R&S®OSP Open Switch and Control Platform Getting Started

1178711702
Version 12

ROHDE&SCHWARZ
Make ideas real

The R&S®OSP is a high-performance switch platform from Rohde & Schwarz. It facilitates RF tests by eliminating the need to rearrange coaxial cable connections repeatedly during measurements. Instead, the application-specific modules in the base unit automatically switch the required signal paths.

This document describes the following R&S®OSP base units with firmware version 2.60 and later:

- **R&S®OSP220** Base Unit 2HU without Touchscreen (order no. 1528.3105.02)
- **R&S®OSP230** Base Unit 2HU with Touchscreen (order no. 1528.3105.03)
- **R&S®OSP320** Base Unit 3HU without Touchscreen (order no. 1528.3111.02)
- **R&S®OSP-B200S2** Satellite 2HU for Base Units (order no. 1528.3134.02/.04)

For all optionally available standard switch modules, refer to the user manual, which is available for download at https://www.rohde-schwarz.com/product/osp-n > Manuals

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 OSP product page at https://www.rohde-schwarz.com/product/osp-n > Firmware.
Rohde & Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

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

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1 Safety and regulatory information

The product documentation helps you use the product safely and efficiently. Follow the instructions provided here and in the following chapters.

Intended use

The R&S OSP is designated for switching and control applications, including RF switching, in industrial, administrative, and laboratory environments. Use the R&S OSP only for its designated purpose.

Observe the operating conditions and performance limits stated in the data sheet.

Target audience

This document is targeted at all users, including installers, operators, and maintenance personnel.

Where do I find safety information?

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

- In Chapter 1.1, "Safety instructions", on page 5. The same information is provided in many languages in printed format. The printed "Safety Instructions" for "Mains-Powered Products, Not Heavy" (document number 1171.1771.99) 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 specifications document, manuals and the printed "Safety Instructions" document. If

you are unsure about the appropriate use, contact Rohde & Schwarz customer support.

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.

Reconfigure or adjust the product only as described in the product documentation or the specifications document. Any other modifications can affect safety and are not permitted.

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

Lifting and carrying the product

The maximum weight of the product is provided in the specifications document. You can lift or carry the product by yourself, if you can manage the weight on your own. Alternatively, you can use lifting or transporting equipment. Follow the instructions provided by the equipment manufacturer.

Choosing the operating site

Only use the product indoors. The product casing is not waterproof. Water that enters can electrically connect the casing with live parts, which can lead to electric shock, serious personal injury or death if you touch the casing.

If Rohde & Schwarz provides accessories designed for outdoor use of your product, e.g. a protective cover, you can use the product outdoors.

You can operate the product up to an altitude of 2000 m above sea level. If a higher altitude is permissible, the value is provided in the specifications document. 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 specifications document.

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 the product

Before connecting the interfaces and measuring inputs of the product to other products or electrical circuits, make sure that the other products or electrical circuits provide special protection against electric shock. This protection principle is referred to as SELV (safety extra-low voltage) and is based on a low voltage level and increased insulation. Exceptions are indicated by a measurement category on the product and given in the specifications document.

Connecting to power

The product is an overvoltage category II product. Connect the product to a fixed installation used to supply energy-consuming equipment such as household appliances and similar loads. Keep in mind that electrically powered products have risks, such as electric shock, fire, personal injury or even death. Replace parts that are relevant to safety only by original parts, e.g. power cables or fuses.

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.
- 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.

- 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 connection protects you against electric shock if an electric problem occurs.

1.2 Labels on the product

Labels on the casing inform about:

- Personal safety, see "Meaning of safety labels" on page 8
- Product and environment safety, see Table 1-1
- Identification of the product, for example as in the top left of Figure 5-1

Table 1-1: Labels regarding product and environment safety

	Potential hazard Read the product documentation to avoid personal injury or product damage.
	China RoHS certification, certifies compliance with the Chinese government's regulation on the restriction of hazardous substances (RoHS).
	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. See "Disposal" in the user manual.

1.3 Restrictions on opening a switch unit

Do not open an R&S OSP, to avoid personal injury and instrument damage.

- If opening is required for mounting a module, let Rohde & Schwarz service personnel mount this module.
- If opening is not required, follow the mounting instructions in the user manual.

1.4 Safety considerations for SSRs

Risk of injury and damage due to inappropriate SSR usage

At power loss, solid-state relays (SSRs) have **no defined** switching state. Hence, other than an electromechanical monostable relay, if there is a malfunction (for example, missing supply voltage), typically the SSR ports go to a high-impedance state. But the relay does not actively switch off a connected load. This failure can lead to a risk of personal injury and damage of equipment.

To prevent this risk, you must implement a dedicated concept for failsafe operation of your system in a competent manner.

Risk of damage due to inappropriate SSR usage

Solid-state relays (SSRs) are intended for high-frequency and high-speed switching, but their semiconductor elements are damaged easily by excess current, voltage peaks or a short circuit. Hence, inappropriate conditions or usage can damage SSRs or connected components and lead to associated problems.

To prevent this risk, avoid excess current, voltage peaks and short circuits.

Risk of SSR damage due to inappropriate operating conditions

Solid-state relays (SSRs) for RF applications are intended for switching low powers. To avoid damage due to overload, refer to the operating conditions according to the specifications document.

Monostable vs. failsafe

Without power, a solid-state relay (SSR) quits operating as a switch:

- It is in a **non-defined** high-impedance state
- It does not have any stable switching state

Sometimes, SSRs are considered as behaving like a monostable relay. And the term "monostable relay" is often considered to be equivalent with the term "failsafe relay". However, this interpretation is misleading.

For more information, refer to the user manual.

1.5 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.

1.6 Korea certification class B

이 기기는 가정용(B급) 전자파 적합기기로서 주로 가정에서 사용하는 것을 목적으로 하며, 모든 지역에서 사용할 수 있습니다.

2 Documentation overview

This section provides an overview of the R&S OSP user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/product/osp-n

2.1 Getting started manual

Introduces the R&S OSP and describes how to set up and start working with it. Includes, e.g., basic operations and safety instructions. A printed version is delivered with the switch unit. A PDF version is available for download at www.rohde-schwarz.com/manual/osp-n. Also, you can download it from the switch unit during **"WebGUI" control** at "Main" > "Context Menu" > "Downloads...".

2.2 User manual

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

A PDF version is available for download at www.rohde-schwarz.com/manual/osp-n. Also, you can download it from the switch unit during **"WebGUI" control** at "Main" > "Context Menu" > "Downloads...".

A separate R&S OSP-B200R/B200S2 Satellite System user manual is also available for download at www.rohde-schwarz.com/manual/osp-n.

2.3 Specifications and product brochures

The specifications document, also known as the data sheet, contains the technical specifications of the R&S OSP. It also lists the firmware applications 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/osp-n

If there is a data mismatch between the specifications document and other documentation, the information given in the specifications document is valid.

2.4 Service manual

Describes handling failed modules, module replacement, troubleshooting and special remote control commands for service purposes. The document also contains spare part lists and mechanical drawings. The service manual ("Classified Service Document") is available for Rohde & Schwarz personnel, only.

2.5 Printed safety instructions

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

2.6 Instrument security procedures

Deals with security issues when working with the R&S OSP in secure areas. It is available for download on the internet.

2.7 Release notes, open source acknowledgment

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

The documents are available for download at www.rohde-schwarz.com/firmware/osp-n. The OSA is available for download also from the switch unit during **"Web-GUI" control** at "Main" > "Context Menu" > "Downloads...".

2.8 Application notes & cards, white papers, etc.

These documents deal with special applications or background information on particular topics. See www.rohde-schwarz.com/application/osp and www.rohde-schwarz.com/application/osp-n.

Also, we recommend reading the application note "Guidance on Selecting and Handling Coaxial RF Connectors", which is available on the Internet at www.rohde-schwarz.com/appnote/1MA99.

2.9 Tutorials

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

3 Key features

The R&S OSP is a highly flexible, modular switch and control platform. Each switch unit can be equipped with several application-specific switch modules.

The platform meets the requirements of diverse test scenarios in production, labs and development environments. Scenarios range from desktop configurations for laboratory measurements to complex, rack-integrated test systems.

The R&S OSP220/230/320 described in this manual are the second generation of switch units from Rohde & Schwarz, replacing the R&S OSP120/130/150.

Outstanding key features are:

- 5 to 10 module slots and up to 16 module buses provide maximum flexibility
- Fast setup of test and measurement configurations
- Replace complex wirings by a single switch and control platform
- Easy interconnection configuration of primary and secondary switch units
- Optional installation of several remotely controlled satellite units (see p. 30)
- Reliable measurements and reproducible tests
- Automation for cost-efficient test sequences
- Electromechanical relay modules up to 67 GHz
- Solid-state relay modules with switching and settling times down to the µs range
- Backward compatible to all standard modules of the previous switch unit generation R&S OSP120/130/150, as described in the user manual

The available switch modules are described in the user manual.

For detailed specifications of the R&S OSP, refer to the specifications document, available for download at www.rohde-schwarz.com/brochure-datasheet/osp-n.

ⓘ Note that switch units are no measurement instruments. They support efficient working with test and measurement setups, but switch units do not display measurement results or power levels.

4 Preparing for use

Here, you can find basic information about setting up the product for the first time.

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- Unpacking and checking 17
- Choosing the operating site 17
- Setting up the product 18
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- Considerations for test setups 20
- Connecting to power 22
- Connecting to LAN 22
- Connecting monitor, mouse and keyboard 23
- Connecting RF cables 23
- Connecting control cables 24
- Switching on or off 24
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4.1 Lifting and carrying

See "Lifting and carrying the product" on page 6.

The R&S OSP has protruding handles at the left and right of its front panel. Each handle is designed to carry the weight of the switch unit. Also, the handles provide some mechanical protection for the front panel.

Figure 4-1: Handles (1) for lifting and carrying the R&S OSP. Underneath: foldable feet (2)

4.2 Unpacking and checking

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

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

4.3 Choosing the operating site

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

For safety information, see "Choosing the operating site" on page 6.

Electromagnetic compatibility classes

The electromagnetic compatibility (EMC) class indicates where you can operate the product. The EMC class of the product is given in the specifications document.

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

4.4 Setting up the product

See also "Intended use" on page 5 and "Setting up the product" on page 6.

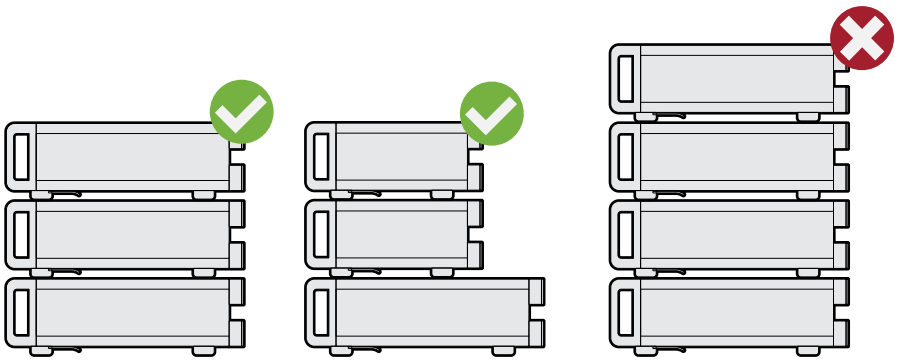
4.4.1 Placing the product on a bench top

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 specifications document.
2. **CAUTION!** Foldable feet can collapse. For safety information, see "Setting up the product" on page 6.

   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:
   - If the products have foldable feet, fold them in completely.
   - It is best if all products have the same dimensions (width and length). If the products have different dimensions, stack according to size and place the smallest product on top.
   - Do not exceed the permissible total load placed on the product at the bottom of the stack:
     – 50 kg when stacking products of identical dimensions (left figure).
     – 25 kg when stacking smaller products on top (middle figure).



Left = Stacked correctly, same dimensions
Middle = Stacked correctly, different dimensions
Right = Stacked incorrectly, too many products

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 to provide sufficient airflow and ventilation.
   - Do not place the product next to heat-generating equipment such as radiators or other products.

4.4.2 Mounting the product in a rack

Note that the satellite unit R&S OSP-B200S2 is not designed for rack-mounting.

To prepare the rack

1. Observe the requirements and instructions in "Setting up the product" on page 6.
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 19" rack

1. Use an adapter kit to prepare the product for rack mounting.
   a) Order the rack adapter kit designed for the product:
      - For 2 HU (R&S OSP220 and R&S OSP230), use R&S ZZA-KNA21 (order no. 1177.8026.00)
      - For 3 HU (R&S OSP320), use R&S ZZA-KNA31 (order no. 1177.8032.00)

   b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.
2. Grab the R&S OSP by its handles (Figure 4-1).
3. Insert it onto the shelf until the rack brackets fit closely to the rack.
4. Tighten all screws on the rack brackets, typically with a torque of 4.6 Nm, to secure the product in the rack.

To unmount the product from a rack

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

4.5 Accessory list

The R&S OSP base unit comes with the following accessories:

- Printed "Getting Started" manual, English (order no. 1178.7117.02)
- Ethernet (LAN) cable, 2 m, RJ45 (1:1), category 6 (order no. 0041.9748.00)
- Power supply cable, delivered country-specific to fit your local wall outlet format, see Table 4-1

Table 4-1: Power cords

Power supply cables according to country-specific standards	Order no.
European standard Angular adapter for European standard	0025.2365.00 0086.4400.44
British standard	0006.7013.00
Swiss standard	0006.7020.00
US American standard	0006.7036.00
Australian standard	0006.7107.00
Chinese standard	0041.4752.00
Japanese standard	0041.6232.00
Brazilian standard	3587.8102.00

4.6 Considerations for test setups

Preventing electrostatic discharge (ESD)

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

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

Ground yourself to prevent electrostatic discharge damage:

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

A risk of damage due to ESD is typically limited to switch units that are equipped with modules that have one or more of the following features:

- Digital input or output ports (I/O ports)
- Solid-state relays (SSR)
- Integrated amplifiers in special modules that are delivered as part of a test system

Preventing electromagnetic interference (EMI)

Electromagnetic interference (EMI) can affect the measurement results.

To suppress electromagnetic radiation during operation:

- Use high-quality shielded cables, for example, double-shielded RF, LAN and HDMI cables.
  Note: USB cables are of varying and often poor quality. Therefore, consider the quality of each individual USB cable.
- Always terminate open cable ends.
- Note the EMC classification in the specifications document.
- Ensure that connected external devices comply with EMC regulations.

Preventing overload on internal terminations

Overloading an electromechanical RF relay with internal port termination can damage or destroy the relay.

The maximum load that the internal termination of one port can handle is approximately 1 W. However, if the relay has several terminated ports, their cumulative maximum load is less than the sum. For example, an SP6T relay with 6 internally terminated ports cannot handle 6 W, but typically 3 W, only.

To avoid the risk of damage due to overloading internal terminations, limit the load to the "Max. termination power per relay" that is stated in the specifications document.

4.7 Connecting to power

The switch unit is equipped with an AC power supply connector and can be used with different AC voltages. The R&S OSP adapts itself automatically to the voltage. Refer to the specifications document for the voltage and frequency requirements. The AC power connector is on the rear panel of the switch unit.

► Connect the R&S OSP to an AC power supply using the supplied power cable.
As the switch unit's assembly is in line with the specifications for safety class EN61010, you must connect it only to an outlet that has a ground contact.

For replacing the fuses, refer to the maintenance chapter in the user manual.

4.8 Connecting to LAN

The LAN connector (RJ45) of the R&S OSP is on its rear panel, shown in Figure 6-4.

Network environment

Before connecting the product to a local area network (LAN), consider the following:

- Install the latest firmware, as described in the user manual, to reduce security risks.
- For internet or remote access, use secured connections if applicable.
  For example, use HTTPS, SFTP, FTPS instead of HTTP, FTP.
- Ensure that the network settings comply with the security policies of your company. Contact your local system administrator or IT department before connecting your product to your company LAN.
- When connected to the LAN, the product may potentially be accessed from the internet, which may be a security risk. For example, attackers might misuse or damage the product.

For more information on how to connect the switch unit to the LAN, and for the IP address, refer to the user manual.

4.9 Connecting monitor, mouse and keyboard

The HDMI and USB connectors for an external monitor, a mouse and a keyboard are on the front panel of the R&S OSP, shown in Figure 6-4.

For connecting these devices, refer to the user manual.

4.10 Connecting RF cables

Many modules are desigened for connecting test equipment via RF cables.

Misalignment and excessive tightening of coaxial RF connections can damage the connectors of both cables and modules. Too weak tightening leads to inaccurate measurement results.

Connecting RF cables / TORQUE RECOMMENDATIONS

For best connections, proceed as follows:

1. Carefully **align** the connectors along a common axis.
2. Mate the connectors along the common axis until the male pin of the inner connector engages with the female socket of the outer connector.
3. When fastening the connectors, **only turn the nut** of the outer connector until the connectors are firmly coupled.
   Avoid rotating the body of the outer connector.
4. If the inner connector is on a cable, hold it stationary with a spanner.
5. For fastening the connection, use a calibrated **torque wrench** suitable for the connector type.
   Never use a standard open-end wrench.
6. Fasten the nut of the outer connector to the specified torque.
   For specifications, refer to **application note 1MA99**, which is available on the Internet at www.rohde-schwarz.com/appnote/1MA99.

   For N, SMA and PC connectors, we recommend applying the following torque:
   - **150 N·cm** for **N** connectors
   - **56 N·cm** for **SMA** connectors (standard, PTFE-filled)
   - **90 N·cm** for **PC** connectors (3.5 mm / 2.92 mm / 2.4 mm / 1.85 mm, air-filled)

Rohde & Schwarz offers torque wrenches for various connectors. For ordering information, also refer to the application note 1MA99

7. Note that 3.5 & 2.92 mm PC connectors are **incompatible** with 2.4 & 1.85 mm PC connectors.

4.11 Connecting control cables

Many modules are desigened for connecting test equipment via control cables. Typically, these connections are straight forward and require no precautions.

However, **take special care** in the following cases:

- In I/O modules (input / output), avoid overloading the **digital input lines**. The maximum voltage to be applied directly to the input connectors is TTL level: standard 3.3 V DC, tolerating up to 5 V DC. For voltages > 5 V DC up to 28 V DC, insert a resistor in series with a minimum resistance of **22 kΩ**.
- In the satellite system, use the **[Wired Link]** connectors **only** for connecting the remote control module R&S OSP-B200R with the satellite unit R&S OSP-B200S2. Connecting a [Wired Link] connector to any other device's connector can damage your equipment.
  See Chapter 5.2.4, "Rear panel of the R&S OSP-B200S2 satellite unit", on page 34.

4.12 Switching on or off

Table 4-2: Overview of power states

Status	LED above [Pwr] key	Position of rear power switch
Off	Off	[0]
Standby	orange	[I]
Ready	green	[I]

To switch on the R&S OSP

The product is off but connected to power.

► Set the AC power switch on the rear panel to position [I].

The instrument is supplied with AC power. After booting, the instrument is ready for operation. A green LED above the [Pwr] key on the front panel indicates the operating mode.

To shut down the R&S OSP

1. **NOTICE!** Risk of data loss. See "How to avoid losing settings" on page 25.

   Check the LED above the [Pwr] key on the front panel (labeled 7 in Figure 6-4).

   - If the LED emits orange light ●, do not press the [Pwr] key.
     The switch unit is already in standby mode.
   - Otherwise, if the LED emits green light ●, set the switch unit to standby mode by pressing the [Pwr] key.
     The LED changes from green to orange light, indicating **standby mode**.
     The switch unit is now unavailable via LAN, even if connected.

2. Optionally, set the AC power switch on the rear panel to position [O].

   The R&S OSP changes into **off mode**.

To disconnect from power

1. Shut down the switch unit.
2. Disconnect it from the power source.

How to avoid losing settings

While the R&S OSP is in operating mode, if you switch it off using the rear panel switch or by disconnecting the power cord, the instrument loses its current settings. (Operating mode is indicated by a green LED above the [Pwr] key.)

For example, if you have selected signal paths previously, you must select and enable these paths again, when you restart the switch unit.

To avoid a loss of settings, press the [Pwr] key first to set the switch unit into standby mode. Then shut it down properly by setting the rear AC power switch to position [O].

- If "Configuration" > "General" > "Switch-On Reset" is activated, the R&S OSP resets all internal latching switches during the startup procedure.
- If "Configuration" > "General" > "Switch-On Action" is set to "Switch Path", the R&S OSP loads the previously set path while booting. The switch unit activates this path when the startup procedure is completed.

Display timeout

The **OLED status display** of a switch unit R&S OSP220 or R&S OSP320 serves for showing you the network connection. The LAN connection is set typically at power-up.

The status display switches off automatically after setting the LAN connection with a timeout specified by the "Status Display Period" parameter in the "General" configuration tab (see user manual). Without a network connection, the status display switches off with the same timeout after power-up. This feature helps to prevent burn-in effects often seen in OLED displays.

When the switch unit is connected via a new network address, the status display is switched on again for the next 30 minutes. (Your server can assign a new address, for example, when you change the switch unit's network settings from static IP to DHCP, as described in the user manual.)

The RGB-LED **touchscreen display** in the R&S OSP230 and in the module R&S OSP-B300M needs no burn-in protection. Thus, it has no timeout.

4.13 Checking the installed modules

The instrument is typically equipped with one or more optional switch modules.

You can visually check whether the modules listed on your delivery note correspond with the installed modules. Each module's name is printed on its panel.

You can also view the installed modules in the "Module Operation" dialog (touchscreen display or "WebGUI", see Chapter 6.2, "User interface and functional elements", on page 38):

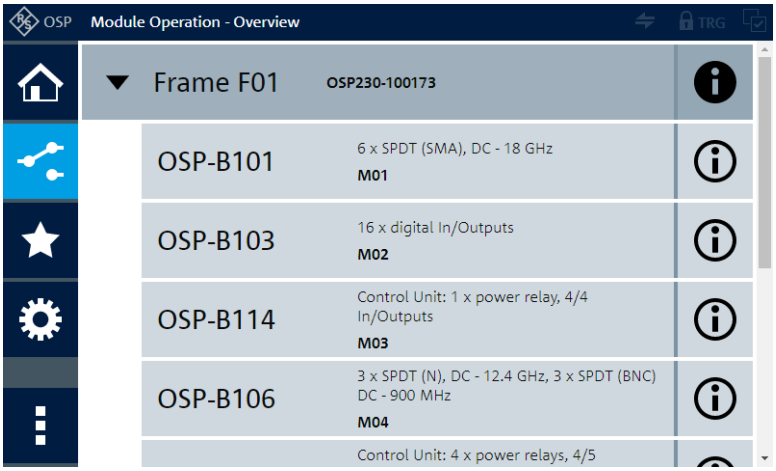


Figure 4-2: The module operation dialog, here with a single switch unit and 5 modules

The information in this dialog is updated during the booting process, when the R&S OSP automatically detects the installed modules.

4.14 Configuring the initial instrument settings

After startup, the switch unit is fully configured automatically, and ready for use.

However, you have many options to change the configuration, for example:

- Edit the network settings
- Define or modify an interconnection setup
- Restore a previous setting
- Define switching paths and output channels

These configuration settings and many more, for example for a setup of primary and secondary switch units, are described in the user manual.

5 Instrument tour

- Front panel view.....28
- Rear panel view..... 32

5.1 Front panel view

The following chapters describe the front panels of all models of the R&S OSP switch unit family. For the functional elements, refer to Chapter 6.2.

5.1.1 Front panel of the R&S OSP220

The front panel of the R&S OSP220 features 3 module slots, a monochrome non-touch status display, a power switch and various connectors.

The R&S OSP220 occupies 2 height units (2HU) in a standard 19" rack. You can insert 1-slot, 2-slot or 3-slot modules into the 3 front slots:

Figure 5-1: Front view of the R&S OSP220 (2HU)

FS01 = Front slot 01, here with a blind plate
FS02 = Front slot 02, here with a 1-slot switch module
FS03 = Front slot 03, here with a blind plate
F Int = Front interfaces and status display (OLED, 128 x 64 pixels), see Figure 6-4

5.1.2 Front panel of the R&S OSP230

The front panel of the R&S OSP230 features 2 module slots, an integrated touch-screen display, a power switch and various connectors.

The R&S OSP230 occupies 2 height units (2HU) in a standard 19" rack. You can insert two 1-slot modules or one 2-slot module into the 2 front slots:

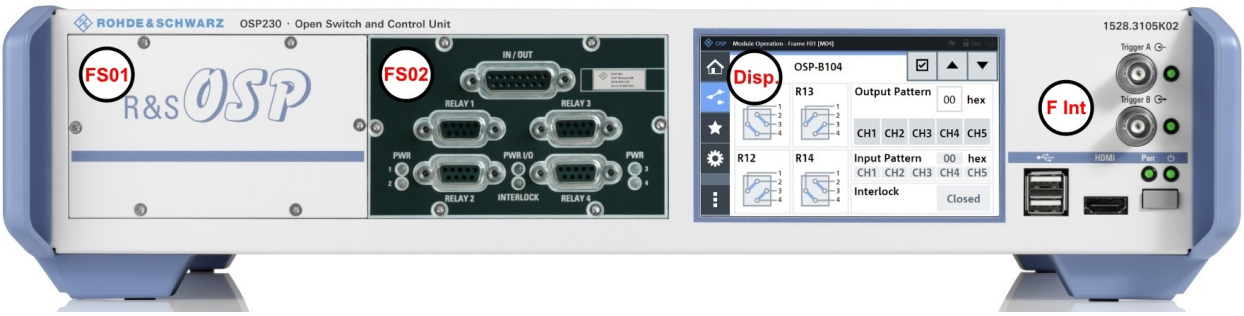


Figure 5-2: Front view of the R&S OSP230 (2HU)

FS01 = Front slot 01, here with a blind plate
FS02 = Front slot 02, here with a 1-slot switch module
Disp. = Integrated touchscreen display (and no front slot 03)
F Int = Front interfaces, see Figure 6-4

5.1.3 Front panel of the R&S OSP320

The R&S OSP320 is higher than all other switch units from Rohde & Schwarz. With its 3 height units (3HU), it enables a more dense fitting of 1-slot switch modules within the same instrument width. Hence, its front panel features 5 module slots, along with a power switch, a status display and various connectors.

2 of the 5 front slots (labeled FS04 and FS05 in Figure 5-3) can hold the factory-mounted optional touchscreen display module R&S OSP-B300M:

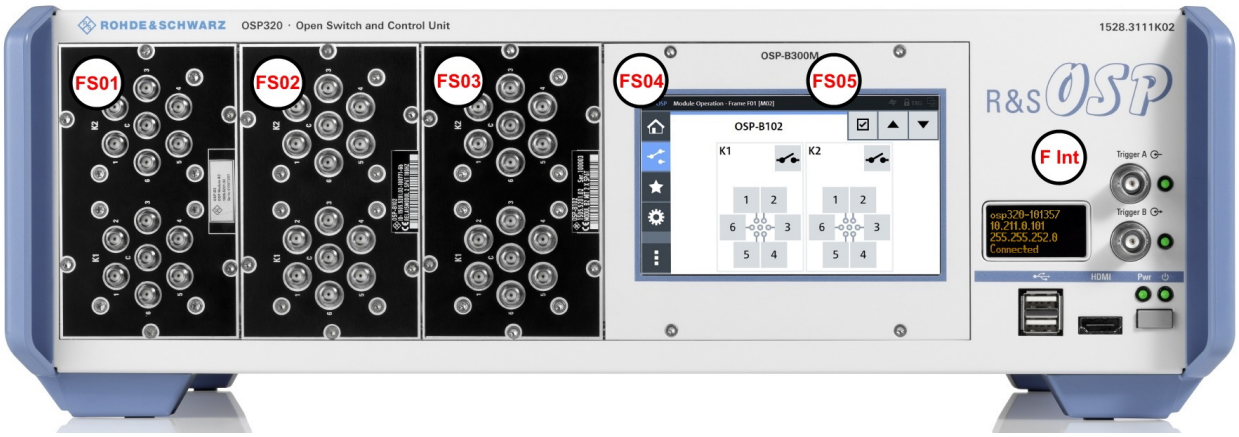


Figure 5-3: Front view of the R&S OSP320 (3HU)

FS01 to FS03 = Front slots 01 to 03, here each with a 1-slot switch module
FS04 + FS05 = Front slot 04 and 05, here with mounted touchscreen display module
F Int = Front interfaces and status display (OLED, 128 x 64 pixels), see Figure 6-4

The dedicated touchscreen display module R&S OSP-B300M shown in Figure 5-3 is optional (see p. 31). It can only be factory-mounted in the R&S OSP320 with 3 height units (3HU) in position FS04 + FS05.

You cannot insert any modules into the R&S OSP320 that are designed as 2-slot or 3-slot modules for a switch unit with 2 height units (2HU, see above).

5.1.4 Front panel of the R&S OSP-B200S2 satellite unit

For a comprehensive description of this unit, also refer to the **R&S OSP-B200R/B200S2 Satellite System user manual**, available for download at www.rohde-schwarz.com/manual/osp-n.

The R&S OSP-B200S2 is a standalone device, only, not to be mounted into a 19" rack. The front panel of satellite unit the features 2 module slots, into which you can insert 1-slot or 2-slot modules:

Figure 5-4: Front view of the R&S OSP-B200S2 (2HU)

SlotA = Front slot A, here with a 1-slot switch module
SlotB = Front slot B, here with a 1-slot switch module

This unit is designed to serve as a satellite with up to 2 switch modules, controlled from a base switch unit with remote control module R&S OSP-B200R.

For example, you can use the satellite unit inside a shielded chamber for EMC tests that do not tolerate electrical wiring. In this scenario, use the satellite with local battery power supply, and control the switch modules fitted in the unit via a fiber-optic link. See also Chapter 5.2.4.1, "Wired link versus fiber-optic link", on page 35.

5.1.5 Touchscreen

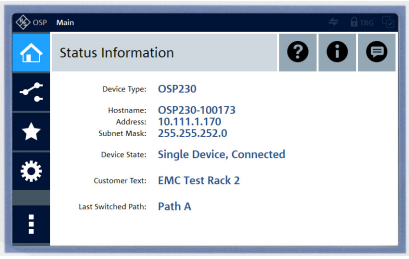


Figure 5-5: Touchscreen display, here showing the Main menu

- The R&S OSP230 is equipped with an **integrated** touchscreen display on the front panel.
- The R&S OSP320 can be equipped with the touchscreen display **module** R&S OSP-B300M.

Touch the screen gently with your fingers or use a stylus pen with a smooth soft tip.

For instructions on cleaning the screen, see the Maintenance chapter in the R&S OSP user manual.

Both the *integrated display* and the *display module* are based on a touch-sensitive RGB LCD with a resolution of 800 x 480 pixels.

The touchscreen display offers one out of several means of user interaction for easily handling the switch unit. It shows the relay and switch-path settings, provides status information and allows configuring and controlling your measurement tasks.

The touchscreen reacts in a defined way when you tap a particular element on the screen with a finger or with a pointing device, for example an external USB mouse. Any user interface element that reacts to a click by a mouse pointer also reacts to a tap on the screen, and vice versa. Using the touchscreen, you can perform all tasks by the tap of your finger.

For the remainder of this manual, all interactions are described for a "click" action. These descriptions also mean the equivalent "tap" action using the touchscreen.

On-screen keyboard

The on-screen keyboard is an additional means of direct interaction with the switch unit R&S OSP230 or R&S OSP320, the latter if equipped with touchscreen module R&S OSP-B300M.

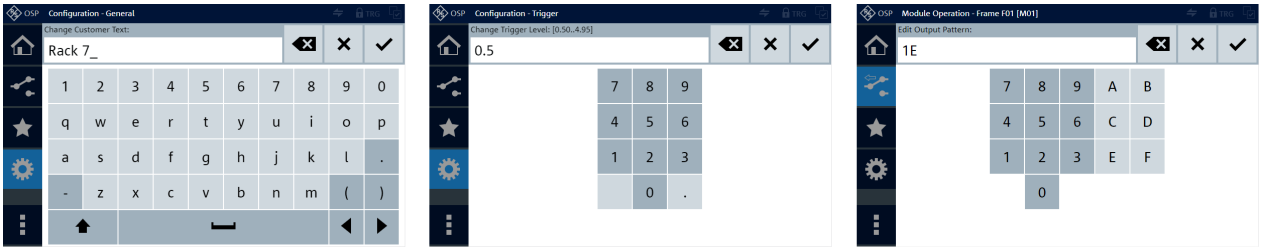


Figure 5-6: Different versions of the on-screen keyboard

Left = Numbers and characters allowed
Center = Decimal numbers, only
Right = Hexadecimal numbers

The touchscreen automatically opens an on-screen keyboard, if your current action requires entering numbers or characters. The cancel button or the OK button closes the on-screen keyboard.

Instead of using the on-screen keyboard, you can enter data with a connected external keyboard (Figure 6-1) or via the user interface in a browser (Figure 6-2).

5.2 Rear panel view

The following chapters describe the rear panels of all models of the R&S OSP switch unit family. For the functional elements, refer to Chapter 6.2.

The meanings of the labels on the product are described in Chapter 1.2, "Labels on the product", on page 8.

5.2.1 Rear panel of the R&S OSP220

The rear panel of the R&S OSP220 features 3 module slots, an on/off switch, fuses, power supply connector, LAN and USB connectors and a micro SD card slot. You can insert 1-slot, 2-slot or 3-slot modules into the 3 rear slots:

Figure 5-7: Rear view of the R&S OSP220 (2HU)

R Int = Rear interfaces, see Figure 6-4
RS01 to RS03 = Rear slots 01 to 03, here each with a blind plate

5.2.2 Rear panel of the R&S OSP230

The rear panel of the R&S OSP230 features 3 module slots, an on/off switch, fuses, power supply connector, LAN and USB connectors and a micro SD card slot. You can insert 1-slot, 2-slot or 3-slot modules into the 3 rear slots:

Figure 5-8: Rear view of the R&S OSP230 (2HU)

R Int = Rear interfaces, see Figure 6-4
RS01 to RS03 = Rear slots 01 to 03, here each with a 1-slot switch module

5.2.3 Rear panel of the R&S OSP320

The rear panel of the R&S OSP320 features 5 module slots, an on/off switch, fuses, power supply connector, LAN and USB connectors and a micro SD card slot:

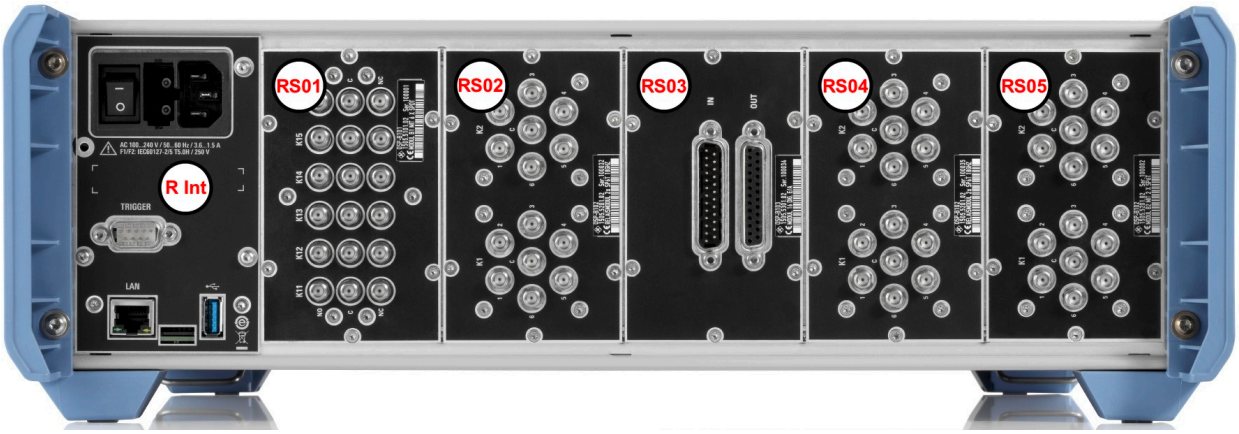


Figure 5-9: Rear view of the R&S OSP320 (3HU)

R Int = Rear interfaces, see Figure 6-4, with an additional D-Sub 9 trigger connector
RS01 to RS05 = Rear slots 01 to 05, here each with a 1-slot switch module

You cannot insert any modules into the R&S OSP320 that are designed as 2-slot or 3-slot modules for a switch unit with 2 height units (2HU, see above).

The D-Sub 9 trigger connector (next to the label "R Int" in Figure 5-9) is only available in the rear interface panel of the R&S OSP320, not in any other switch unit. This connector enables the addressed hardware trigger.

5.2.4 Rear panel of the R&S OSP-B200S2 satellite unit

For a comprehensive description of this unit, also refer to the **R&S OSP-B200R/B200S2 Satellite System user manual**, available for download at www.rohde-schwarz.com/manual/osp-n.

The rear panel of the R&S OSP-B200S2 features various connectors and LEDs.

You cannot insert any modules into the rear panel of the R&S OSP-B200S2.

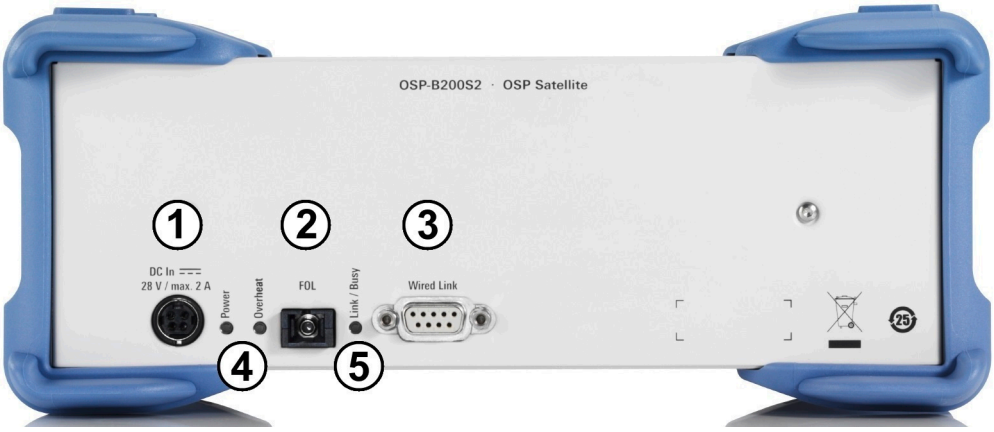


Figure 5-10: Rear view of the R&S OSP-B200S2 (2HU)

1 = DC power supply connector
2 = Fiber-optic link (FOL) connector for optical remote control
3 = Wired link connector for electrical remote control
4 = Status LEDs for indicating [Power] and [Overheat]
5 = Status LED for indicating [Link / Busy]

5.2.4.1 Wired link versus fiber-optic link

The link connectors (labeled 2 and 3 in Figure 5-10) allow choosing either an electrical or an optical control connection.

- **Wired link**
  For remote operation of the satellite unit R&S OSP-B200S2 across distances up to 10 m, use the D-Sub cable R&S OSP-Z200x.
  Connect this cable **exclusively** to the remote control interface module R&S OSP-B200R in your base switch unit. Connecting it to any other device or module can harm your equipment.
  The wired link cable supplies power from the base switch unit to the satellite.
- **Fiber-optic link**
  For remote operation of the satellite unit R&S OSP-B200S2 across larger distances up to 20 m, or inside a shielded room, use the fiber-optic cable R&S OSP-Z201x or R&S OSP-Z202x.
  As the fiber-optic link cable does not supply power to the satellite unit, you must also use the 28 V DC power supply R&S OSP-B200P.

6 Trying out the switch unit

This chapter introduces the most important basic operations and settings of the R&S OSP step by step. For a complete overview, see the user manual (p. 12).

Prerequisite: the instrument is set up, connected to mains power supply and started up, as described in Chapter 4 on page 16. The next sections describe:

- Manual and remote modes of operation 36
- User interface and functional elements 38
- Main action buttons 41
- Elements of the status bar 42
- Manual module operation: switching / selecting 42
- Contacting customer support 45

6.1 Manual and remote modes of operation

You can operate the switch unit by any of the following modes:

- Direct manual operation 36
- Manual remote operation 37
- Remote operation by SCPI commands 37

6.1.1 Direct manual operation

If you use an R&S OSP230 or an R&S OSP320 with display module R&S OSP-B300M, you can control your switch unit by the user interface on the integrated touchscreen display.

Alternatively, with any of the R&S OSP models, you can control your switch unit via an external mouse and keyboard, connected to the USB interfaces (see 4 in Figure 6-4). Optionally (especially without integrated touchscreen), you can connect an external monitor to the switch unit's HDMI interface (see 5).

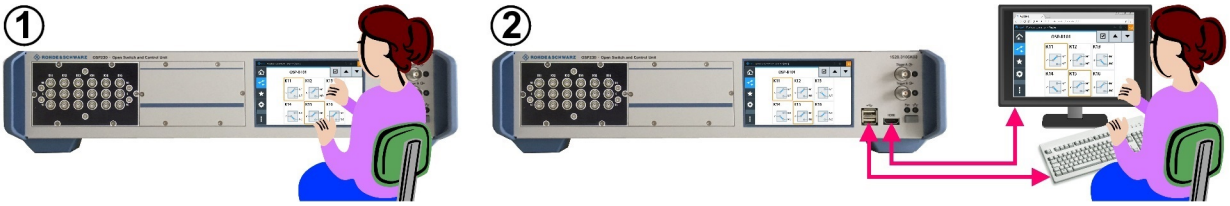


Figure 6-1: Operation by integrated touchscreen (1) or by external USB / HDMI devices (2)

For scrolling the touchscreen, swipe it with your finger. With an external monitor, click and use the mouse wheel or the keyboard's up/down keys.

For connecting external devices, see Figure 6-4.

6.1.2 Manual remote operation

You can control one or more switch units by working with the user interface in a web browser ("WebGUI") on a remote computer that is connected via LAN.

Figure 6-2: Manual remote operation via "WebGUI" and LAN

RJ45 = Ethernet (LAN) connector on the rear panel of each switch unit

Refer to the user manual for more information, also regarding the combination of several switch units in "Interconnection" mode.

Note that the legacy software R&S OSP Panel is not compatible with the switch units R&S OSP220, R&S OSP230 and R&S OSP320.

6.1.3 Remote operation by SCPI commands

You can control the R&S OSP by SCPI commands sent from a remote computer that is connected via LAN. Refer to the user manual.

Figure 6-3: Remote operation by SCPI commands

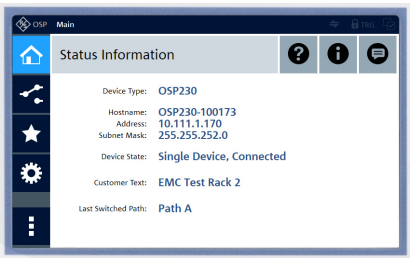
RJ45 = Ethernet (LAN) connector on the rear panel of each switch unit
Far left = Two switch units integrated in a test system like R&S CEMS

To do so, you have the following options:

- For SCPI command communication, use a terminal program like R&S Forum or similar programming interface (for example with R&S VISA driver). Remote operation and RC commands are described in the user manual.
- Use your own application to communicate with the R&S OSP via a VISA interface or directly via a TCP/IP raw socket connection.
- Let a test system software like R&S EMC32 or R&S ELEKTRA send the required commands. Refer to www.rohde-schwarz.com/product/emc32 and www.rohde-schwarz.com/product/elektra.

The R&S OSP can handle up to 5 open SCPI command connections simultaneously.

6.2 User interface and functional elements



The switch unit R&S OSP230 and the display module R&S OSP-B300M have a **touchscreen display**.

Its functions are described in the user manual.

The switch units R&S OSP220 and R&S OSP320 have a **status display**.

After booting, it displays the hostname, IP address, subnet mask and device status information. For details, refer to the user manual.

See also "Display timeout" on page 26.

You cannot operate the switch units R&S OSP220 – and the R&S OSP320 without display module R&S OSP-B300M – by their status displays. To operate these

switch units without the graphical user interface of a built-in full touchscreen display, use one of the following alternatives:

- As on the right-hand side in Figure 6-1, connect an external monitor to the HDMI connector on the unit's front panel (labeled 5 in Figure 6-4). Also connect a mouse and keyboard to the USB connectors, labeled (4).
- Use the switch unit as a secondary device in interconnection mode, as described in the user manual.
- Connect the switch unit to a local area network (LAN) by the RJ45 connector on the unit's rear panel. The connector is labeled (1) in Figure 6-4. Read the unit's IP address from the status display and proceed as described in Chapter 6.1.2, "Manual remote operation", on page 37, or Chapter 6.1.3, "Remote operation by SCPI commands", on page 37.

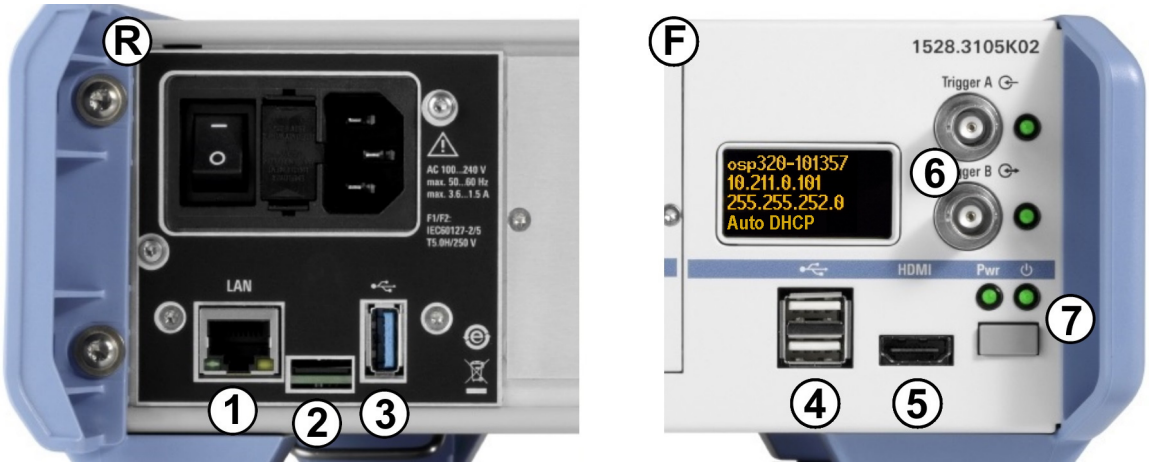


Figure 6-4: Connectors and functional elements on the switch unit's rear and front panel

R = Rear interfaces (where the R&S OSP320 has an additional trigger port, see Figure 5-9)
F = Front interfaces (where the R&S OSP230 has no OLED status display, see Chapter 6, "Trying out the switch unit", on page 36)
I/0 = Main power switch with fuse holder and power connector
1 = LAN connector (RJ45)
2 = Slot for the micro SD card that holds the switch unit's operating system
3 = USB 3.1 connector
4 = Two USB 2.0 connectors (for external mouse and keyboard)
5 = HDMI connector (for an external monitor)
6 = Two BNC trigger input connectors (A and B, with two trigger status LEDs), see below
7 = Front power switch with [Pwr] and LAN status LEDs

If you connect an external monitor to the **HDMI** connector (5), use a monitor that is compatible with this port's DVI signal. This signal is configured for the touchscreen's resolution of 800 x 480 pixels. Incompatible monitors cannot display the graphical user interface.

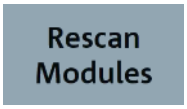
With the **trigger** connectors (6), the R&S OSP is prepared for external triggering, which requires the hardware trigger option **R&S OSP-K100**. Firmware versions below version `2.00` do not support this trigger option.

Note that the rear interface panel of the R&S OSP320 has an additional D-Sub 9 trigger connector, as shown in Figure 5-9.

In any of these configurations, you can operate a switch unit by its user interface: either on an external monitor or in a web browser (we recommend using **Chrome** as browser). The same holds true for the R&S OSP230 and R&S OSP320 with integrated display module R&S OSP-B300M, which allow touchscreen operation.

Using any of these options, you get access to the graphical user interface (GUI):

Figure 6-5: Main menu of the graphical user interface ("WebGUI"), here in the recommended Chrome browser



The "Rescan Modules" button is available only, if the switch unit has detected a remote control module R&S OSP-B200R, but without a connected satellite unit R&S OSP-B200S2. Connect or switch on the satellite unit and click the "Rescan Modules" button instead of a restart. For more information, refer to the user manual.

In the "Main" menu of the user interface, clicking the "Help" icon in the top-right area opens an overview of the available functions:

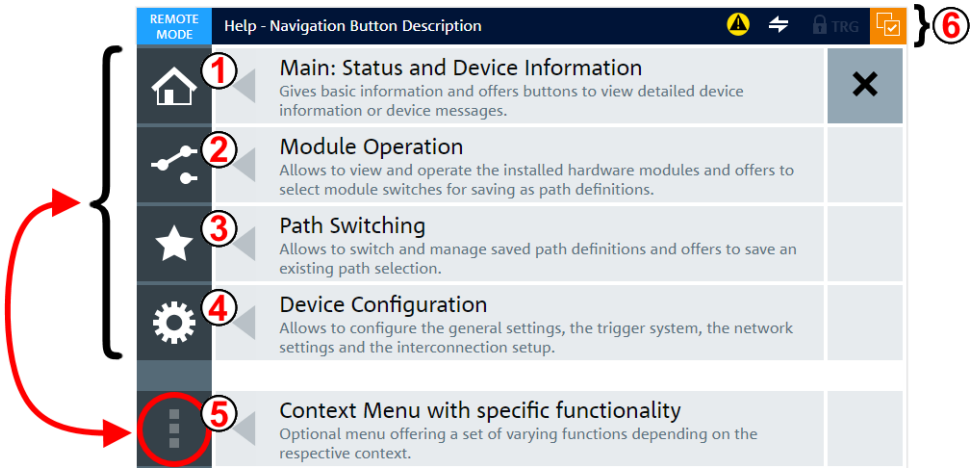


Figure 6-6: Main elements of the graphical user interface (GUI)

1 = Main menu
2 = Module operation
3 = Path switching
4 = Device configuration
5 = Context menu, always used together with one of the menu buttons above
6 = Status bar with varying elements, see Chapter 6.4

The main GUI elements listed above are briefly described in Chapter 6.3, "Main action buttons", on page 41, and Chapter 6.4, "Elements of the status bar", on page 42. For more information, refer to the user manual.

6.3 Main action buttons

The user interface includes the following main action buttons:

The **"Main"** menu provides status and network information. Its context menu (1)+(5) gives additional device info and messages.

The **"Module Operation"** dialog allows immediate interaction with the relays. For a brief overview, see **Chapter 6.5.**

The **"Path Switching"** dialog allows defining, editing and activating paths. You can also export and import paths.

The **"Configuration"** dialog allows configuring the general settings, the trigger system (optional), the network settings and the interconnection setup.

Context Menu

The **"Context Menu"** button calls specific functionality for any of the menu items shown above and listed as (1) to (4) in Figure 6-6. Hence, this button is always used **together** with one of the other buttons.

For more information, refer to the user manual.

6.4 Elements of the status bar

The status bar is shown on top in Figure 6-5 and Figure 6-6. The various indicator icons have the following meanings:

Left: the R&S OSP is controlled by its graphical user interface (locally or via LAN). Right: the R&S OSP is controlled remotely by SCPI commands or a primary device. See Chapter 6.1, "Manual and remote modes of operation", on page 36.

If this label is displayed in the status bar, the R&S OSP is in virtual mode (see user manual).

If the lock icon is highlighted (right), it indicates the locked mode (see user manual).

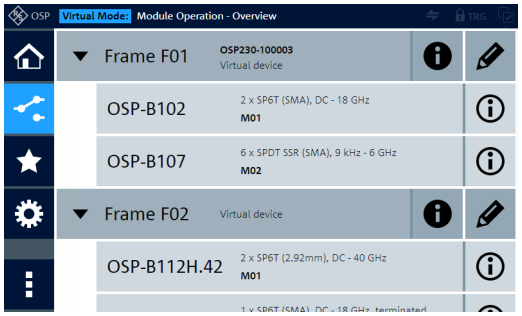
If the trigger icon is highlighted (right), the software option **R&S OSP-K100** is enabled and the trigger is activated (see user manual).

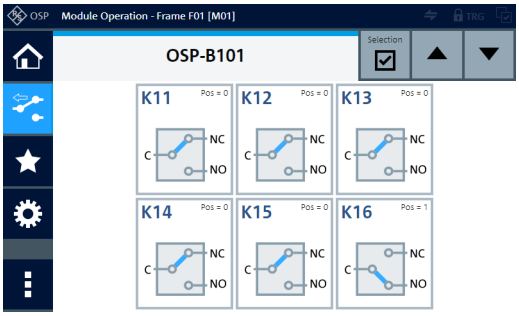
If the selection indicator icon is highlighted (right), at least one relay or output channel is selected (see Chapter 6.5.2).

6.5 Manual module operation: switching / selecting

This chapter outlines only the most basic features of the dialogs for manual "Module Operation" that allow immediate interaction with the relays. Click the "Module Operation" button to see a **list** of all installed switch modules or to open the **interaction dialog** of one switch module:

Table 6-1: Left overview: list of modules in virtual mode. / Right: interaction dialog of one module in physical mode.





If you see the interaction dialog of one switch module (as in the right picture above), click the "Module Operation" button . You see the list of installed modules (as in the left picture above, here a screenshot in virtual mode). In the icon of the "Module Operation" button, the "back" arrow (available with firmware versions from 1.40) indicates that it brings you back to the list. To see the interaction dialog of any module, click its name in the list.

6.5.1 Switching mode

Allows switching the state of relays and output channels.

Switching mode is active, if the selection mode (see Chapter 6.5.2) is deactivated. In switching mode, clicking the icon of a switchable item changes its state:

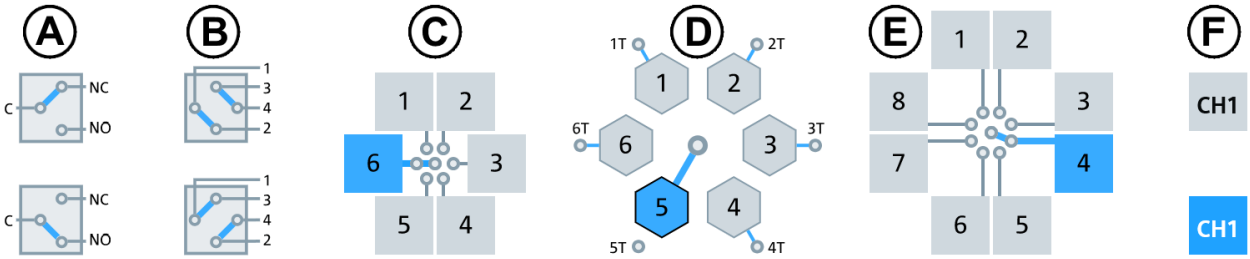


Figure 6-7: Various relay types and the effect of clicking them

- (A) SPDT relays, and (B) DPDT relays: Clicking toggles the state
- (C) and (D) SP6T relays, and (E) SP8T relays (or SPxT relays): Clicking a terminal port selects it to be connected to the common port
- (F) Output channels: Clicking toggles the state

For switching relays, output channels or other switchable items, the "Selection" button (orange, described below) must **not** be active.

6.5.2 Selection mode

Allows selecting relays and output channels.

The "Selection" button switches the "Selection Mode" on or off. This button (marked by a red circle in Figure 6-8) is only available in a view that shows at least one module and its details.

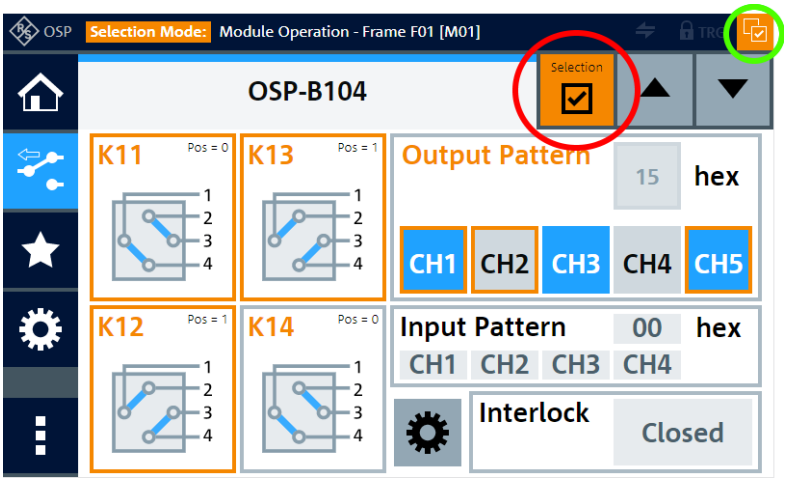


Figure 6-8: Relay or channel selection dialog

Red circle	= If the "Selection" button (mouse-over: "Toggle select mode") is orange, the "Selection Mode" is activated, also indicated by the name color of the selectable items changing from black to orange.
Green circle	= "Items selected" indicator. The icon is highlighted, if at least one relay or output channel in any module is selected.
Orange frames	= Selected relays and output channels are highlighted in the module's interaction dialog

While the "Selection Mode" is active, tapping or clicking the icon of a relay, output channel or other Switchable items **does not change** its state, but only **selects or deselects** it. This selection is indicated by the icon's name and frame color changing from gray to orange.

Use the selection mode for defining paths and output patterns. To select or deselect all relays and output channels, go to "Module Operation" (or "Path Switching") > "Context Menu" > "Path Selection" > "Select All" or "Deselect All".

In a full-screen window of your web browser, the module interaction dialog can display several modules at the same time:

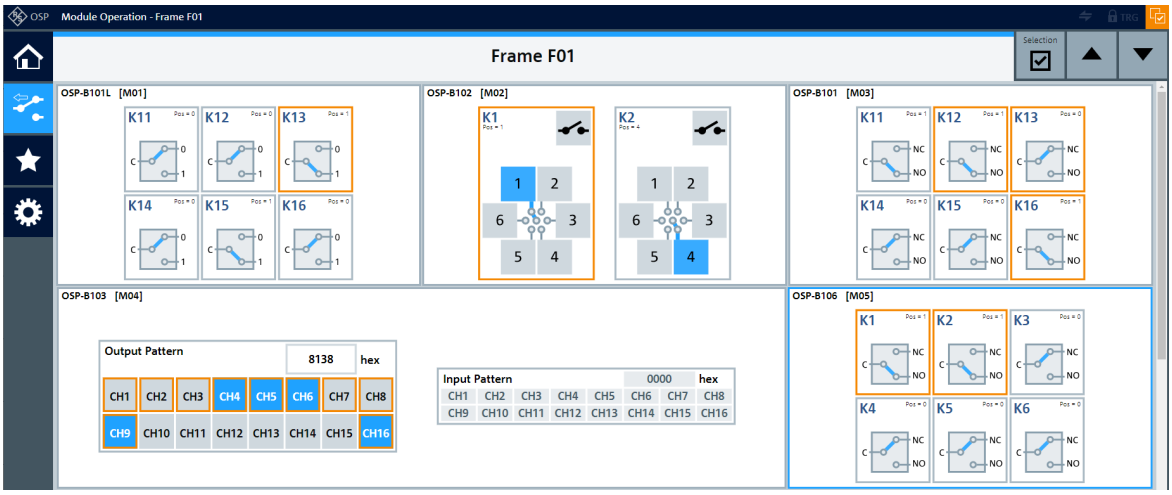


Figure 6-9: Full-screen representation of several modules in a browser window

On the contrary, to reproduce the original size of the touchscreen display, set your browser window to 800 × 480 pixels. Optionally, press [F12] to enter this setting.

For a comprehensive description of module operation and all other functions, including the definition and switching of paths, refer to the user manual.

6.6 Contacting customer support

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

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