. To define a measurement gate, draw a rectangle on the screen.

To modify the measurement, double-tap one of the result values.



Quick meas

Performs a set of measurements on the selected waveform or on the selected gate. You can configure up to 8 measurements to be included in quick measurement.

Tap the icon and then tap the diagram with the waveform to be measured or draw a rectangle to define the gate.



FFT

Transforms a waveform to the frequency spectrum by fast Fourier transform (FFT). The FFT trace is shown in a new diagram.

Tap the icon and adjust the settings in the toolbar assist. Tap the diagram with the waveform to be transformed. The FFT diagram is created from the selected waveform.

To adjust FFT settings, double-tap the FFT diagram.



Label

Defines a waveform label that names or explains the waveform. Tap the icon and then tap the waveform to be labeled. Enter the label text using the on-screen keyboard. The text is shown in the same color as the waveform. If you tap the display background, the label is assigned to the selected waveform. You can drag the label to another position.



Save Reference

Copies the selected source waveform with all its settings to the reference waveform. If the acquisition is running, the reference waveform is a snapshot. You can configure up to four reference waveforms.

Tap the icon, and select the required reference waveform (R1 to R4) in the toolbar assist. Tap the waveform to be copied as reference.



Save Waveform

Exports the waveform data to file using the settings defined in "Menu" > "Save/Recall" > "Save" tab > "Waveform" > "Setup" tab.

The filename is created according to the autonaming pattern.

Tap the icon and then tap the waveform to be exported. If you tap the display background, the selected waveform is exported, or a multichannel export is performed if configured.

**Zone trigger**

Defines a zone trigger, which combines the trigger condition with the intersection or non-intersection of one or more zones or masks.

Tap the icon and then tap the corner points of the zone on the screen. Tap "Finish zone". You can add more zones to the trigger condition.

**Spectrogram (option R&S RTO-K18)**

Starts an FFT and the spectrogram. The FFT trace and the spectrogram are shown in separate diagrams.

Tap the icon. Select the source in the sidebar, or tap diagram with the waveform to be transformed. The diagrams are created from the selected waveform.

**Delete**

Removes waveforms, measurements, zoom, histograms, mask segments and other elements from the display.

Tap the icon and then tap the element to be deleted, or the waveform to be switched off.

6.7 Displaying results

The results of measurements, mask tests, searches, protocol decoding and others are displayed immediately. There are several places to display the results:

- In a table that is docked below the diagram (not available for mask test results)
- In a floating result box in front of the diagrams, which you can move on the display
- In a minimized view (result icon) on the signal bar
- In a separate that can be arranged similar to a diagram

The default position and the font size can be adjusted.

To define the default position of measurement results

For results of automatic, cursor measurements and protocol measurements, the docked position below the diagram is the initial default position.

To change the default position of the results:

- ▶ Open the "Menu" > "Settings" > "Appearance" dialog.

Displaying results

- Automatic measurements: select "Measurement" tab > "Result position".
- Cursor measurements: select "Cursor" tab > "Result position".
- Protocols: select "Protocol" tab > "Result position".

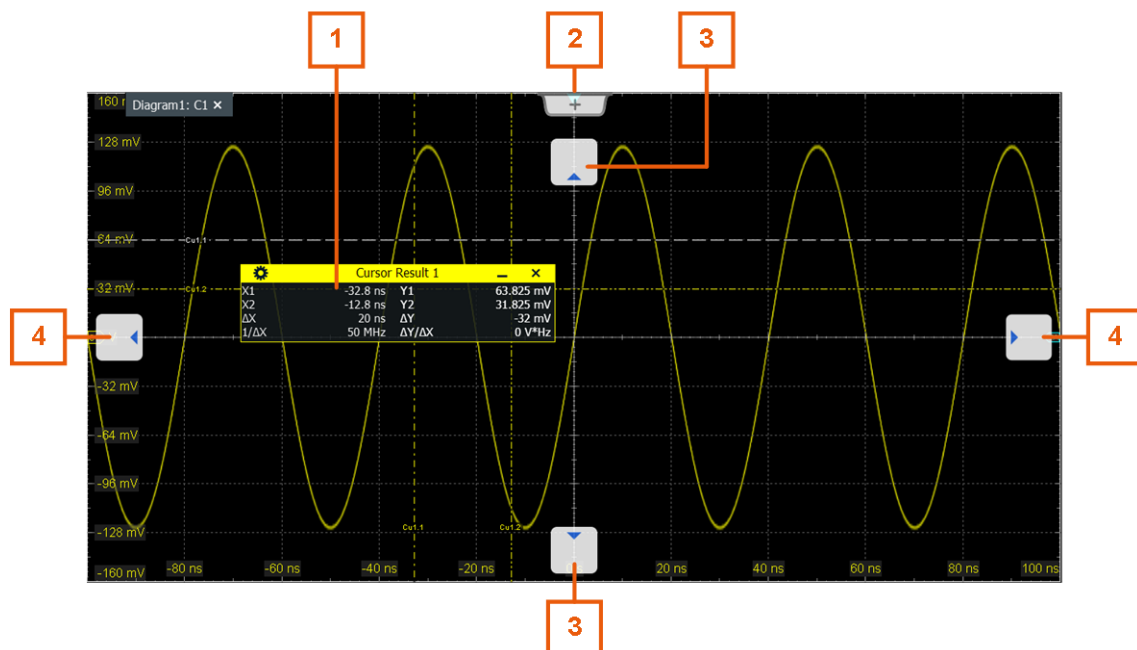
To arrange the results on the display

1. If the results are listed in a docked table, touch and hold a result line and drag it.

The results are now shown in a result box.


Note: Once you undock the measurement results, you cannot move the result box back to the docked position.

2. Touch and hold the title of the result box and drag the box on the screen. The SmartGrid indicates where the result box will be placed.
 - If you drop the box on one of the buttons, the results are shown in a separate tab besides, above, or below the diagram.
 - If you drop the box on the signal bar, a result icon is created.
 - If you drop the box somewhere else, a floating result box is placed.



- 1 = Floating result box
 2 = New tab
 3 = Table in a tab above or below
 4 = Table in a tab on the left or right

To open the corresponding setup dialog box

1. Double-tap one of the result values.
If a result box is shown, you can also tap the  icon.
2. In the toolbar assist, tap "Advanced Setup" .
The dialog box with corresponding settings opens.





To adjust the font size of results

1. Open the "Menu" > "Settings" > "Appearance" dialog.
2. Select the "Dialogs" tab.
3. Set the "Result dialog" > "Font size".

6.8 Using dialog boxes

All functionality is provided in dialog boxes as known from computer programs. You can control the instrument intuitively with the touchscreen. This section provides an overview of the accessing methods and describes how to use the dialog boxes.

Each dialog box has four icons in the upper right corner:


	Go back: opens the previously opened dialog box.
	Go forward: opens the next dialog box.
	Minimizes the dialog box to a small box that only contains the last selected function.
	Closes the dialog box.



For direct access to important control and measurement functions, use the toolbar, see [Chapter 6.6, "Toolbar"](#), on page 56.

To open a dialog box

- ▶ Perform one of the following actions:

- Open the "Menu", and select the menu entry.
- Press the function key on the front panel.
- Double-tap a result icon, or tap the  icon in a result box to open the corresponding dialog box.
- To open the "Vertical" dialog box of a waveform, tap the signal icon.
- Tap the "Horizontal", "Acquisition" or "Trigger" label to open the corresponding dialog box.

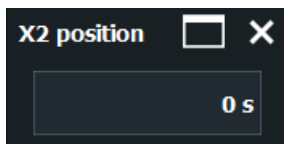
To minimize a dialog box

If you want to change only one setting during analysis, and you need to change it often, you can display a small box that only contains the required setting.

1. Tap the setting that you need to modify.
2. Tap the "Minimize" icon in the upper right corner of the dialog box.



The dialog box turns into a small box that contains only the setting, that was last selected.



3. To restore the complete dialog box, tap the "Maximize" icon in the small box.



To close a dialog box

- ▶ Tap the "Close" icon in the upper right corner.

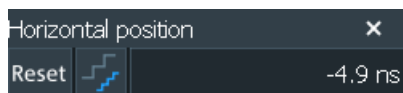
6.9 Entering data

To set parameter values and enter other data, you use the various knobs and the on-screen keypad or keyboard.

Using scale, position and level knobs

The instrument has dedicated rotary knobs to set vertical and horizontal positions and scale, and the trigger level. When you turn a knob, the input box appears in the lower right corner of the screen, showing the parameter name and current value.

1. Turn the knob to change the value.
2. Press the knob:
 - [Scale]: to toggle the increment.
 - [Position]: to set to zero.
 - [Levels]: to set the trigger level to 50% of the signal.
3. The input box also provides settings
 - Tap the "Steps" icon to toggle the increment.
 - Tap the "Reset" icon to set the parameter to the autoselected value (if available).

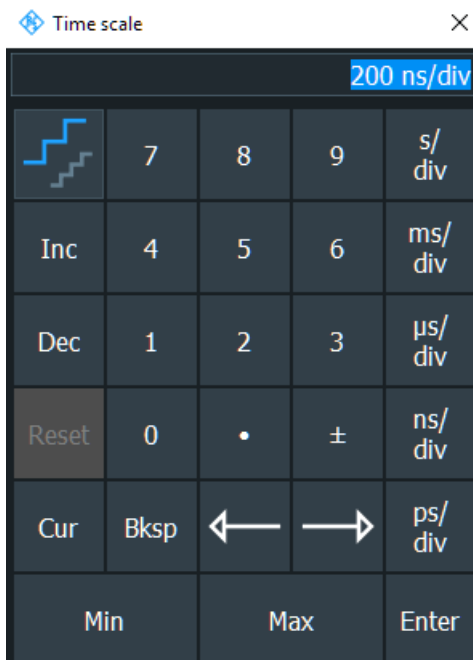


The [Navigation] knob is described in [Chapter 5.3, "Keys and controls"](#), on page 31.

To enter values with the on-screen keypad

For data input in dialog boxes, the touchscreen provides an on-screen keypad to enter numeric values and units. For text input, the on-screen keyboard with English key layout is used.

1. Double-tap the entry field.
The on-screen keypad opens.

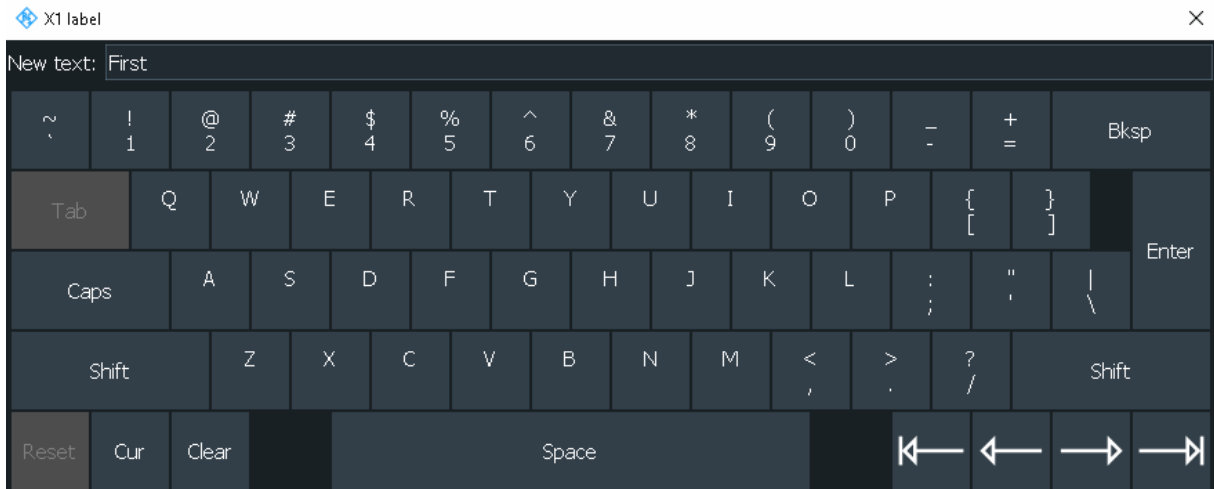


2. Enter the numeric value using the following methods:

- To use the default value, tap "Reset" (if available).
- To use the minimum or maximum value, tap "Min" or "Max", respectively.
- To increase the displayed value in fixed steps, tap "Inc".
To decrease the value in fixed steps, tap "Dec".
To toggle between small steps and large steps, tap the "Steps" icon.
- To get the value that was used before the keypad was displayed, tap "Cur".
- To enter a user-defined value, tap the numbers and complete the entry by tapping the unit button.
 - The arrow buttons move the cursor left or right.
 - "Bksp" deletes the last character before the cursor.
 - "±" changes the sign of the value.

To enter data with the on-screen keyboard

1. Double-tap the entry field to open the on-screen keyboard.
If available, you can also tap the keyboard icon on the right of the entry field.



2. Enter the text as you would on a normal keyboard.
 - To enter a series of capital characters, tap "Caps".
To enter one capital character, tap "Shift".
 - To use the currently defined value, tap "Cur". This is the value that was used before the keyboard was displayed.
 - The arrow buttons move the cursor left or right.
 - "Bksp" deletes the last character before the cursor.
3. Tap "Enter" to complete the entry.

To enter numeric data in a dialog box with navigation controls



1. To navigate to the entry field, press the [←] and [→] keys.
2. To change the value with a small step size, turn the rotary knob.
Alternatively, press the [▲] and [▼] keys for a larger step size.

If you edit numeric data in tables, the entry field must be in edit mode. To activate the edit mode, press ENTER, or the [✓] key, or the navigation rotary knob.

6.10 Instrument information and notifications

In the upper right corner of the screen, you see the Rohde & Schwarz logo, date and time, the symbolic information on LAN connection and the notifications status.



- ▶ To see the instrument information, tap the Rohde & Schwarz logo.

Notification	Info	2021-05-27 19:13:14	
Sample	2		
	Notifications		
Model:	R&S RTO2000 6 GHz		
Analog Bandwidth:	6 GHz		
Firmware Version:	5.0.12.190 Beta		
Serial Number:	900999		
Device ID:	1329.7002k64		
Ethernet:	Connected		
IP address:	10.111.0.255		
Operating time:	1 day and 03:40:56		

Notifications are status messages, information on mismatching settings and similar information. They are displayed for a few seconds and saved.

The color of the dot before the text indicates the severity: gray for information, orange for warnings, and red for errors.

- ▶ To read the notifications, tap "Notification".
You can also delete the list of notifications.

Horizontal	Acquisition		Info	2021-01-28 14:55:29	
5 ns/ 0 s	10 Gpts/s 1 kpts	Sample Avg 1 Hist 2.37 k	1 Notification		
	● Math expression adjusted for using in optimized mode.				
					remove all

1. To hide the date and time, open "Menu" > "Settings" > "Appearance" > "Diagram" tab.
2. Disable "Show date / time".

6.11 Getting information and help

If you need information on the instrument's functionality, you can use the following sources:

- Tooltips give a short description of the parameter.
- The context help provides functional description on a setting, and the corresponding remote command.
- The general help opens the help window with a table of contents, where you can browse and search for information.
- Videos explain various analyzing and measurement tasks. They are available in the [R&S®RTO2000 - Media Center](#).

6.11.1 Displaying help

To display tooltips and context help

1. Enable the "Help" icon on the toolbar.




2. Tap the parameter for which you need information.
The tooltip opens.
3. To open the corresponding help topic, tap the "Show Help" button in the lower right corner of the tooltip.

The "Help" window opens and displays the comprehensive description and the corresponding remote command. You can browse the help for further information.

Note: The tooltip icon disables automatically when you tap a parameter. To show another tooltip, tap the tooltip icon again.

To open general help

1. Open the "Menu".
2. Tap the  "Help" icon.
The help window opens with the "Contents" page, where you can select the topics.

6.11.2 Using the help window

The Help window contains several tabs:

- "View" - shows the selected help topic

- "Contents" - contains a table of help contents
- "Index" - contains index entries to search for help topics
- "Search" - provides text search

View Contents Index Search

The Help toolbar provides some buttons:

- To browse the topics in the order of the table of contents: Up arrow = previous topic, Down arrow = next topic
- To browse the topics visited before: Left arrow = back, Right arrow = forward
- To increase or decrease the font



To navigate the Help, use the touchscreen.

To search for a topic in the index

The index is sorted alphabetically. You can browse the list, or search for entries in the list.

1. Switch to the "Index" tab.
2. Select the "Keyboard" icon beside the entry field.
3. Enter the first characters of the keyword you are interested in.
The entries containing these characters are displayed.
4. Double-tap the suitable index entry.
The "View" tab with the corresponding help topic is displayed.

To search topics for a text string

1. Switch to the "Search" tab.
2. Select the "Keyboard" icon beside the entry field.
3. Enter the string you want to find.
If you enter several strings with blanks between, topics containing all words are found (same as AND operator).

For advanced search, consider the following:

- To find a defined string of several words, enclose it in quotation marks. For example, a search for *"trigger qualification"* finds all topics with exactly

Getting information and help

"trigger qualification". A search for *trigger qualification* finds all topics that contain the words *trigger* and *qualification*.

- Use "Match whole word" and "Match case" to refine the search.
- Use operators AND, OR, and NOT.

To close the Help window

- ▶ Select the "Close" icon in the upper right corner of the help window.
Or: Press the [Esc] key.

7 Setting up the instrument

Basic setup procedures for the instrument are the following:

- [Performing a self-alignment](#)..... 76
- [Setting the display language](#)..... 77
- [Adjusting passive probes](#)..... 77

7.1 Performing a self-alignment

The self-alignment aligns the data from several input channels vertically and horizontally to synchronize the timebases, amplitudes and positions. The self-alignment process includes a basic hardware check.

Recommendation on performing the self-alignment:

- When putting the instrument into operation for the first time
 - After a firmware update
 - Once a week
 - When major temperature changes occur ($> 5^\circ$)
1. Warm up the instrument before you start the self-alignment. The minimum warm-up time is indicated in the data sheet.
 2. Remove the probes from the input connectors.
 3. In the "Menu" > "Settings" menu, select "Maintenance".
 4. In the "Alignment" tab, tap "Start Alignment".

The alignment is performed, the process might take several minutes. A message box informs you about the running process, wait until this message box closes.

The overall pass/fail result is shown in the "Overall alignment state" field. The results of the individual alignment steps for each input channel are indicated in the "Results" tab. This information is required if problems arise.

7.2 Setting the display language

You can change the language in which the dialog boxes, result boxes and other screen information is displayed. A reboot of the instrument is not necessary.

1. Open the "Menu" > "Settings" > "System" dialog.
2. Select the "Localization" tab.
3. Tap the "Language" button. The button shows the current language.
4. Select the required language.

The instrument changes the language after a few seconds.

7.3 Adjusting passive probes

When using a passive probe, you have to compensate it when you connect it to the instrument the first time. Compensation matches the probe cable capacitance to the oscilloscope input capacitance to assure good amplitude accuracy from DC to upper bandwidth limit frequencies. A poorly compensated probe reduces the performance of the probe-oscilloscope system and introduces measurement errors resulting in distorted waveforms and inaccurate results.

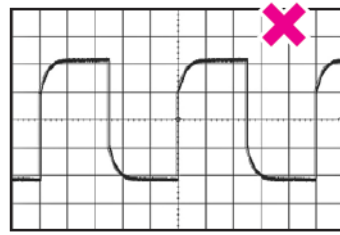
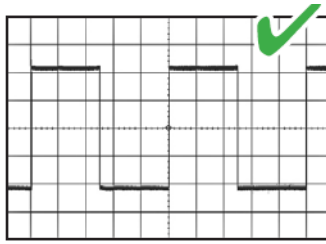
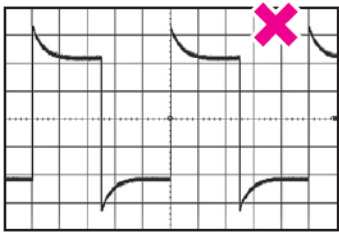
Two connector pins are located on the front panel. The right pin is on ground level. The left pin supplies a square wave signal with 1 kHz for low frequency probe compensation.

1. Connect the BNC connector of the probe to input [C1].
2. Connect the probe's ground connector to the right compensation pin, and the tip with the left pin.
3. Press [Autoset].

A square wave appears on the display.

4. Adjust the compensation trimmer of the probe to optimum square wave response. For details, refer to the documentation of your probe.

Adjusting passive probes



8 Contacting customer support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

Contact information

Contact our customer support center at www.rohde-schwarz.com/support, or follow this QR code:



Figure 8-1: QR code to the Rohde & Schwarz support page

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