

R&S®BTC

Broadcast Test Center

Getting Started



2114302302

The software contained in this product uses several valuable open source software packages. For information, see the "Open Source Acknowledgment" document, which is available for download from the R&S BTC product page at www.rohde-schwarz.com/product/btc.html > "Downloads" > "Firmware".

Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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2114.3023.02 | Version 11 | R&S®BTC

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

Safety Instructions

Instrucciones de seguridad

Sicherheitshinweise

Consignes de sécurité

WARNING

Risk of injury and instrument damage

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

- Do not open the instrument casing.
 - Read and observe the "Basic Safety Instructions" delivered as printed brochure with the instrument.
 - Read and observe the safety instructions in the following sections. Note that the data sheet may specify additional operating conditions.
 - Keep the "Basic Safety Instructions" and the product documentation in a safe place and pass them on to the subsequent users.
-

ADVERTENCIA

Riesgo de lesiones y daños en el instrumento

El instrumento se debe usar de manera adecuada para prevenir descargas eléctricas, incendios, lesiones o daños materiales.

- No abrir la carcasa del instrumento.
 - Lea y cumpla las "Instrucciones de seguridad elementales" suministradas con el instrumento como folleto impreso.
 - Lea y cumpla las instrucciones de seguridad incluidas en las siguientes secciones. Se debe tener en cuenta que las especificaciones técnicas pueden contener condiciones adicionales para su uso.
 - Guarde bien las instrucciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.
-

⚠️ WARNUNG**Gefahr von Verletzungen und Schäden am Gerät**

Betreiben Sie das Gerät immer ordnungsgemäß, um elektrischen Schlag, Brand, Verletzungen von Personen oder Geräteschäden zu verhindern.

- Öffnen Sie das Gerätegehäuse nicht.
 - Lesen und beachten Sie die "Grundlegenden Sicherheitshinweise", die als gedruckte Broschüre dem Gerät beiliegen.
 - Lesen und beachten Sie die Sicherheitshinweise in den folgenden Abschnitten; möglicherweise enthält das Datenblatt weitere Hinweise zu speziellen Betriebsbedingungen.
 - Bewahren Sie die "Grundlegenden Sicherheitshinweise" und die Produktdokumentation gut auf und geben Sie diese an weitere Benutzer des Produkts weiter.
-

⚠️ AVERTISSEMENT**Risque de blessures et d'endommagement de l'appareil**

L'appareil doit être utilisé conformément aux prescriptions afin d'éviter les électrocutions, incendies, dommages corporels et matériels.

- N'ouvrez pas le boîtier de l'appareil.
 - Lisez et respectez les "consignes de sécurité fondamentales" fournies avec l'appareil sous forme de brochure imprimée.
 - Lisez et respectez les instructions de sécurité dans les sections suivantes. Il ne faut pas oublier que la fiche technique peut indiquer des conditions d'exploitation supplémentaires.
 - Gardez les consignes de sécurité fondamentales et la documentation produit dans un lieu sûr et transmettez ces documents aux autres utilisateurs.
-

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1 Preface

This chapter provides safety related information, an overview of the user documentation and the conventions used in the documentation.

1.1 For Your Safety

The R&S BTC is designated to develop, produce and verify electronic components and devices in an industrial environment. Use the R&S BTC only in its designated purpose as described in the product documentation, for example in [Chapter 3, "System Overview"](#), on page 11. Observe the operating conditions and performance limits stated in the specifications (data sheet).

The product documentation helps you to use the R&S BTC safely and efficiently. Keep the product documentation in a safe place and pass it on to the subsequent users.

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

- In the "Basic Safety Instructions", safety issues are grouped according to subjects. For example, one subject is electrical safety. The "Basic Safety Instructions" are delivered with the R&S BTC in different languages.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

Always read the safety instructions carefully. Make sure to comply fully with them. Do not take risks and do not underestimate the potential danger of small details such as a damaged power cable.

1.2 Conventions Used in the Documentation

The following conventions are used throughout this documentation.

Typographical conventions

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialogs, menus, options, buttons, and softkeys are enclosed by parentheses.
[keys]	Key names are written in capital letters.
File names, commands, program code	File names, commands, coding samples and screen output are distinguished by their font.
<i>Input</i>	Input to be entered by the user is displayed in italics.

Convention	Description
Links	Links are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by parentheses.

Conventions for procedure descriptions

When describing how to operate the R&S BTC, several alternative methods may be available to perform the same task. If possible, the procedure using the touchscreen is described.

The following table gives an overview how the terms for different operating methods are related.

For more information on operation refer to the user manual, chapter "Operating Concepts".

Table 1-1: Terms used in the documentation

Term used in documentation	Control in focus	Used method and its common term		
		Finger on the touchscreen	Mouse pointer in the display	Hardkey or keyboard
To tap	Icon, button	To tap	To click	To press
To double-tap	Directory, file	To double-tap To touch & hold	To double-click	To focus and press <Enter> key
To select	Menu, command, tab, list entry, parameter value	To tap	To click	To focus and press <Enter> key
To activate/deactivate	Option	To tap	To click	To focus and press <Enter> key
To scroll	Scroll bar (vertical or horizontal)	To flick	To scroll	To press [PAGE DOWN] or [PAGE UP] key
To drag & drop	Graphical elements, files	To touch & hold, slide and release	To drag & drop	-

2 Documentation Overview

This chapter provides an overview of the R&S BTC user documentation. Unless specified otherwise, you find the documents on the R&S BTC product page at:

www.rohde-schwarz.com/manual/btc

2.1 Getting Started Manual

Introduces the R&S BTC and describes how to set up and start working with the product. Includes a sample application and general information, e.g. safety instructions, etc. A printed version is delivered with the instrument.

2.2 User Manuals and Help

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

The contents of the user manual is available as help in the R&S BTC. The help offers quick, context-sensitive access to the complete information for the base unit and the software options.

For detailed information on how to use the help, refer to the chapter "Operating Concepts".

The user manual (PDF) is provided on the R&S BTC under:

`C:\Program Files\Rohde&Schwarz\Btc\Docu`

If you install a new firmware version, the information in this directory is also updated.

2.3 Tutorials

Tutorials offer guided examples and demonstrations on operating the R&S BTC. They are provided on the product page of the internet.

2.4 Basic Safety Instructions

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

2.5 Data Sheets and Brochures

The data sheet contains the technical specifications of the R&S BTC. It also lists the options and their order numbers, and optional accessories.

The brochure provides an overview of the instrument and deals with the specific characteristics.

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

2.6 Release Notes and Open Source Acknowledgment (OSA)

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. On the R&S BTC, the open source acknowledgment document is provided as PDF file in the same directory as the user manual.

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

2.7 Application Notes, Application Cards, White Papers, etc.

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

See www.rohde-schwarz.com/application/btc

3 System Overview

The R&S BTC broadcast test center is a reference signal generator featuring analysis functions and automated tests for audio, video and multimedia applications. It is a unique combination of outstanding technical features and a modular, flexible design to meet the highest demands.

The multistandard R&S BTC offers a complete DUT environment in a single instrument. As a high-end signal generator, it generates RF signals for all global broadcasting standards, performs transmission simulation and, at the same time, makes audio and video analyses for the DUTs. All this is made possible by using diverse interface, generator and analysis modules.

Integrated and automated test sequence control as well as test suites ensure that test results are reproducible while reducing test times.

See the Rohde & Schwarz Home Page (<http://www.rohde-schwarz.com>) for information on available hardware and software options, data sheet and product brochure, application notes.

4 Setting Up the R&S BTC

WARNING

Risk of injuries

To avoid injuries to yourself or others, always follow the instructions provided in the following chapters. Furthermore, observe the general safety instructions delivered with the R&S BTC.

4.1 Unpacking the R&S BTC

The R&S BTC is shipped together with its mandatory accessories in a cardboard box.

4.1.1 Inspecting for Shipping Damage

Check the following. If anything is damaged, immediately notify the carrier.

1. Check the shipping container and cushioning material for damage.
2. Unpack the cardboard box (see [Chapter 4.1, "Unpacking the R&S BTC"](#), on page 12), and check the housing and handle for visible damages or loose parts.

4.1.2 Unpacking the Cardboard Box

Proceed as follows:

1. Open the cardboard box.
2. Remove the accessories packed into the box.
3. Take the R&S BTC out of the packaging.
4. Remove the shock protectors attached to the R&S BTC.



Retain the original packing material. If the R&S BTC needs to be transported or shipped at a later date, you can use the material to prevent control elements and connectors from being damaged. Rohde & Schwarz will only accept claims of warranty if the R&S BTC is shipped with sufficient packaging.

4.1.3 Checking the Accessories

The R&S BTC comes with the following accessories:

- Power cable
- Getting started manual

4.1.4 Warranty Conditions

For information on warranty conditions for the R&S BTC refer to the terms of the delivery documents.

4.2 Putting Up the R&S BTC

The R&S BTC is designed for interior use under general laboratory conditions.

NOTICE

Risk of material damage

Make sure that the following conditions are met at the operation site:

- The ambient temperature does not exceed the range specified in the data sheet.
- All fan openings are unobstructed and the airflow perforations are unimpeded. The minimum distance from the wall is at least 10 cm.

Failure to meet these conditions may cause damage to the R&S BTC or other devices in the test setup.

If necessary, use proper protective equipment to protect DUTs against electrostatic discharge in the event of human contact.

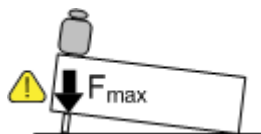
4.2.1 Placing the R&S BTC on a Bench Top

Place the R&S BTC on a stable and level surface. The R&S BTC can be used in horizontal position, standing on its feet, or with the support feet on the bottom extended. Do not place anything on top of the R&S BTC, if the R&S BTC is not in a level position. Keep in mind that the R&S BTC is heavy and can cause injury to you or others if not set up securely.

⚠ WARNING**Risk of injury if feet are folded out**

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

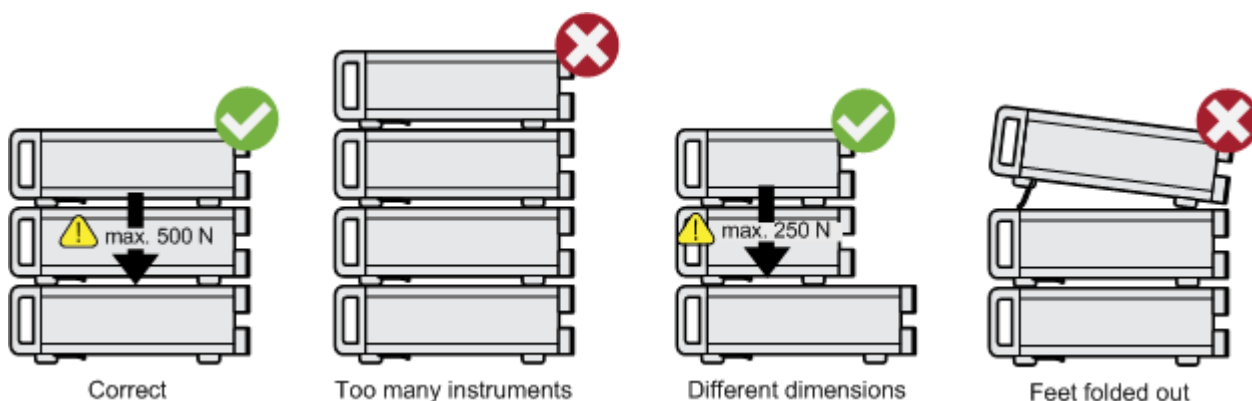
- Fold the feet completely in or out to ensure stability of the instrument. Never shift the instrument when the feet are folded out.
- When the feet are folded out, do not work under the instrument or place anything underneath.
- The feet can break if they are overloaded. The overall load on the folded-out feet must not exceed 500 N.

**⚠ WARNING****Risk of injury when stacking instruments**

A stack of instruments can tilt over and cause injury if not stacked correctly. Furthermore, the instruments at the bottom of the stack can be damaged due to the load imposed by the instruments on top.

Observe the following instructions when stacking instruments:

- Never stack more than three instruments. If you need to stack more than three instruments, install them in a rack.
- The overall load imposed on the lowest instrument must not exceed 500 N.
- It is best if all instruments have the same dimensions (width and length). If you need to stack smaller instruments on the top, the overall load imposed on the lowest instrument must not exceed 250 N.
- If the instruments have foldable feet, fold them in completely.



4.2.2 Mounting the R&S BTC in a Rack

The R&S BTC may be installed in a 19" rack mount by using a rack adapter kit (for order no. see data sheet). Follow the installation instructions that are part of the adapter kit.

5 Interfaces and Connectors

In this manual, the front and rear panel of the base unit are described. In the user manual or the help system, this chapter also includes the following:

- Description of the modules that you can optionally install
- Information on pin assignments

For information on permissible input and output levels, see the data sheet.



When using the interfaces and connectors, take care to avoid electromagnetic interference. See [Chapter 6.1, "Preventing Electromagnetic Interference"](#), on page 28.

5.1 Front Panel

This chapter provides an overview of the controls and connectors on the front panel. Each control or connector is briefly described along with a reference to the chapter(s) containing detailed information about its usage.

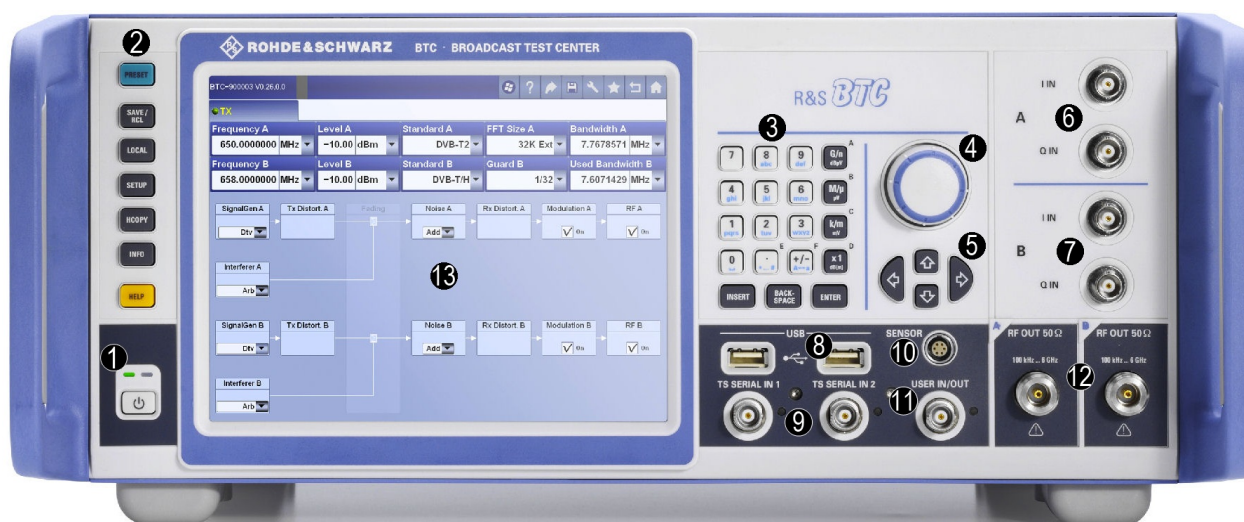


Figure 5-1: Front panel view (example; 2 paths instrument)

- 1 = On/standby key
- 2 = Keys
- 3 = Keypad
- 4 = Rotary knob
- 5 = Cursor keys
- 6/7 = I/Q inputs (path A, B)
- 8 = USB interfaces
- 9 = TS serial inputs
- 10 = Power sensor connector
- 11 = Application-specific input/output
- 12 = RF outputs
- 13 = Display

5.1.1 On/Standby Key

See (1) in [Figure 5-1](#).

The on/standby key works only if the AC power switch on the back of the R&S BTC is switched on. The on/standby key switches the R&S BTC from standby to on and back.

See [Chapter 7.1, "Instrument States"](#), on page 32.

5.1.2 Keys for Frequently-Used Functions

See (2) in [Figure 5-1](#).

See the user manual or the help system.

For information on corresponding keys of an external keyboard see [Table 6-1](#).

PRESET key

Sets a defined instrument state.

SAVE/RCL key

Saves and recalls instrument data.

LOCAL key

Switches from remote control to manual operation.

SETUP key

Opens the "Setup" dialog to perform basic instrument configurations.

HCOPY key

Configures the screen printout.

INFO key

Displays the "Setup" dialog, "HW Equipment" tab. There, the basic hardware and software information is provided.

HELP key

Displays context-sensitive help.

5.1.3 Cursor Keys

See (5) in [Figure 5-1](#).

Cursor keys

<Up Arrow>/<Down Arrow> keys:

- Moves the focus vertically in windows, dialogs, tables and lists.
- If a numeric parameter value is in editing mode, increases or decreases the digit value at the cursor position.

<Left Arrow>/<Right Arrow> keys:

- Moves the focus horizontally in windows, dialogs, tables and lists.
- If a numeric parameter value is in editing mode, moves the cursor from digit to digit.

5.1.4 Keypad

See (3) in [Figure 5-1](#).

The keys on this keypad have a multiple purpose. The required characters are selected by pressing the keys an appropriate number of times.

Key	Description
Alphanumeric keys 1 to 9	To enter data.
0	To enter the number zero.
␣	To enter a space.
.	To enter a decimal point.
*...#	To enter a special character.
+/-	To enter a sign.
A↔a	Switches between upper-case and lower-case letters.
G/n dB μ V M/ μ μ V k/m mV x1 dB(m)	To enter the unit.
[INSERT]	Sets the way to enter text: <ul style="list-style-type: none"> • By adding to the existing text. • By replacing existing text.
[BACKSPACE]	Deletes the character to the left of the cursor.
[ENTER]	<ul style="list-style-type: none"> • Displays the next menu level. • Activates the editing mode for the marked numeric and alphanumeric parameters. • Completes the data entry and accepts the new value. For numeric parameters, the unit is displayed in the menu next to the value. • Switches the marked status parameters on/off (State On/Off). • Confirms (OK) and closes message windows, see user manual or the help system.

5.1.5 Rotary Knob

See (4) in [Figure 5-1](#).

Turning the rotary knob performs one of the following actions:

- Moves the focus in windows, dialogs, tables and lists.
- If a numeric parameter value is in editing mode, increases or decreases the digit value at the cursor position.

Pressing the rotary knob performs the same actions as the [ENTER] key.

Further information:

- [Chapter 5.1.4, "Keypad"](#), on page 18.

5.1.6 Display

See (13) in [Figure 5-1](#).

For information on the touch screen operation see the user manual or the help system.

5.1.7 I, Q, \bar{I} , \bar{Q} (Path A)

Only 1 path instruments are fitted with these connectors.

BNC connectors. Single-ended or differential analog I/Q inputs.

See the user manual or the help system.

5.1.8 I IN/Q IN (Path A, B)

See (6/7) in [Figure 5-1](#).

Only 2 paths instruments are fitted with these connectors.

BNC connectors. Inputs for an external analog modulation signal for I/Q modulation.

See the user manual or the help system.

5.1.9 USB Interfaces

See (8) in [Figure 5-1](#).

See [Chapter 5.2.5, "USB Interfaces"](#), on page 23.

5.1.10 TS SERIAL IN 1/2

See (9) in [Figure 5-1](#).

BNC connectors. Inputs to feed in a serial transport stream.

The provided signal is accepted in the following formats:

- ASI (asynchronous serial interface)
- SMPTE 310 (society of motion picture and television engineers)

The input is selected on the "Input Signal" subtab, under "Input".

See the user manual or the help system.

5.1.11 SENSOR

See (10) in [Figure 5-1](#).

Reserved for future use.

ODU mini-snap connector, series B (manufacturer: ODU-Steckverbindersysteme GmbH). Used to connect a power sensor (R&S NRP-Zxxx). It allows independent power measurement and calibration of the RF signal from the R&S BTC.

See the power meter application in the user manual or the help system.

5.1.12 USER IN/OUT

See (11) in [Figure 5-1](#).

Application-specific inputs/outputs.

5.1.13 RF OUT 50 Ω

See (12) in [Figure 5-1](#).

N (50R mechanics) connector. Used to output the RF signal.

NOTICE

Do not overload the RF output

See the data sheet for the limits for the DC voltage and reverse RF power. Do not exceed these limits. Exceeding these limits can cause instrument damage.

5.2 Rear Panel

This chapter provides an overview of the controls and connectors on the rear panel. Each control or connector is briefly described along with a reference to the chapter(s) containing detailed information about its usage.

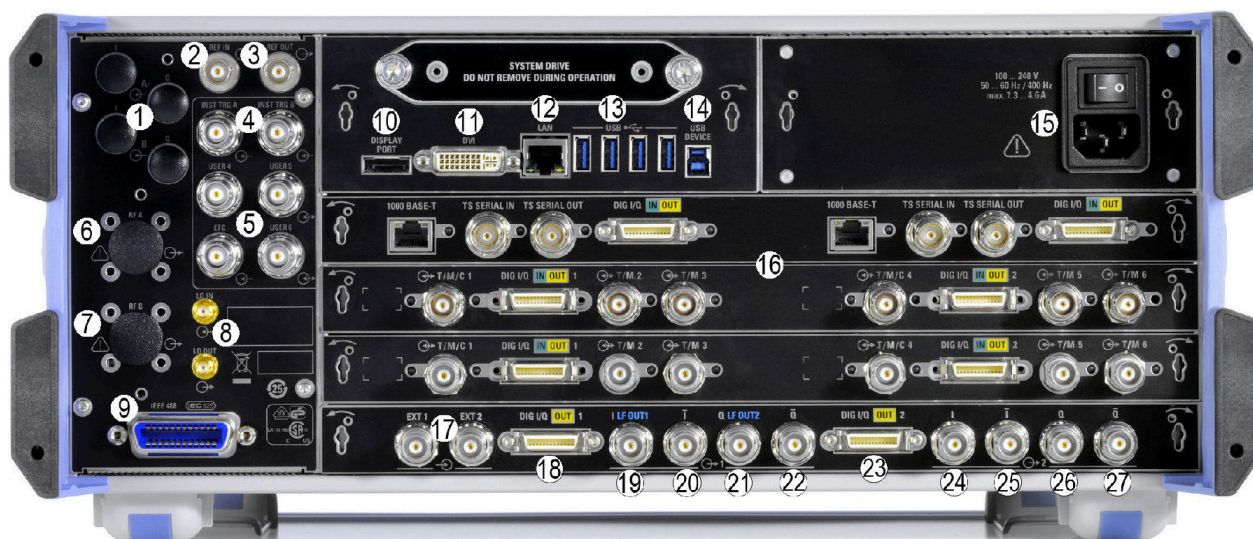


Figure 5-2: Rear panel view (example; 2 paths instrument)

- 1 = Analog I/Q inputs (optional)
- 2/3 = Reference input/output
- 4 = Trigger inputs
- 5 = BER interfaces
- 6/7 = RF outputs (paths A, B; optional)
- 8 = Local oscillator input/output
- 9 = IEC bus interface for remote control
- 10/11 = DVI port, display port
- 12 = LAN interface
- 13 = USB interfaces type A
- 14 = USB interface type B
- 15 = AC power supply connector and switch
- 16 = Module (example); maximal number of modules: 6
- 17 = External reference inputs
- 18/23 = Digital I/Q outputs
- 19-22 = Analog I/Q outputs (path A)
- 24-27 = Analog I/Q outputs (path B)



The connectors with the numbers 17 to 27 are part of the baseband main module (R&S BTC-B11/B12).

5.2.1 AC Power Supply Connector and Switch

See (15) in [Figure 5-2](#).

The IEC 320/EN 60320 AC power supply connector and the AC power switch are combined (type C14). For the ratings of the power supply refer to the data sheet.

The AC power switch is located above the AC power supply connector.

Switch positions:

- [I]: Depending on the setting of the on/standby function key on the front panel, the R&S BTC is either in standby mode or in operation.

- [O]: The entire instrument is disconnected from the AC power supply.

Further information:

- [Chapter 6.2, "Connecting to the AC Power Supply"](#), on page 29
- [Chapter 7, "Switching On or Off the R&S BTC"](#), on page 32

5.2.2 DISPLAY PORT

See (10) in [Figure 5-2](#).

The display port connector provides the monitor output signal of the built-in computer. The connected computer monitor should provide a resolution of 1024x768 pixels or higher.



You can use either the DISPLAY PORT or the DVI-D port. Using both connectors at the same time is not supported.

5.2.3 DVI Port

See (11) in [Figure 5-2](#).

DVI-D socket. Output for the monitor signal of the built-in computer. The connected computer monitor should provide a resolution of 1024x768 pixels or higher.



You can use either the DISPLAY PORT or the DVI-D port. Using both connectors at the same time is not supported.

You can use a DVI-I cable for connecting R&S BTC and display, but the analog video interface (pins C1 to C4) is not provided by the R&S BTC.

5.2.4 LAN

See (12) in [Figure 5-2](#).

1 Gigabit LAN interface (1000 Base-T). Used to connect the R&S BTC to a local network for remote control, remote operation, printouts and data transfer. The assignment of the RJ.45 CAT5 connector supports twisted pair category 7 UTP/STP cables in a star configuration (UTP stands for "unshielded twisted pair", and STP for "shielded twisted pair").



Do not connect or disconnect the network cable until the instrument is switched off. Otherwise, the network connection cannot be reliably detected.

Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, use category 7 cables.

Further information:

- [Chapter 9, "Operating the R&S BTC in a LAN"](#), on page 40
- See user manual or the help system for remote control using the Ethernet.

5.2.5 USB Interfaces

See (13) in [Figure 5-2](#).

USB 3.0 (universal serial bus) interfaces of the type A (host USB). Used to connect external devices like a keyboard, mouse, printer, memory stick ([Chapter 6.3, "Connecting External USB Devices"](#), on page 29), or to perform a firmware update.



Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, make sure that the following conditions are met:

- Use suitable double-shielded cables.
 - Do not use USB connecting cables exceeding 1 m in length.
 - Use only USB devices that remain within the permissible EMI limits.
-

5.2.6 USB DEVICE Port

See (14) in [Figure 5-2](#).

USB 3.0 (universal serial bus) interface of the type B (receptacle). Used to connect the R&S BTC to a computer.



Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, make sure that the following conditions are met:

- Use suitable double-shielded cables.
 - Do not use USB connecting cables exceeding 5 m in length.
-

5.2.7 I, Q (Port A), I/A:Ī, Q/A:Q̄ (Port B)

See (1) in [Figure 5-2](#).

Optional; the required options depend on the number of paths:

- 1 path instrument: rear panel connectors for 1st RF path option (R&S BTC-B3121)
- 2 paths instrument: rear panel connectors for 1st RF path option (R&S BTC-B3121) and rear panel connectors for 2nd RF path option (R&S BTC-B3122)

BNC connectors. Analog I/Q inputs.

5.2.8 INST TRG A/INST TRG B

See (4) in [Figure 5-2](#).

BNC connectors. Application-specific inputs for triggering the R&S BTC.

5.2.9 REF IN

See (2) in [Figure 5-2](#).

BNC connector. Input for the reference frequency.

See the user manual or the help system.

5.2.10 REF OUT

See (3) in [Figure 5-2](#).

BNC connector. Output for the reference frequency.

At the reference frequency output, a signal is always present. When using an internal reference, the frequency generated by the internal reference oscillator of the R&S BTC is made available. If an external reference is activated, the signal applied to the reference frequency input is also available here. It is buffered and filtered.

5.2.11 BER Interfaces

See (5) in [Figure 5-2](#).

BNC connectors. Used by the bit error rate tester application (BER R&S BTC-K60) for the serial bit error rate (BER) measurement.

See the user manual or the help system.

USER 4

Clock input for a bit clock associated with the input data stream.

USER 5

Enable input to extract parts of the bit sequence on *data* that are not related to the PRBS. This can include synchronization and framing bits.

USER 6

Data input for a data stream that has a bit clock associated with it.

5.2.12 RF A/RF B

See (6, 7) in [Figure 5-2](#).

Optional; the required options depend on the number of paths:

- 1 path instrument: rear panel connectors for 1st RF path option (R&S BTC-B3121)
- 2 paths instrument: rear panel connectors for 1st RF path option (R&S BTC-B3121) and rear panel connectors for 2nd RF path option (R&S BTC-B3122)

BNC connectors. RF outputs.

5.2.13 LO IN/LO OUT

See (8) in [Figure 5-2](#).

Local oscillator input and output for phase-coherent RF signal.

See user manual or the help system.

5.2.14 IEEE 488

See (9) in [Figure 5-2](#).

IEC bus (IEEE 488) interface for remote control of the R&S BTC. Used to connect a controller to remote control the R&S BTC. Use a shielded cable for the connection.

Characteristics of the IEC bus (IEEE 488) interface:

- 8 bit parallel data transfer
- Bidirectional data transfer
- Three-wire handshake
- High data transfer rate
- Up to 15 R&S BTCs can be connected
- Maximum length of connecting cables 15 m (single connection 2 m)
- Wired OR operation with parallel connection of several R&S BTCs

See the user manual or the help system.

5.2.15 HDMI Connector

The HDMI type A socket is used in several optional modules. The pin assignment and pin assignment are as follows.

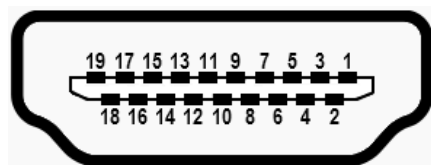


Figure 5-3: HDMI type A socket

Table 5-1: Pin assignment

Pin	Description
1	TMDS data2+
2	TMDS data2 shield
3	TMDS data2–
4	TMDS data1+
5	TMDS data1 shield
6	TMDS data1–
7	TMDS data0+
8	TMDS data0 shield
9	TMDS data0–
10	TMDS clock+
11	TMDS clock shield
12	TMDS clock–
13	CEC
14	Reserved (not connected)
15	SCL
16	SDA
17	DDC/CEC Ground
18	+5 V power (+5 V / 500 mA)
19	Hot plug detect

5.2.16 Baseband Main Module

The baseband main module is available in two designs:

- One I/Q path to RF (R&S BTC-B11)
- Two I/Q paths to RF (R&S BTC-B12)

EXT 1/EXT 2

See (17) in [Figure 5-2](#).

BNC connectors used for synchronization in single-frequency networks (SFN).

EXT 1: 1PPS input for external signals.

EXT 2: 1PPS output for external signals.

See the user manual or the help system.

DIG I/Q OUT 1/2 (Path A, B)

See (18, 23) in [Figure 5-2](#).

Only 2 paths instruments are fitted with the DIG I/Q OUT 2 connector.

Outputs for digital I/Q signals to another R&S instrument with the same interface.

See the user manual or the help system.

I LF OUT1, Q LF OUT2, \bar{I} , \bar{Q} (Path A)

See (19 to 22) in [Figure 5-2](#).

BNC connectors. Single-ended or differential analog I/Q outputs for path A.

See the user manual or the help system.

I, Q, \bar{I} , \bar{Q} (Path B)

See (24 to 27) in [Figure 5-2](#).

Only 2 paths instruments are fitted with these connectors.

BNC connectors. Single-ended or differential analog I/Q outputs for path B.

See the user manual or the help system.

6 Connecting the R&S BTC

This chapter describes how to connect the R&S BTC to the power supply and external devices.

Further information:

- [Chapter 9.1, "Connecting the R&S BTC to a Network"](#), on page 40
- [Chapter 9.2, "Connecting the R&S BTC to a Computer"](#), on page 41

6.1 Preventing Electromagnetic Interference

To prevent electromagnetic interference, the R&S BTC must be operated with all shielding covers fitted. Only suitable and shielded signal and control cables may be used.

RF/marker/trigger/reference inputs and outputs

In particular cables that are connected to these inputs/outputs can cause EMC problems. Therefore these cables should have at least 80 dB to 1 GHz shielding. This is usually achieved by means of double-shielded cables.

USB interfaces

To connect the USB interfaces, only use peripheral equipment that does not cause limit violations. For information on the interface, see [Chapter 5.2.5, "USB Interfaces"](#), on page 23.

TS serial inputs

To connect the TS serial inputs, use double-shielded cables. A termination impedance of 50 Ω is required.

Display port interface

To connect the display port interface, only use peripheral equipment that does not cause limit violations. For information on the interface, see [Chapter 5.2.2, "DISPLAY PORT"](#), on page 22.

DVI interface

To connect the DVI interface, use a cable shielded with ferrite cores. For information on the interface, see [Chapter 5.2.3, "DVI Port"](#), on page 22.

LAN interface

To connect the LAN interface, use a suitable cable. For information on the interface, see [Chapter 5.2.4, "LAN"](#), on page 22.

All other cables can be single shielded. The AC cable is unshielded.

6.2 Connecting to the AC Power Supply

The R&S BTC can be used with different AC power voltages and adapts itself automatically to it. Adjusting the R&S BTC to a particular AC supply voltage is therefore not required. Refer to the data sheet for the requirements of voltage and frequency.

WARNING

Shock hazard

Observe the basic safety instructions delivered with the R&S BTC, especially the instructions on electrical safety.

Take care that the AC voltage lies within the limits printed on the AC power connector of the R&S BTC and listed in the data sheet.

- ▶ Connect the R&S BTC to the AC power supply, using the power cable that is supplied. The AC power connector is located on the rear panel of the R&S BTC. The R&S BTC complies with safety class EN61010-1. The R&S BTC's power supply must be connected to a socket with protective conductor.

Further information:

- [Chapter 5.2.1, "AC Power Supply Connector and Switch"](#), on page 21

6.3 Connecting External USB Devices

Using the USB interfaces, you can directly connect USB devices to the R&S BTC. This number can be increased as necessary by using USB hubs.

Due to the large number of available USB devices, there is almost no limit to the possible expansions. In the following, USB devices that can be useful are listed.

- Keyboard for entering comments, file names, etc. or for easy access to Windows 7 settings. See [Chapter 6.3.1, "External Keyboard"](#), on page 30.
- Mouse if you prefer this way of operation over a touchscreen. See [Chapter 6.3.2, "Mouse"](#), on page 30.
- Memory stick for easy transfer of data to/from a computer (e.g. firmware updates). See [Chapter 6.3.3, "Memory Stick"](#), on page 31.
- External drives for easy installation of firmware applications. See [Chapter 6.3.4, "External Drive"](#), on page 31.
- Printer for printing out measurement results.

To install a USB device

1. Connect the USB device to the R&S BTC. You can do this during operation because all USB devices are Plug and Play.

Windows 7 automatically searches for a suitable device driver.

2. If Windows 7 does not find a suitable driver, it will prompt you to specify a directory that contains the driver software. If the driver software is on a CD-ROM, connect a USB CD-ROM drive to the R&S BTC before proceeding.

To uninstall a USB device

- ▶ Disconnect the USB device from the R&S BTC. You can do this during operation. Windows 7 immediately detects the change in the hardware configuration and deactivates the corresponding driver.

6.3.1 External Keyboard

Connect the keyboard to one of the USB interfaces (type A). The default language setting is for a UK keyboard. You can change the language and modify other settings such as the repetition rate in Windows 7. For information on how to change these settings refer to the Windows 7 documentation.

Table 6-1: Corresponding keys: front panel - external keyboard

Key on front panel	Corresponding key on keyboard	Function description
Rotary knob: left turn	<Shift>+<Tab>	Chapter 5.1.5, "Rotary Knob" , on page 19
Rotary knob: right turn	<Tab>	"
Rotary knob: press	<Shift>+<Enter>	"
Cursor keys	<Left Arrow>, <Right Arrow>, <Up Arrow>, <Down Arrow>	Chapter 5.1.3, "Cursor Keys" , on page 17
[ENTER]	<Enter>	"
[ESC]	ESC	"
[PRESET]	F4	Chapter 5.1.2, "Keys for Frequently-Used Functions" , on page 17
[SAVE/RCL]	F5	"
[LOCAL]	F3	"
[SETUP]	F6	"
[HCOPY]	F2	"
[INFO]	F7	"
[HELP]	F1	"

6.3.2 Mouse

You can change settings such as the speed of the mouse cursor in Windows 7. For information, see the Windows 7 documentation.

6.3.3 Memory Stick

The R&S BTC has a disk drive. You can exchange data by using a memory stick which you plug into one of the USB interfaces. The memory stick is automatically assigned a free drive letter and you can use Windows Explorer to transfer data.

6.3.4 External Drive

You can use the USB interface to supply the power for an external hard disk drive (HDD). Make sure that the maximum current suffices the power requirement of the HDD. For USB 2.0, the maximum current is limited to 500 mA. With a Y cable, you can use a second USB port as additional power supply.

7 Switching On or Off the R&S BTC

⚠ WARNING

Shock hazard

Observe the basic safety instructions delivered with the R&S BTC, especially the instructions on electrical safety.

Be aware that in standby mode, the R&S BTC is still power-supplied.

7.1 Instrument States

The following states are possible:

- Off
The AC power switch on the back of the R&S BTC is switched off. The R&S BTC is disconnected from the AC power supply.
- Ready
The R&S BTC is ready for operation.
The left LED of the on/standby key is illuminated in green color.
See [Figure 7-1](#).
- Standby
The power supply has the operating voltage supplied to it.
The right LED of the on/standby key is illuminated in yellow color.
See [Figure 7-1](#).



Figure 7-1: On/standby key

Further information:

- [Chapter 5.2.1, "AC Power Supply Connector and Switch"](#), on page 21.
- [Chapter 5.1.1, "On/Standby Key"](#), on page 17.

7.2 Switching On the R&S BTC

NOTICE

Risk of instrument damage

Before switching on the R&S BTC, make sure that the following conditions are met:

- The R&S BTC is set up as described in [Chapter 4, "Setting Up the R&S BTC"](#), on page 12.
- Signal levels at the input connectors are all within the specified ranges.
- Signal outputs are correctly connected and are not overloaded. In particular, do not exceed the maximum permissible reverse power allowed at the RF output.

The values are specified in the data sheet. Failure to meet these conditions may cause damage to the R&S BTC or other devices in the test setup.

To switch on the R&S BTC

1. Make sure that the R&S BTC is connected to a power supply (see [Chapter 6.2, "Connecting to the AC Power Supply"](#), on page 29).
2. Press the AC power switch on the rear panel into [I] position (see [Chapter 5.2.1, "AC Power Supply Connector and Switch"](#), on page 21).
3. Press the on/standby key on the front panel.

The R&S BTC starts booting:

- The installed BIOS version and some of the computer features are displayed on the screen for a few seconds.
- The Windows 7 operating system is booted, followed by the R&S BTC firmware.
- A self-test is performed.

After booting is completed, the main screen of the R&S BTC is displayed, and the R&S BTC is ready for operation.

(Ready state, see [Chapter 7.1, "Instrument States"](#), on page 32.)

The configuration settings that were active before the R&S BTC was last shut down are automatically restored.

Use the "File" dialog to load another instrument setting. For details see the user manual or the help system.



Activating the power save mode

Power save mode is not set by default for the R&S BTC.

If you do not need the display, you can switch off the monitor in Windows 7. For details refer to the Windows 7 documentation.

7.3 Switching Off the R&S BTC

NOTICE

Risk of losing data

If you switch off the running R&S BTC using the rear panel switch or by disconnecting the power cord before shutting it down, the R&S BTC loses its current settings. Furthermore, program data may be lost.

Always shut down the R&S BTC first.

To switch off the R&S BTC


1. Press the on/standby key on the front panel.
The R&S BTC saves the current settings to the hard disk and shuts down the Windows operating system. During this process, an according message may be displayed.
The power supply is switched over to standby and the yellow LED on the on/standby key is illuminated.
2. If you want to completely disconnect the R&S BTC from the AC power line, set the AC switch on the rear panel to the [O] position, or disconnect the R&S BTC from the AC power supply.
All LEDs on the on/standby key should go out.



You can leave the AC power switch switched on permanently. You only need to switch off the R&S BTC if you want to completely disconnect it from the AC power line.

7.4 Checking the Provided Options

The R&S BTC may be equipped with options. In order to check whether the installed options correspond to the options indicated on the delivery note, proceed as follows.

1. In the toolbar, tap .
2. Select the "SW/HW Equipment" tab.
3. Under "Hardware Configuration", check the availability of the hardware options as indicated in the delivery note.
4. Under "Installed Software", check the availability of the software options as indicated in the delivery note.

Further information:

- User manual or the help system.

For an overview of the all options available for the R&S BTC refer to the Rohde & Schwarz Homepage.


7.5 Turn-On Tests

During power-on and on an ongoing basis during operation, the R&S BTC automatically monitors the main instrument functions. If an error is detected, a message is displayed. Read the description of the error or warning carefully.

Besides automatic monitoring of instrument functions, the R&S BTC also offers the following way of ensuring proper operation.

System adjustment

Use the setup to carry out an internal adjustment. This is a way of obtaining the best possible level accuracy, for example.

1. In the toolbar, tap .
2. Select the "Adjustment" tab.

Further information:

- User manual or the help system.

8 Sample Application

The following example involves the following main steps:

- Feed an MPEG2 transport stream to the R&S BTC using the serial interface (TS SERIAL IN, see [Chapter 5.1.10, "TS SERIAL IN 1/2"](#), on page 19) on the front panel.
- This MPEG2 transport stream undergoes channel encoding and modulation for transmission in compliance with the DVB-C specification. To achieve this, perform the following step-by-step instructions. The involved settings are summed up in [Table 8-1](#).
- The result is output as an RF signal on the RF output.

Table 8-1: Parameter settings

Parameter	Value
Center frequency	330 MHz
Level	-20.0 dBm
Transmission standard	DVB-C
Constellation	64 QAM
Symbol rate	6.9 MS/s
Roll off	0.15

An explanation of the graphical user interface and information on how to select items, open lists and enter parameters are provided in the user manual or the help system.



In the sample application, an R&S BTC with 2 paths is used.

If you use a 1 path R&S BTC, in the TX application, the index indicating the path is omitted. For example the "RF A" work view element is named "RF".

Displaying the transmitter application (TX)

1. In the toolbar, tap .

The home screen is displayed.
2. In the right pane on the "Applications" tab, touch and hold the icon of the TX application until the color of the icon changes.
3. Slide the icon into the left pane of the home screen and release it.
4. Tap the icon.

The main dialog of the TX application is displayed.

Setting the output frequency

1. In the work view pane, tap "RF A".
2. Set a frequency of 330 MHz.

- a) On the "Frequency" subtab, tap the numeric entry of the "Frequency" field.
The on-screen keypad is displayed.
- b) Tap the CLR key.
- c) Enter 330.
- d) Tap the MHz key.


Setting the output level

1. Select the "Level" subtab.

2. Set a level of -20 dBm.
 - a) Tap the numeric entry of the "Level" field.
The on-screen keypad is displayed.
 - b) Tap the CLR key.
 - c) Tap the \pm key.
 - d) Enter 20.
 - e) Tap the dBm key.

The entered level is displayed in the information and favorites pane.

Setting the modulation parameters and selecting the transmission standard

1. In the toolbar, tap .
The main dialog of the TX application is displayed.
2. In the work view pane, tap "SignalGen A".
The "Signal" subtab is displayed.

Pilot A	Level A	Standard A	Constellation A	Symbol Rate A
1000.000000 MHz	-10.00 dBm	8VSB	8VSB	10.762238 MS/s

Signal Type	Digital TV	AWGN	Off
Transmission Standard	8VSB	C/N	20.00 dB
Frequency Offset	0.000000 MHz	E_b/N_o	0.00 dB
		Settings	
		Bandwidth Coupling	Off
		Receiver Bandwidth	5.3811190 MHz
		Generated Noise BW	120.000 MHz

Signal	Input Signal	Coding	Special
--------	--------------	--------	---------

- Under "Signal Type", select "Dtv".
- Under "Transmission Standard", select "DVB-C".

Selecting the transport stream input and setting the DVB-C transmission parameters

- Tap the "Input Signal" subtab.

Source	External
Input	TS IN 1
Input Format	ASI
Stuffing	On
Packet Length	Invalid
Max. Useful Data Rate	0.000000 Mbit/s
Measured Data Rate	0.000 Mbit/s
Useful Data Rate	0.000 Mbit/s

- Under "Source", select "External".
- Under Input, select the "TS IN 1" input.
The ASI signal is fed into the TS SERIAL IN 1 input on the front panel.
- Under Input, select "On".

This ensures that the incoming transport stream will be adapted to the proper data rate of the coder. The data rate of the coder will depend on the transmission parameters. The data stream is padded with null packets to allow adaptation to the transmission parameters.

5. Tap the "Coding" subtab.

Symbol Rate	6.900000 MS/s ▾
Constellation	64QAM ▾
Roll Off	0.15 ▾

6. Select a symbol rate of 6.9 MS/s.
 - a) Tap the numeric entry of the "Symbol Rate" field.
The on-screen keypad is displayed.
 - b) Tap the CLR key.
 - c) Enter 6.9.
 - d) Tap the MS/s key.The selected symbol rate is displayed in the information and favorites pane.
7. Under "Constellation", select "64QAM".
The selected constellation is displayed in the information and favorites pane.
8. Under "Roll Off", select "0.15".

9 Operating the R&S BTC in a LAN

The R&S BTC is equipped with a network interface and can be connected to an Ethernet LAN (local area network). The network card operates with 1000 Mbit Ethernet IEEE 802.3ab. The TCP/IP network protocol and the associated network services are preconfigured.

To be able to exchange data within a local area network (LAN), every computer or R&S BTC that is connected must have a unique IP address or a unique computer name. Access between different users is managed with access authorizations.

Provided the appropriate rights have been assigned and the Windows 7 firewall configuration is adapted accordingly, the interface can be used e.g. for transferring data, printing on network printers, operating/controlling the R&S BTC from a remote computer.

To use network resources, access must be granted. To share files on the R&S BTC with other network users, access to R&S BTC resources, e.g. the hard drives, must also be granted. All these administration tasks are normally performed by a network administrator using the Windows 7 Start menu (for details refer to the Windows 7 documentation). Contact your network administrator for access authorizations.

User name and password of the R&S BTC are factory-set. The user name is used for auto login, access authorization and remote operation.

For further information:

- [Chapter 10.1.1, "Login"](#), on page 44
- [Chapter 5.2.4, "LAN"](#), on page 22
- User manual or help system for details on remote operation and remote control.

9.1 Connecting the R&S BTC to a Network

NOTICE

Risk of network failure/virus infection

Before connecting the R&S BTC to a network or configuring a network, do the following:

- Consult your network administrator.
- If your network does not support DHCP or if you choose to disable dynamic TCP/IP configuration, you must assign valid address information before connecting the R&S BTC to the LAN.

Errors may affect the entire network.

Efficient virus protection is a prerequisite for secure operation in the network. Never connect the R&S BTC to a network without proper protection against a virus infection, as doing so may cause damage to the R&S BTC firmware.

To connect the R&S BTC to a network

1. Fulfill all prerequisites mentioned above.
2. Make sure that the R&S BTC is switched off. This is the only way to ensure that the network connection is reliably detected and any disruptions during the operation of the R&S BTC are avoided.
3. Connect the R&S BTC to the network using a CAT-5e cable or better.
4. Switch on the R&S BTC.

To disconnect the R&S BTC from a network

1. Make sure that the R&S BTC is switched off.
2. Disconnect the R&S BTC from the network.

9.2 Connecting the R&S BTC to a Computer

How to set up a LAN connection between an R&S BTC and a single computer without integration into a larger network depends on the operating system installed on the computer.

9.2.1 Windows 7 Operating System

If Windows 7 is installed on the computer, you can set up a LAN connection really fast.

1. Activate DHCP on both the computer and the R&S BTC.
2. Connect the computer and the R&S BTC with a standard RJ.45 cross-over cable (LAN cable).

After approx. 16 seconds, the connection is established.

3. To address the R&S BTC, use the computer name.

Further information:

- [" Querying the computer name using the firmware"](#) on page 42

9.2.2 Other Operating Systems

If Windows 7 is not installed on the computer, you need to assign IP addresses.

1. Assign an IP address to the R&S BTC and the computer.
The IP addresses *192.168.xxx.yyy* are available for use here. *xxx* and *yyy* can assume values of *1* to *255*. The value for the subnet mask is *255.255.255.0*.

2. Connect the R&S BTC and the computer with a standard RJ.45 cross-over cable (LAN cable).
3. To address the R&S BTC, use the assigned IP address.

9.3 Zero Configuration Networking

The R&S mDNS service is installed with the firmware. Using this service, you can connect to a network automatically. You do not need to set up services, such as dynamic host configuration protocol (DHCP) and domain name system (DNS), or configure the network settings manually as described in [Chapter 9.4, "Configuring the Network Card"](#), on page 42.

9.4 Configuring the Network Card

Under Windows 7, network card drivers do not need to be installed separately. If the R&S BTC is connected to the LAN, Windows 7 automatically detects the network connection and activates the required drivers.

The configuration tasks depend on whether your network has a DHCP server or not. They are performed in Windows 7.



If you are not familiar with LAN configurations, ask your network administrator.

If you use the R&S mDNS Service, you do not need to configure at all. For details, see [Chapter 9.3, "Zero Configuration Networking"](#), on page 42.

Networks with DHCP Server

The R&S BTC is preconfigured for networks using the dynamic host configuration protocol (DHCP). In such networks, the R&S BTC is automatically assigned a free IP address. Identification in the network is based on the use of a unique computer name.

Every R&S BTC is assigned an individual computer name at the factory. It is displayed as part of the window title of the application.

If necessary, you can change the computer name using the Windows 7 Start menu (for details refer to the Windows 7 documentation).

Querying the computer name using the firmware

In the firmware, "host name" is used as synonym for "computer name".

1. If the R&S BTC has a default computer name, the computer name is displayed in the title bar of the application.
2. If no default computer name is displayed, do the following.
 - a) In the toolbar, tap .
 - b) On the "System" tab, under "LAN Services", select the "Host Name" field.

3. Read out the name.

Naming rule for the default computer name

The default computer name is composed as follows:

<instrument short name>-<serial number>

Example: BTC-100104

The serial number consists of 6 digits and is printed on the cabinet of the R&S BTC.

Networks without DHCP Server

In networks that assign fixed IP addresses, the network administrator usually configures the network card. Contact your network administrator. The IP address is set using the Windows 7 Start menu (for details refer to the Windows 7 documentation).

9.5 Firewall Settings

By default, the Windows Firewall is activated to protect the R&S BTC from an attack of hostile users and programs. The Windows Firewall suppresses all network communication which is not initialized by the R&S BTC itself or which is not defined as an exception.

To enable data transfer or to allow access to the R&S BTC, define exceptions using the Windows 7 Start menu. For details refer to the Windows 7 documentation or contact your network administrator for support.

10 Installed Software

The firmware and the operating system are already installed on the R&S BTC.

Further information:

- Performing a firmware update: see the release notes.
- Installing software options
See the installation instructions for options or the user manual.

10.1 Operating System

The R&S BTC is equipped with the Windows 7 Embedded operating system in the 32-bit version. When the R&S BTC is delivered, the operating system is configured for optimum operation. Changes to the system settings are required only if you install peripherals such as a keyboard and printer or if you configure the network and the settings do not conform to the default settings.

NOTICE

Risk of causing instrument unusability

To prevent malfunctions and to avoid instrument repair, only install service packs approved by Rohde & Schwarz.

In particular, do not use service packs for other Windows 7 editions.

10.1.1 Login

Windows 7 requires that you identify yourself by entering a user name and password in a login window. The R&S BTC provides a factory-installed auto login function, i.e. login is carried out automatically in the background. The ID used for auto login has administrator rights.



User name and password are factory-set as follows.

- User name = *instrument*
- Password = *894129*

If the R&S BTC is connected to a network and if the user name and the password are identical under Windows 7 and on the network, you log on to operating system and the network at the same time.

10.1.2 Windows 7 Start Menu

The Windows 7 Start menu provides access to the Windows 7 functionality and the installed programs. Under "Control Panel", the system settings are grouped. For details, see the Windows 7 documentation.

To open the Start menu

- ▶ In the toolbar, tap .

10.2 Additional Software

NOTICE

Risk of causing instrument unusability

The instrument is equipped with the Windows 7 operating system. Additional software can therefore be installed on the instrument. The use and installation of additional software may impair instrument function. Thus, run only programs that Rohde & Schwarz has tested for compatibility with the instrument software.

The drivers and programs used on the instrument under Windows 7 have been adapted to the instrument. Existing instrument software must always be modified using only update software released by Rohde & Schwarz.

10.3 Backup and Restore Application

Using the backup and restore application, you can back up the instrument installations and their configuration so that they can be restored if necessary. When restoring, you can choose between various states.

- Factory default state
If, for example, the system crashes, you can restore the factory default state.
- Intermediate states that you have saved
For example, you can back up the current system partition before a firmware update or provide different system configurations for different environments.

In the restore process, the system partition is deleted, formatted and written newly. The data partition is not affected.



Connect an external keyboard.

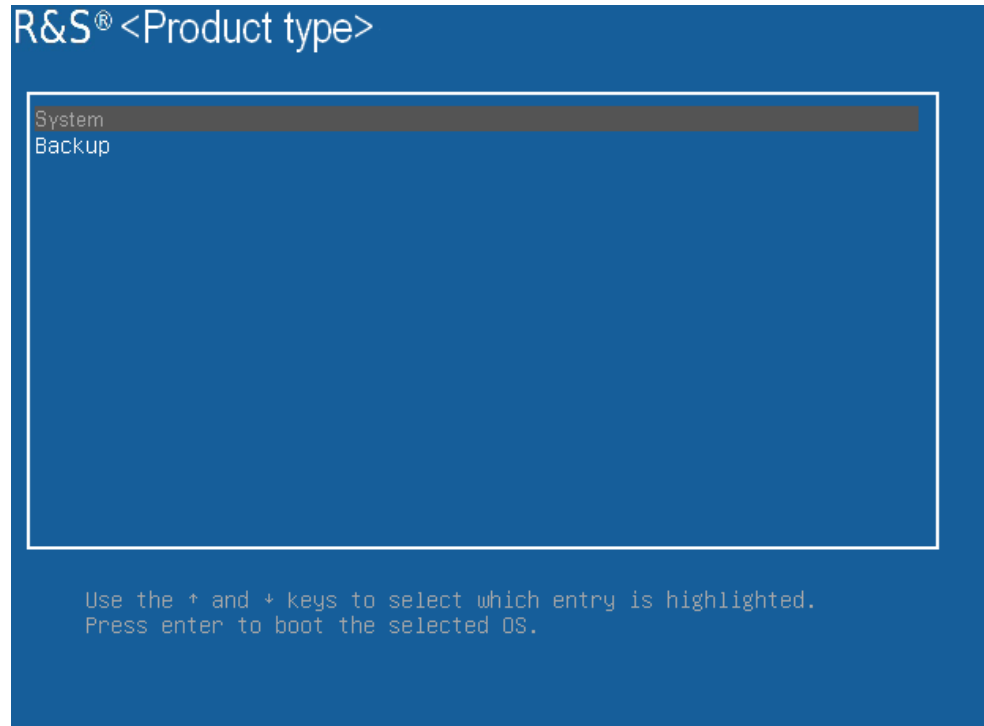
If the instrument does not have a monitor, connect also an external monitor.

To display the main dialog for backup and restore

1. Restart the R&S BTC.

The boot screen is displayed. By default, "System" is selected. If you do not perform the next step within 4 seconds, the dialog vanishes and the booting process continues.

2. Select the "Backup" partition and press [ENTER].



The main dialog is displayed. It provides access to all functions of the backup and restore application.

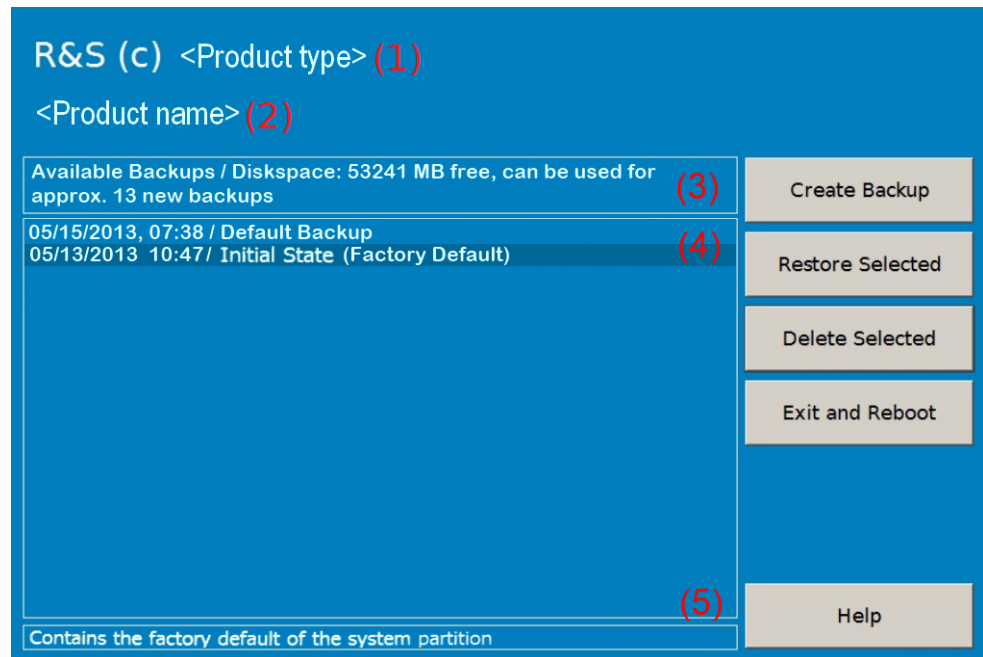


Figure 10-1: Main dialog (example)

- (1) = Header showing instrument type
- (2) = Header showing instrument name
- (3) = Free memory space on backup partition
- (4) = List of backups already created
- (5) = Description of currently selected backup

To continue, see one of the following chapters:

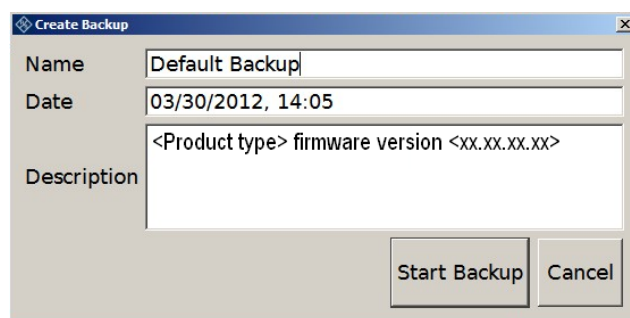
- [Chapter 10.3.1, "Creating a Backup"](#), on page 47
- [Chapter 10.3.2, "Restoring a Selected Backup Version"](#), on page 48
- [Chapter 10.3.3, "Deleting a Backup"](#), on page 49

10.3.1 Creating a Backup

Using this function, you can create a backup of the current instrument installation and its configuration.

1. In the main dialog (see [Figure 10-1](#)), select "Create Backup".

The "Create Backup" dialog is displayed. Under "Description", the current version of the firmware is displayed.



2. Enter a name for the backup and the date. If necessary, you can add information to the description.
3. Select "Start Backup".

During the backup process, a progress information dialog is displayed. You can terminate at any time ("Cancel").

After the process has been finished, the dialog is closed automatically, and the main dialog is displayed again.

Note: If you activate "Keep open when finished", the progress information dialog remains open until you close it.
4. In the main dialog, select "Exit and Reboot".

The backup and restore application is closed, and the R&S BTC is restarted.

10.3.2 Restoring a Selected Backup Version

Using this function, you can restore the selected instrument installation and its configuration.



Malware protection

When restoring a backup, the Windows operating system and installed anti-malware software are probably outdated. To minimize the risk of malware threats after restoring a backup, verify and adjust the "Windows Update" settings. Follow the recommendations from Rohde & Schwarz applicable to your instrument. Also, install all Windows security updates that have been published in the meanwhile.

1. In the main dialog (see [Figure 10-1](#)), select the backup you want to restore.
2. Select "Restore Selected".
3. In the "Restore Selected" dialog, select "Yes".

During the restoring process, a progress information dialog is displayed. You can terminate at any time ("Cancel").

After the process has been finished, the application is closed automatically, and the R&S BTC is restarted.

Note: If you activate "Keep open when finished", the progress information dialog remains open until you close it.

10.3.3 Deleting a Backup

Using this function, you can delete the selected instrument installation and its configuration.

To provide space for new backups, you can remove older backups. The factory default cannot be deleted.

1. In the main dialog (see [Figure 10-1](#)), select the backup you want to delete.
2. Select "Delete Selected".
3. In the "Delete Selected" dialog, select "Yes".

Note: You are not authorized to delete a factory default backup. If you have selected one, an error message is displayed and the backup is not deleted.

4. In the main dialog, select "Exit and Reboot", or continue with [Chapter 10.3.1, "Creating a Backup"](#), on page 47.

11 Maintenance

The R&S BTC does not need a periodic maintenance unless it is operated in dusty areas.

NOTICE

Risk of instrument damage

If the R&S BTC is operated in dusty areas, the fans may become obstructed by dust or other particles in the process of time. Make sure to check and, if necessary, clean the fans regularly to ensure they operate properly at all times. If the R&S BTC is run with obstructed fans for a longer period, it may become overheated which may cause damage.

Clean the outside of the instrument when necessary and check the rated data from time to time.

If any problem arises, contact one of our customer support centers. The addresses of our customer support centers are provided at www.customersupport.rohde-schwarz.com.

11.1 Cleaning the Instrument

WARNING

Shock hazard

Before cleaning the R&S BTC, make sure that the R&S BTC is switched off and disconnected from all power supplies.

1. Clean the outside of the R&S BTC using a soft, lint-free dust cloth.
2. Make sure that vents are not obstructed.

NOTICE

Instrument damage caused by cleaning agents

Cleaning agents contain substances that may damage the R&S BTC, e.g. cleaning agents that contain a solvent may damage the front panel labeling or plastic parts. Never use cleaning agents such as solvents (thinners, acetone, etc), acids, bases, or other substances.

11.2 Storing the Instrument

The storage temperature range of the R&S BTC is given in the data sheet. If the R&S BTC is to be stored for a longer period of time, it must be protected against dust.

Repack the R&S BTC as it was originally packed when transporting or shipping. The two protective foam plastic parts prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.

If you do not use the original packaging, provide for sufficient padding to prevent the R&S BTC from slipping inside the package. Wrap antistatic packing foil around the R&S BTC to protect it from electrostatic charging.

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