R&S®VTC
Video Test Center
Getting Started

2116131102

ROHDE & SCHWARZ

This manual describes the R&S®VTC (2115.7400.02).

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 VTC product page at www.rohde-schwarz.com/product/vtc.html > "Downloads" > "Firmware". Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

Contents

1   Safety and Regulatory Information

The product documentation helps you use the product safely and efficiently. Follow the instructions provided here and in the Chapter 1.1, "Safety Instructions", on page 7.

Intended use

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 7. 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.

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

Lifting and carrying the product

The maximum weight of the product is provided in the data sheet. To move the product 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 a carrying bag designed for your product, you can use the product outdoors.

Unless otherwise specified, you can operate the product up to an altitude of 2000 m above sea level. 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

The product is an overvoltage category II product and 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:

- 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.

- 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 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.

- 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.

- Only connect the product to a power source with a fuse protection of maximum 20 A.

- 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.

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.

⚠	Potential hazard
	Read the product documentation to avoid personal injury or product damage.
⚡	Electrical hazard
	Indicates live parts. Risk of electric shock, fire, personal injury or even death.
🔥	Hot surface
	Do not touch. Risk of skin burns. Risk of fire.
⏚	Protective conductor terminal
	Connect this terminal to a grounded external conductor or to protective ground. This protects you against electric shock should an electric problem occur.

Connecting headphones

Take the following measures to prevent hearing damage. Before using head-phones, check the volume and reduce it if necessary. If you monitor varying sig-nal levels, take off the headphones and wait until the signal has settled. Then adjust the volume.

1.2   Labels on the Product

Labels on the casing inform about:

● Personal safety, see "Meaning of safety labels" on page 9.

● Product and environment safety, see Table 1-1.

● Identification of the product on the type plate.

Table 1-1: Labels regarding product and environment safety

🗑	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.
	For more information, see the product user manual, chapter "Disposal".
⚠	Read the manual for information.
🎧	Headphone. Take care with the volume setting, see "Connecting headphones" on page 10.

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   Documentation Overview

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

www.rohde-schwarz.com/manual/vtc

2.1   Getting Started Manual

Introduces the R&S VTC 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 on the R&S VTC. 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".

2.3   Tutorials

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

2.4   Printed Safety Instructions

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

2.5   Data Sheets and Brochures

The data sheet contains the technical specifications of the R&S VTC. 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/vtc

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 VTC, the open source acknowledgment document is provided as PDF file in `C:/Program%20Files/ Rohde-Schwarz/VTS/2.11.0/Tools/`.

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

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/vtc

3 Key Features

The R&S VTC video test center is a universal platform for testing video and audio interfaces on consumer electronics equipment in R&D where a wide variety of applications need to be addressed and involve different AV interface technologies. The modular platform accommodates up to eight test modules and can be equipped with additional software to optimally suit the requirements of specific applications.

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

4   Preparing for Use

This chapter describes the basic steps to be taken when setting up the product for the first time.

4.1   Lifting and Carrying

See "Lifting and carrying the product" on page 8.

Use the handles to carry the R&S VTC.

4.2   Unpacking and Checking

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

1. Check the shipping container and cushioning material for damage.

2. Unpack the product carefully.

   a) Open the cardboard box.
   b) Remove the accessories packed into the box.
   c) Take the R&S VTC out of the packaging.
   d) Remove the shock protectors attached to the R&S VTC.

3. Retain the original packing material. Use it when transporting or shipping the product later.

4. Using the delivery documents, check the equipment for completeness.

5. Check the equipment for damage.

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

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

4.3   Choosing the Operating Site

Specific operating conditions ensure accurate measurements 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 8.

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.

4.3.1   Setting Up the Product

See also:
* "Setting up the product" on page 8
* "Intended use" on page 7

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 8.

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

3. **WARNING!** A stack of products can fall over and cause injury. Never stack more than three products on top of each other. Instead, mount them in a rack.

Stack as follows:

● It is best if all products have the same dimensions (width and length).
● The overall load on the lowest product must not exceed 500 N.
● With smaller products on top of the lowest product, the overall load on the lowest product must not exceed 250 N.

| Correct | Different dimensions | Too many instruments |
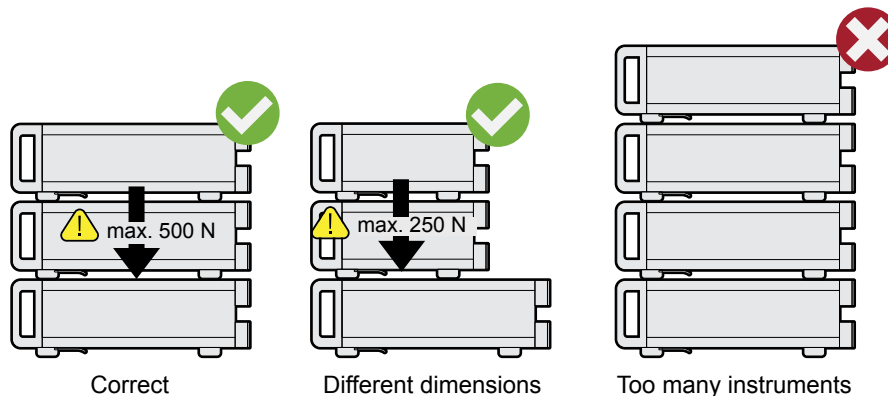
4. **NOTICE!** Overheating can damage the product.

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.

You can mount the product in a 19" rack.

To prepare the rack

1. Observe the requirements and instructions in "Setting up the product" on page 8.

2. **NOTICE!** Insufficient airflow can cause overheating and damage the product.

Design and implement an efficient ventilation concept for the rack.

To mount the product in a rack

1. Use an adapter kit to prepare the product for rack mounting.

   a) Order the rack adapter kit designed for the product. For the order number, see data sheet.

   b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.

2. Lift the product to shelf height.

3. Grab the handles and push the product onto the shelf until the rack brackets fit closely to the rack.

4. Tighten all screws at the rack brackets 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.

4.4   Considerations for Test Setup

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, especially for connecting the following:
    – RF/marker/trigger/reference inputs and outputs: Use cables with at least 80 dB to 1 GHz shielding, usually achieved by double-shielded cables.
    – USB interfaces: Use double-shielded cables no longer than 1 m. Use only USB devices that remain within the permissible EMI limits.
    – USB device port: Use double-shielded cables no longer than 5 m.
    – Display port interface: Only use peripheral equipment that does not cause limit violations.
    – DVI interface: Use a cable shielded with ferrite cores.
    – LAN interface: Use category 7 cables.
● Always terminate open cable ends.
● Ensure that connected external devices comply with EMC regulations.

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.

4.5 Connecting to Power

For safety information, see "Connecting to power" on page 9.

The R&S VTC is powered by alternating current.

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.

Further information:
- Chapter 5.2.1, "AC Power Supply Connector and Switch", on page 32

4.6 Connecting External USB Devices

Using the USB interfaces, you can directly connect USB devices to the R&S VTC. 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 4.6.1, "External Keyboard", on page 22.

- Mouse if you prefer this way of operation over a touchscreen. See Chapter 4.6.2, "Mouse", on page 23.

- Memory stick for easy transfer of data to/from a computer (e.g. firmware updates). See Chapter 4.6.3, "Memory Stick", on page 23.

- External drives for easy installation of firmware applications. See Chapter 4.6.4, "External Drive", on page 23.

- Printer for printing measurement results.

To install a USB device

1. Connect the USB device to the R&S VTC. You can connect a USB device 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 prompts 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 VTC before proceeding.

To uninstall a USB device

► Disconnect the USB device from the R&S VTC at any time convenient.

   Windows 7 immediately detects the change in the hardware configuration and deactivates the corresponding driver.

4.6.1　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 4-1: 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 30
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 29
[ENTER]	<Enter>	"
[ESC]	ESC	"
[PRESET]	F4	Chapter 5.1.2, "Keys for Frequently Used Functions", on page 28
[SAVE/RCL]	F5	"

Key on front panel	Corresponding key on key-board	Function description
[LOCAL]	F3	"
[SETUP]	F6	"
[HCOPY]	F2	"
[INFO]	F7	"
[HELP]	F1	"

4.6.2   Mouse

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

4.6.3   Memory Stick

The R&S VTC 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.

4.6.4   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.

4.7   Switching On or Off

Table 4-2: Overview of power states

Status	LEDs at standby key	Position of power switch
Off	Not illuminated	[0]
Standby	🟡 yellow LED (right) illuminated.	[I]
Ready	🟢 green LED (left) illuminated.	[I]

The standby key is at the front panel of the R&S VTC, see Chapter 5.1.1, "Standby Key", on page 28.

The power switch is at the rear panel of the R&S VTC, see Chapter 5.2.1, "AC Power Supply Connector and Switch", on page 32.

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 yellow LED at the standby key is illuminated.

2. Press the standby key.

   The green LED at the standby key is illuminated.

   The R&S VTC 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 VTC firmware.
   - A self-test is performed.

   After booting is completed, the main screen of the R&S VTC is displayed, and the R&S VTC is ready for operation.
   The configuration settings that were active before the R&S VTC was last shutdown 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 VTC.

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

To shut down the product

The product is in the ready state.

► Press the standby key.

   The operating system shuts down. The yellow LED at the standby key is illuminated.

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 LEDs at the standby key are switched off.

2. Disconnect the product from the power source.

4.8   Checking the Provided Options

The R&S VTC can be equipped with options. 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 VTC, refer to the Rohde & Schwarz Homepage.

4.9   Turn-On Tests

During power-on and on an ongoing basis during operation, the R&S VTC 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 VTC also offers the following way of ensuring proper operation.

5   Instrument Tour

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.

Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, follow the instructions in "Cable selection and electro-magnetic interference (EMI)" on page 20.

The meanings of the labels on the product are described in Chapter 1.2, "Labels on the Product", on page 10.

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 chapters containing detailed information about its usage.

Figure 5-1: Front panel view

1 = Standby key
2 = Keys
3 = Rotary knob
4 = Cursor/ENTER/ESC keys
5 = USB interfaces
6 = Headphones and volume control
7 = Display

5.1.1   Standby Key

See (1) in Figure 5-1.

For safety information, see "Connecting to power" on page 9.

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

Further information:
● Chapter 4.5, "Connecting to Power", on page 21
● Chapter 4.7, "Switching On or Off", on page 23

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 4-1.

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 (4) 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 ENTER/ESC Keys

See (4) in Figure 5-1.

ENTER key

Pressing the [ENTER] key performs one of the following actions:

- If the focused parameter has numeric values, activates the editing mode.

- If the focused parameter has alphanumeric values other than "ON"/"OFF", opens the parameter value list.
- If the focused parameter has the values "ON"/"OFF", changes from one to the other.
- Completes the data entry and accepts the new value. For numeric parameter values, the unit is displayed in the menu next to the value.
- Confirms and closes message windows (as tapping "OK").

ESC key

- Exits the selected parameter value without making changes.
- Exits the dialog without making changes.

5.1.5   Rotary Knob

See (3) 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:
- "ENTER key" on page 29.

5.1.6   Display

See (7) in Figure 5-1.

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

5.1.7   USB Interfaces

See (5) in Figure 5-1.

See Chapter 5.2.9, "USB Interfaces", on page 34.

5.1.8   Headphones

See (6) in Figure 5-1.

For safety information, see "Connecting headphones" on page 10.

The jack socket for the L/R analog audio output provides the Windows system sound. The socket is intended for connecting headphones or an active loudspeaker.

The R&S VTC has an internal active loudspeaker. If the jack socket for the L/R analog audio output is connected, the internal loudspeaker is disabled.

► To regulate the volume, use the volume control knob on the right of the jack socket.
  - Turning to the left increases the volume.
  - Turning to the right decreases the volume.

► To mute the audio output, push the volume control knob.

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 chapters containing detailed information about its usage.

Figure 5-2: Rear panel view

1   = Trigger input
2   = Marker output
3   = External reference input
4   = Reference output
5/6 = DVI and display port
7   = LAN interface
8   = USB interfaces type A
9   = USB interface type B
10 = eSATA interface
11 = AC power supply connector and switch
12 = Module (example); maximal number of modules: 8

5.2.1   AC Power Supply Connector and Switch

See (11) in Figure 5-2.

Observe the safety instructions in "Connecting to power" on page 9.

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 standby key on the front panel, the R&S VTC is either in standby mode or in operation.
- [O]: The entire instrument is disconnected from the AC power supply.

Further information:

- Chapter 4.5, "Connecting to Power", on page 21
- Chapter 4.7, "Switching On or Off", on page 23

5.2.2   TRIGGER Input

See (1) in Figure 5-2.

BNC connector. Input for external triggering.

5.2.3   MARKER Output

See (2) in Figure 5-2.

BNC connector. Output of the internal marker signal.

See the user manual or the help system.

5.2.4   EXT REF IN

See (3) in Figure 5-2.

BNC connector. Input for the external reference frequency.

See the user manual or the help system.

5.2.5   REF OUT

See (4) in Figure 5-2.

BNC connector. Output of the internal reference signal. If activated, a signal is always present at this output.

When using an internal reference, the frequency generated by the internal reference oscillator of the R&S VTC 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.

See the user manual or the help system.

5.2.6   DISPLAY PORT

See (5) in Figure 5-2.

The display port connector provides the monitor output signal of the built-in computer. The connected computer monitor needs to 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.

5.2.7   DVI Port

See (6) in Figure 5-2.

DVI-D socket. Output for the monitor signal of the built-in computer. The connected computer monitor needs to 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 VTC and display, but the analog video interface (pins C1 to C4) is not provided by the R&S VTC.

5.2.8 LAN

See (7) in Figure 5-2.

1 gigabit LAN interface (1000 Base-T). Used to connect the R&S VTC 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, follow the instructions in "Cable selection and electromagnetic interference (EMI)" on page 20.

Further information:
- Chapter 6, "Operating the R&S VTC in a LAN", on page 37
- See user manual or the help system for remote control using the Ethernet.

5.2.9 USB Interfaces

See (8) in Figure 5-2.

USB 2.0 (universal serial bus) interfaces of the type A (host USB). Used to connect external devices like a keyboard, mouse, printer, memory stick, or to perform a firmware update.

Further information:
- Chapter 4.6, "Connecting External USB Devices", on page 21

Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, follow the instructions in "Cable selection and electromagnetic interference (EMI)" on page 20.

5.2.10 USB DEVICE Port

See (9) in Figure 5-2.

USB 2.0 (universal serial bus) interface of the type B (receptacle). Used to connect the R&S VTC to a computer.

Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, follow the instructions in "Cable selection and electromagnetic interference (EMI)" on page 20.

5.2.11 eSATA Interface

See (10) in Figure 5-2.

External serial ATA (eSATA) interface. Used to connect external eSATA devices, e.g. hard disk drives.

5.2.12 HDMI Connector

The HDMI type A socket is used in several optional modules. The pin assignment and pin assignment are as follows.
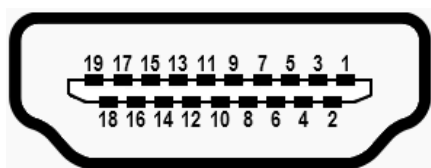
Figure 5-3: HDMI type A socket

Table 5-1: Pin assignment

Pin	Description
1	TMDS data2+
2	TMDS data2 shield

Pin	Description
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

6   Operating the R&S VTC in a LAN

The R&S VTC 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 VTC 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 Window 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 VTC from a remote computer.

To use network resources, access must be granted. To share files on the R&S VTC with other network users, access to R&S VTC 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 VTC are factory-set. The user name is used for auto login, access authorization and remote operation.

For further information:

- Chapter 7.1.1, "Login", on page 43
- Chapter 5.2.8, "LAN", on page 34
- User manual or help system for details on remote operation and remote control.

6.1   Connecting the R&S VTC to a Network

Before connecting the R&S VTC 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 VTC 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 VTC to a network without proper protection against a virus infection, as doing so may cause damage to the R&S VTC firmware.

To connect the R&S VTC to a network

1. Fulfill all prerequisites mentioned above.

2. Make sure that the R&S VTC 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 VTC are avoided.

3. Connect the R&S VTC to the network using a CAT-5e cable or better.

4. Switch on the R&S VTC.

To disconnect the R&S VTC from a network

1. Make sure that the R&S VTC is switched off.

2. Disconnect the R&S VTC from the network.

6.2 Connecting the R&S VTC to a Computer

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

6.2.1 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 VTC.

2. Connect the computer and the R&S VTC with a standard RJ.45 cross-over cable (LAN cable).

   After approx. 16 seconds, the connection is established.

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

Further information:

- " Querying the computer name using the firmware" on page 40

6.2.2   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 VTC 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 VTC and the computer with a standard RJ.45 cross-over cable (LAN cable).

3. To address the R&S VTC, use the assigned IP address.

6.3   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 6.4, "Configuring the Network Card", on page 39.

6.4   Configuring the Network Card

Under Windows 7, network card drivers do not need to be installed separately. If the R&S VTC 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 the "Setup" dialog.

For detailed information see the user manual or the help system.

ⓘ 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 6.3, "Zero Configuration Networking", on page 39.

Networks with DHCP Server

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

Every R&S VTC 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 firmware or 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 VTC 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: VTC-100104

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

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 firmware or the Windows 7 Start menu (for details refer to the Windows 7 documentation).

Entering the IP address using the firmware

1. In the toolbar, tap ▧.

2. On the "System" tab, under "LAN Services", select the "IP Addresses" field.

3. Enter the IP address.

6.5 Firewall Settings

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

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

7   Installed Software

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

Further information:

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

7.1   Operating System

The R&S VTC is equipped with the Windows 7 Embedded operating system in the 32-bit version. When the R&S VTC 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.

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.

7.1.1   Login

Windows 7 requires that you identify yourself by entering a user name and password in a login window. The R&S VTC 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: A label on the casing of the R&S VTC indicates the default password. If there is no such label, the default password is *894129*.

If the R&S VTC is connected to a network and if the login data under Windows 7 and on the network is identical, you log on to operating system and the network at the same time.

7.1.2   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 ▣.

7.2   Additional Software

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 can 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. Modify existing instrument software only by using update software released by Rohde & Schwarz.

7.3   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 VTC.

   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].
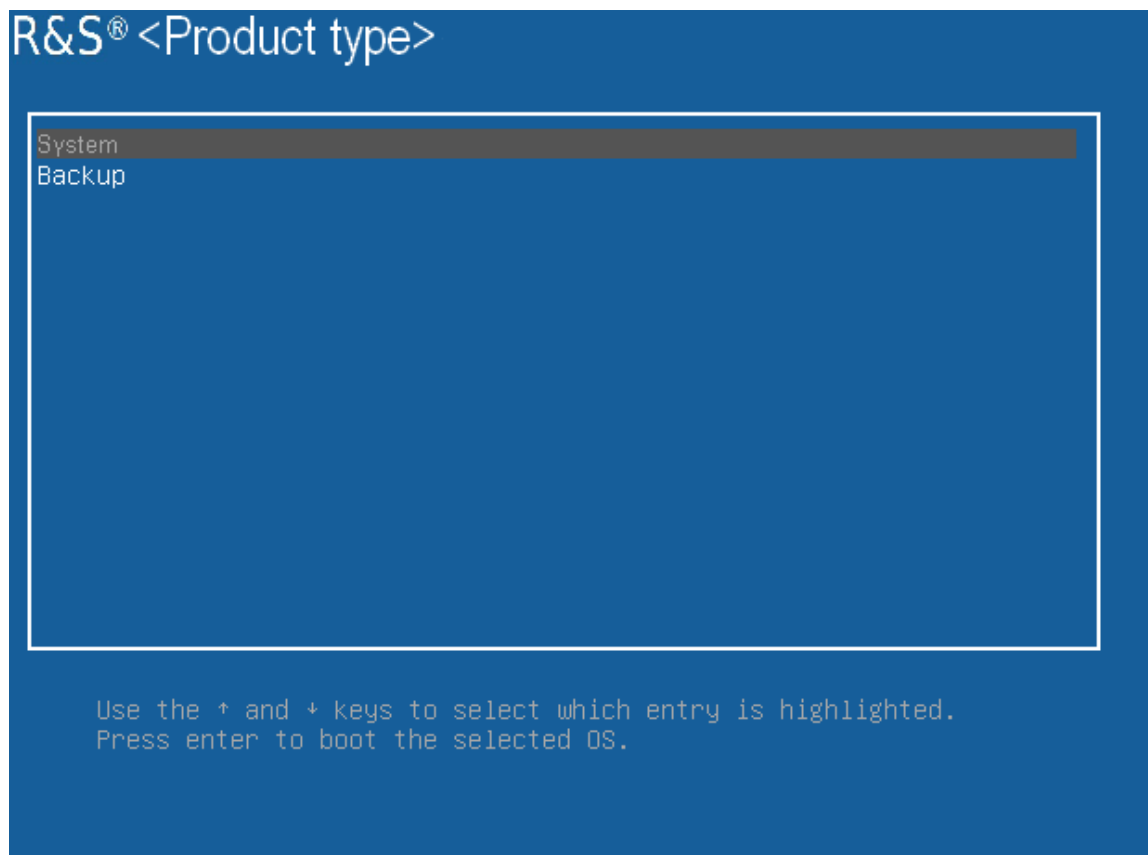
The main dialog is displayed. It provides access to all functions of the backup and restore application.
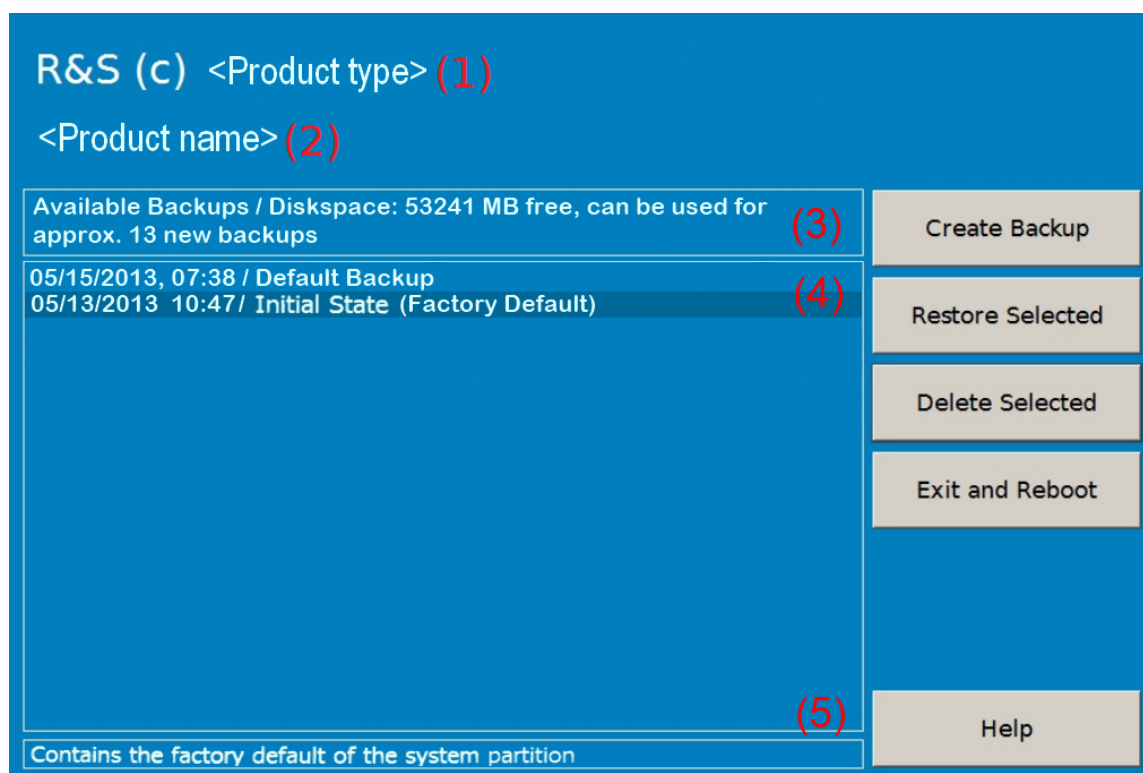
Figure 7-1: Main dialog (example)

(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 7.3.1, "Creating a Backup", on page 46
- Chapter 7.3.2, "Restoring a Selected Backup Version", on page 47
- Chapter 7.3.3, "Deleting a Backup", on page 48

7.3.1   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 7-1), select "Create Backup".

   The "Create Backup" dialog is displayed. Under "Description", the current version of the firmware is displayed.
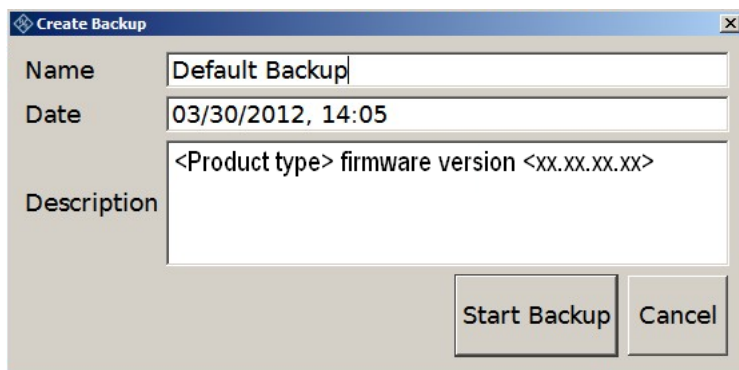
2. Enter a name for the backup and the date. If necessary, you can add information to the description.

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 VTC is restarted.

7.3.2 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.

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1. In the main dialog (see Figure 7-1), 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 VTC is restarted.

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

7.3.3 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 7-1), 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 7.3.1, "Creating a Backup", on page 46.

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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