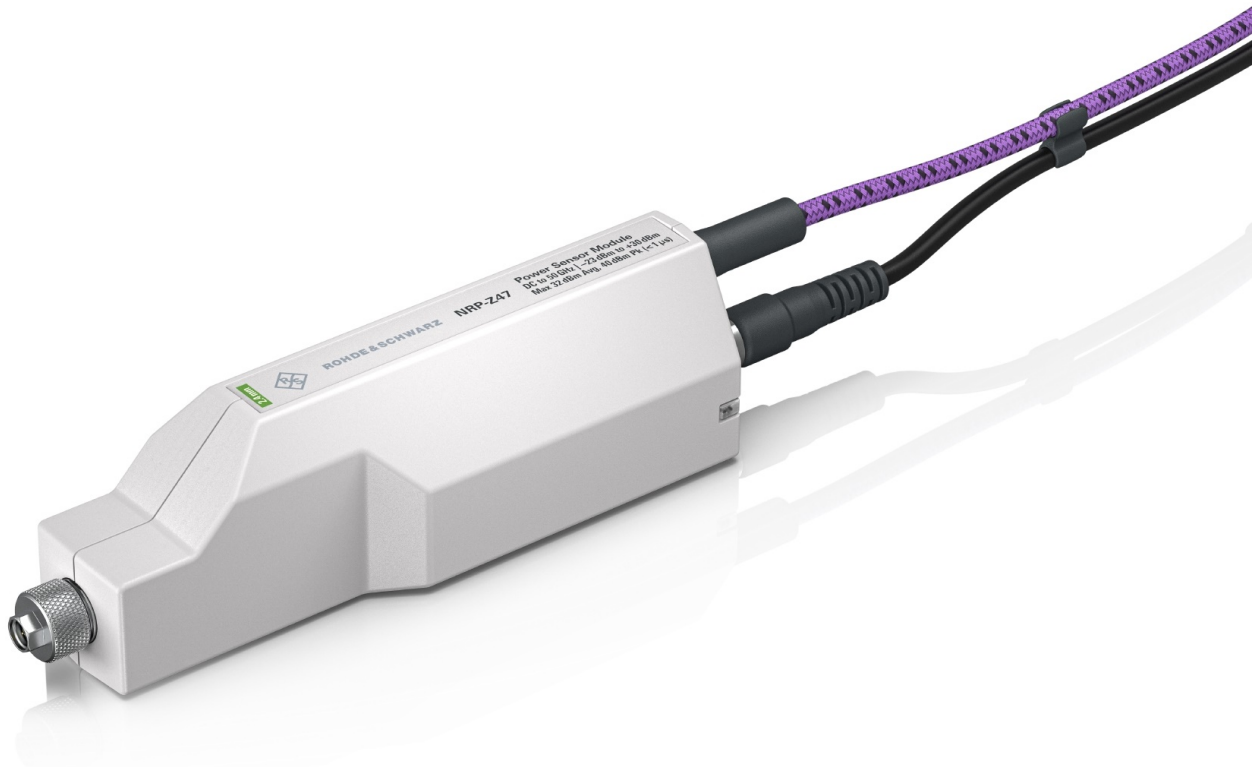


R&S NRP-Zx7 Power Sensor Modules Getting Started



1444177702

Version 03

ROHDE & SCHWARZ

Make ideas real



This document describes the following models:

- R&S®NRP-Z47 (1444.1748K02)
- R&S®NRP-Z37 (1169.3206.02)
- R&S®NRP-Z27 (1169.4102.02)

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1444.1777.02 | Version 03 | R&S NRP-Zx7

Throughout this document, R&S® is indicated as R&S.

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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 sections.

Intended use

The R&S NRP-Zx7 power sensor module is intended for accurate power measurements in R&D and calibration labs.

The main application is level calibration where the R&S NRP-Zx7 power sensor module is used together with an R&S measuring receiver of the R&S FSMR series.

Observe the operating conditions and performance limits stated in the specifications document.

Target audience

The target audience is developers and technicians. The required skills and experience in power measurements depend on the used operating concept.

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 [Section 1.1, "Safety instructions"](#), on page 5. The same information is provided in many languages in printed format. The printed "Safety Instructions" for "Power Sensors" (document number 1171.1865.99) 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.

Labels on the product

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 skilled persons 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>.


Operating the product


Only use the product indoors. The product casing is not waterproof.

Observe the ambient conditions stated in the specifications document. Examples of ambient conditions are altitude, operating temperature and climatic loads.

Meaning of safety labels

Safety labels on the product and its accessories warn against potential hazards.

	<p>Potential hazard Read the product documentation to avoid personal injury or product damage.</p>
---	--

	<p>Hot surface Do not touch. Risk of skin burns. Risk of fire.</p>
---	--

1.2 Labels on the product

Labels on the product inform about:


- Personal safety

Where to find key documents on Rohde & Schwarz

See "[Meaning of safety labels](#)" on page 6.

- Environment safety
See [Table 1-1](#).
- Identification of the product
A sticker on the product shows the product ID, a combination of the order number and the serial number of the product. The serial number identifies the product uniquely.

Table 1-1: Labels regarding environment safety

	<p>Labeling in line with EN 50419 for disposal of electrical and electronic equipment after the product has come to the end of its life. For more information, see the user manual.</p>
---	---

1.3 Warning messages in the documentation

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

NOTICE

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

1.4 Where to find key documents on Rohde & Schwarz

Certificates issued to Rohde & Schwarz that are relevant for your country are provided at www.rohde-schwarz.com/key-documents, e.g. concerning:

- Quality management
- Environmental management
- Information security management
- Accreditations

2 Welcome

This section provides an overview of the user documentation and an introduction to the sensor.

In the manuals, the terms sensor, Power sensor and power sensor module are used synonymously.

2.1 Documentation overview

This section provides an overview of the R&S NRP-Zx7 user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/nrp-zx7

Further documents are available at:

www.rohde-schwarz.com/product/nrp-zx7

2.1.1 Getting started manual

Introduces the R&S NRP-Zx7 and describes how to set up and start working with the product. Includes basic operations and general information, e.g. safety instructions, etc. A printed version is delivered with the power sensor.

2.1.2 User manuals

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

The user manual is also available for download or for immediate display on the internet.

2.1.3 Printed safety instructions

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

2.1.4 Instrument security procedures

Deals with security issues when working with the R&S NRP-Zx7 in secure areas. It is available for download on the internet.

2.1.5 Specifications documents and product brochures

The specifications document, also known as the data sheet, contains the technical specifications of the R&S NRP-Zx7. It also lists the optional accessories and their order numbers.

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

www.rohde-schwarz.com/brochure-datasheet/nrp-zx7

2.1.6 Application notes, application cards, white papers, etc.

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

2.1.7 Calibration certificate

The document is available on <https://gloris.rohde-schwarz.com/calcert>. You need the device ID of your instrument, which you can find on a label on the product.

2.1.8 Release notes and open source acknowledgment (OSA)

The release notes list new features, improvements and known issues of the current software version, and describe the software installation.

The software uses several valuable open source software packages. An open source acknowledgment document provides verbatim license texts of the used open source software.

The open source acknowledgment document is provided on the software CD-ROM, included in the delivery.

www.rohde-schwarz.com/firmware/nrp-zx7

2.2 Key features

The R&S NRP-Zx7 power sensor module is especially designed for level calibration performed with an R&S measuring receiver of the R&S FSMR series. The R&S NRP-Zx7 acts as a highly accurate reference for determining the absolute power level. Together with the high dynamic range and excellent linearity of the measuring receiver, precise power calibration over the entire level range of the measuring receiver is possible.

Using the integrated power splitter, the power is fed to the integrated thermal power sensor and simultaneously to the measuring receiver by using a phase-stable cable.

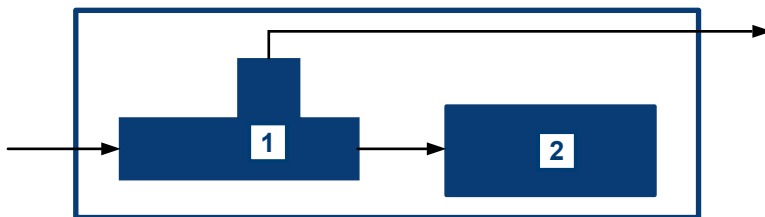


Figure 2-1: RF path in R&S NRP-Zx7

1 = Splitter

2 = Thermal power sensor

For a detailed specification, refer to the specifications document.

3 Preparing for use

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

- [Unpacking and checking](#)..... 11
- [Choosing the operating site](#)..... 11
- [Considerations for test setup](#)..... 12
- [Connecting to a DUT](#)..... 13
- [Powering the sensor](#)..... 14
- [Connecting an interface cable to the host interface](#)..... 15
- [Connecting to a controlling host](#)..... 15

3.1 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.

3.2 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.

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.

3.3 Considerations for test setup

Pay particular attention to the following aspects when handling sensors.

Handling the sensor

If you connect the sensor to a DUT, the entire weight of the main body rests on the RF connector of the sensor. The RF connector is not designed for this load and gets damaged as a result. Therefore, it is important to support the main body of the sensor before connecting the RF connector and to remove the support only after disconnecting. As a support, use a laboratory jack, see [Figure 3-1](#).

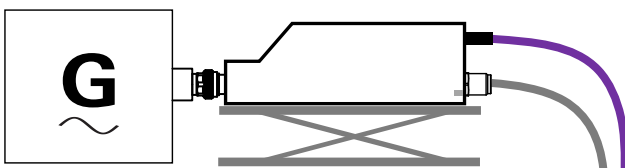


Figure 3-1: R&S NRP-Z47 supported by laboratory jack

The RF cable of the sensor is flexible but in a measurement, do not bend the RF cable more than 150 mm in radius. A bend with a smaller radius can impair the accuracy of the measurement. Connect the RF cable to the RF input of an R&S measuring receiver of the R&S FSMR series or terminate it.

Preventing incorrect measurement results

In setups where you do not connect the RF output to an instrument, terminate the RF output with a matched load with a standing wave ratio (SWR) smaller than 1.05. Alternatively, you can use a mismatched, but characterized load in combination with the RGAMma correction.

Preventing electrostatic discharge (ESD)

Electrostatic discharge is most likely to occur when you connect or disconnect a device under test (DUT). It can damage the electronic components of the product and the DUT.

When handling coaxial connectors, do not touch the inner conductor of the RF connector to prevent electrostatic discharge damage.

EMI impact on measurement results

Electromagnetic interference (EMI) can affect the measurement results.

To suppress electromagnetic radiation during operation:

- Use high-quality shielded cables, for example, double-shielded RF and interface 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 specifications document. Keep the signal levels within the specified ranges to avoid damage to the product and connected devices.

3.4 Connecting to a DUT

For connecting the sensor to a DUT, use the RF connector. See also [Section 4.1, "RF connector"](#), on page 26.

To connect to the DUT

1. Ensure that the RF connector of the DUT is compatible with the RF connector of the sensor.
See [Section 4.1, "RF connector"](#), on page 26.

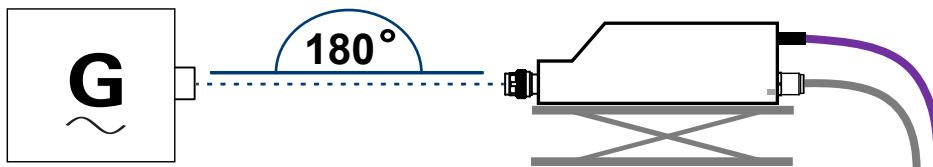
Powering the sensor

2. **NOTICE!** Do not touch the inner conductor of the RF connector. See ["Preventing electrostatic discharge \(ESD\)"](#) on page 13.

Inspect both RF connectors carefully. Look for metal particles, contaminants and defects.

If either RF connector is damaged, do not proceed, because the risk of damaging the mating connector is too high.

3. Place the R&S NRP-Zx7 sensor on a laboratory jack. See also ["Handling the sensor"](#) on page 12.
4. With the help of the laboratory jack, bring the RF connector of the sensor to the same height as the RF connector of the DUT.
5. Insert the RF connector straight into the RF output of your DUT. Take care not to tilt it.



6. **NOTICE!** Risk of damaging the center pin of the RF connector. Only rotate the union nut of the RF connector. Never rotate the sensor itself. Tighten the union nut manually.
7. Tighten the union nut using a torque wrench with the recommended nominal torque to ensure maximum measurement accuracy. See [Section 4.1, "RF connector"](#), on page 26.

To disconnect from the DUT

1. **NOTICE!** Risk of damaging the center pin of the RF connector. Only rotate the union nut of the RF connector. Never rotate the sensor itself. Carefully loosen the union nut at the front of the RF connector of the sensor.
2. Remove the sensor.

3.5 Powering the sensor

The electrical power for the sensor is supplied over the host interface. See [Section 4.2, "Host interface"](#), on page 27.

3.6 Connecting an interface cable to the host interface

For connecting the sensor to a host, use the host interface. See also [Section 4.2, "Host interface"](#), on page 27.

R&S NRP-Z47 model:

The required cable depends on the host. The available cable types and lengths are listed in the specifications document.

To connect a cable to the host interface of the sensor

1. Insert the screw-lock cable connector into the host interface connector. Take care that the guide lug on the left side of the host interface connector fits into the guide gap of the cable connector.
2. To minimize the chance of cross-threading, turn the end cap counterclockwise until the threads of the end cap align with the threads of the connector.
3. Tighten the union nut carefully without using any force.

To disconnect the host interface of the sensor

1. Loosen the union nut of the screw-lock cable connector.
2. Remove the cable.

3.7 Connecting to a controlling host

As a controlling host, you can use:

- [Base units and Rohde & Schwarz instruments](#)
- [Computer](#)
- [Android smartphone or tablet with USB type C](#)

For operating the sensor, you can choose from various possibilities. For details, see [Section 5, "Operating concepts"](#), on page 29.

3.7.1 Base units and Rohde & Schwarz instruments

You can use the following instruments as a controlling host:

- R&S FSMR series
See [Section 3.7.1.1, "R&S FSMR series"](#), on page 16.
- R&S NRX base units
See [Section 3.7.1.2, "R&S NRX base unit"](#), on page 17.
- Supported Rohde & Schwarz instruments with a sensor connector
See the user manual of the instrument.

3.7.1.1 R&S FSMR series

The R&S FSMR series uses an R&S NRP-Zx7 sensor for level calibration. The R&S FSMR3050 supports the R&S NRP-Z47 model.

Required equipment

- Sensor
- R&S NRP-Z47 model:
R&S NRP-ZK6 cable to connect the sensor to the R&S FSMR. A suitable cable is in the scope of delivery.
- R&S FSMR

Setup

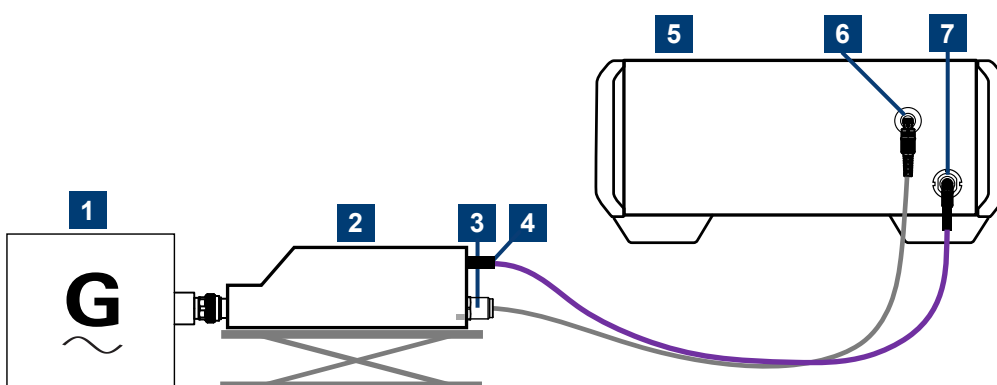


Figure 3-2: R&S NRP-Z47 with an R&S FSMR

Connecting to a controlling host

- 1 = Signal source
- 2 = Sensor supported by laboratory jack
- 3 = Host interface
- 4 = RF output
- 5 = R&S FSMR
- 6 = Sensor input of the R&S FSMR
- 7 = RF input of the R&S FSMR

1. **NOTICE!** Incorrectly connecting or disconnecting the sensor can damage the sensor or lead to incorrect results. Follow the instructions in "[To connect to the DUT](#)" on page 13.

Connect the sensor to the signal source (DUT).

2. R&S NRP-Z27, R&S NRP-Z37 models:
Connect the host connector of the sensor to the sensor input of the R&S FSMR.
3. R&S NRP-Z47 model:
Connect the sensor to the sensor input of the R&S FSMR using the R&S NRP-ZK6 cable.
See "[To connect a cable to the host interface of the sensor](#)" on page 15.
4. Connect the RF output cable of the sensor to the RF input of the R&S FSMR.



For information on measurements, see the user manual of the R&S FSMR series.

3.7.1.2 R&S NRX base unit

You can use an R&S NRX base unit as a controlling host.

The R&S NRX is the successor of the R&S NRP2.

The R&S NRX supports parallel measurements, if enhanced accordingly. For details, see the R&S NRX user manual.

Further information:

- [Section 5.4, "R&S NRX"](#), on page 32
- R&S NRX user manual

Required equipment

- Sensor

Connecting to a controlling host

- R&S NRP-Z47 model:
R&S NRP-ZK6 cable to connect the sensor to the R&S NRX. A suitable cable is in the scope of delivery.
- R&S NRX

Setup

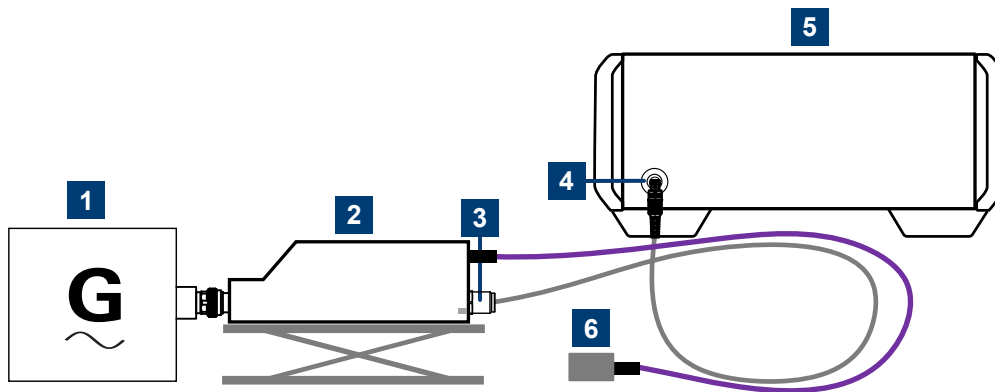


Figure 3-3: R&S NRP-Z47 with an R&S NRX base unit

- 1 = Signal source
- 2 = Sensor supported by laboratory jack
- 3 = Host interface
- 4 = Sensor input of the R&S NRX
- 5 = R&S NRX base unit
- 6 = Terminated RF output

1. R&S NRP-Z47 model:
Connect the sensor to the R&S NRX using the R&S NRP-ZK6 cable.
See ["To connect a cable to the host interface of the sensor"](#) on page 15.
2. R&S NRP-Z27, R&S NRP-Z37 models:
Connect the host connector of the sensor to the R&S NRX.
3. **NOTICE!** Incorrectly connecting or disconnecting the sensor can damage the sensor or lead to incorrect results. Follow the instructions in ["To connect to the DUT"](#) on page 13.
Connect the sensor to the signal source (DUT).
4. Terminate the RF output with a load. For details, see ["Preventing incorrect measurement results"](#) on page 13.

3.7.2 Computer

If the controlling host is a computer, you can establish the connection using:

- Host interface
See [Section 3.7.2.2, "Using a simple USB connection"](#), on page 19.
See [Section 3.7.2.3, "Using R&S NRP-Z5 sensor hub setup"](#), on page 21.

3.7.2.1 Preparing for a USB connection

 Only applies to the R&S NRP-Z27, R&S NRP-Z37 models.

If you want to connect the sensor to a USB interface, you need to attach the R&S NRP-Z4 USB adapter to the host interface.

To connect the R&S NRP-Z4 USB adapter

1. Hold both connectors so the red dots are in line.
2. Insert the host connector of the sensor into the connector of the USB adapter.



3.7.2.2 Using a simple USB connection

All sensors can be connected to the USB interface of a computer.

Required equipment

- Sensor
- R&S NRP-Z47 model:
R&S NRP-ZKU or R&S NRP-ZKC cable
- R&S NRP-Z27, R&S NRP-Z37 models:
R&S NRP-Z4 USB adapter, connected to the host interface as described in [Section 3.7.2.1, "Preparing for a USB connection"](#), on page 19.
- Computer with USB type A or USB type C interface, respectively

Setup

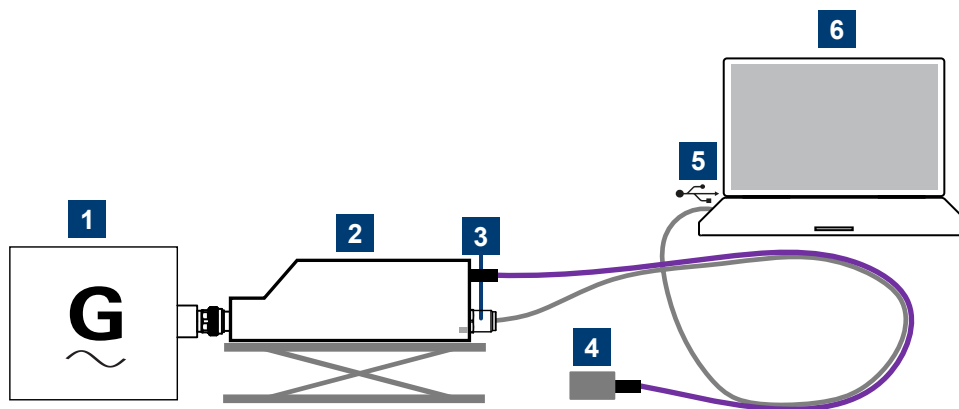


Figure 3-4: R&S NRP-Z47 with an R&S NRP-ZKU cable

- 1 = Signal source
- 2 = Sensor
- 3 = Host interface
- 4 = Terminated RF output
- 6 = USB connector
- 7 = Computer with installed VISA driver or R&S NRP-Toolkit

1. R&S NRP-Z47 model:
Connect the R&S NRP-ZKU cable to the sensor.
See ["To connect a cable to the host interface of the sensor"](#) on page 15.
2. Connect the USB connector to the computer.
3. Terminate the RF output with a load. For details, see ["Preventing incorrect measurement results"](#) on page 13.
4. **NOTICE!** Incorrectly connecting or disconnecting the sensor can damage the sensor or lead to incorrect results. Follow the instructions in ["To connect to the DUT"](#) on page 13.
Connect the sensor to the signal source (DUT).
5. On the computer, start a software application to view the measurement results.
See [Section 5, "Operating concepts"](#), on page 29.

 If the computer has a USB type C port, use an R&S NRP-ZKC cable instead of an R&S NRP-ZKU cable.

3.7.2.3 Using R&S NRP-Z5 sensor hub setup

The R&S NRP-Z5 sensor hub (high-speed USB 2.0) can host up to four sensors and provides simultaneous external triggering to all connected sensors.

Required equipment

- 1 to 4 sensors
- R&S NRP-Z47 model:
 - 1 R&S NRP-ZK6 cable per sensor. A suitable cable is in the scope of delivery.
- R&S NRP-Z5 sensor hub
- External power supply, delivered with the R&S NRP-Z5 sensor hub. The supplied external power supply is short-circuit proof and is also protected by an internal fuse. It is not possible to change the fuse or open the unit.

You can use an alternative DC voltage source, but it must fulfill the following requirements:

 - Supplies an output voltage of 12 V to 24 V and a power output of at least 24 W. Do not use an extra-low voltage supply system.
 - Is in the same building as the R&S NRP-Z5.
 - Is connected to the R&S NRP-Z5 by a cable that is no longer than 30 m.
- USB cable, delivered with the R&S NRP-Z5 sensor hub.

Alternatively, you can use any other USB-2.0-certified USB connector type A to USB connector type B cable with a maximum length of 5 m.
If a locking connection is required at the instrument end, you can use the passive R&S NRP-Z4 interface adapter instead of a standard USB cable.
- Computer
- Optional: BNC cables to connect the trigger input and trigger output signals.

Setup

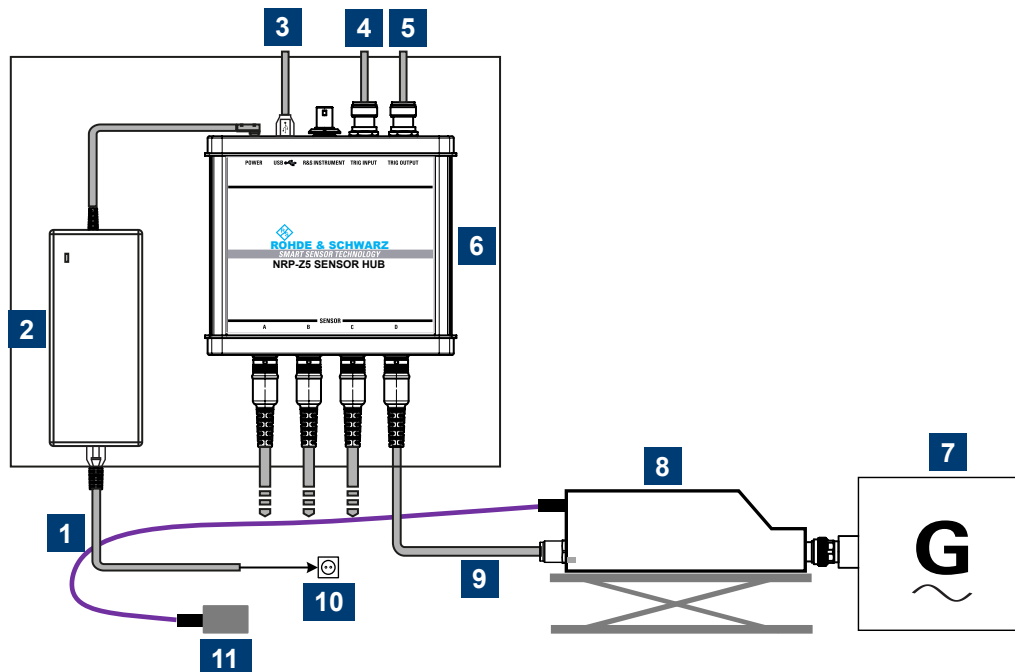


Figure 3-5: R&S NRP-Z47 with an R&S NRP-Z5 sensor hub

- 1 = Connect to AC power supply.
- 2 = External power supply unit
- 3 = Connect to a computer.
- 4 = Optional: Connect to the trigger source.
- 5 = Optional: Connect to the triggered device.
- 6 = R&S NRP-Z5 sensor hub
- 7 = Signal source (DUT)
- 8 = Sensor
- 9 = R&S NRP-ZK6 cable
- 10 = AC power supply
- 11 = Terminated RF output

1. R&S NRP-Z47 model:
Connect each sensor to the R&S NRP-Z5 using a R&S NRP-ZK6 cable. See [Section 3.6, "Connecting an interface cable to the host interface"](#), on page 15.
2. R&S NRP-Z27, R&S NRP-Z37 models:
Connect each sensor to the R&S NRP-Z5 using the host interface.
3. Connect the R&S NRP-Z5 to the computer using a USB cable.
4. Terminate the RF output with a matched load. See also ["Preventing incorrect measurement results"](#) on page 13.

Connecting to a controlling host

5. Connect the external power supply unit to the R&S NRP-Z5 and to an AC supply connector.
6. If you want to use an external trigger source, connect the trigger input of the R&S NRP-Z5 sensor hub to the trigger source using a BNC cable.
7. If you want to use the trigger signal externally, connect the trigger output of the R&S NRP-Z5 sensor hub to the trigger device using a BNC cable.
8. **NOTICE!** Incorrectly connecting or disconnecting the sensor can damage the sensor or lead to incorrect results. Follow the instructions in "[To connect to the DUT](#)" on page 13.
Connect each sensor to the signal source (DUT).
9. On the computer, start a software application to view the measurement results.
See [Section 5, "Operating concepts"](#), on page 29.

3.7.3 Android smartphone or tablet with USB type C

You can operate the sensor using R&S Power Viewer Mobile. For details, see [Section 5, "Operating concepts"](#), on page 29.

Required equipment

- Sensor
- R&S NRP-Z47 model:
R&S NRP-ZKC cable
- R&S NRP-Z27, R&S NRP-Z37 models:
Adapter for USB type C male to USB type A female
- Android smartphone or tablet with USB type C

Setup

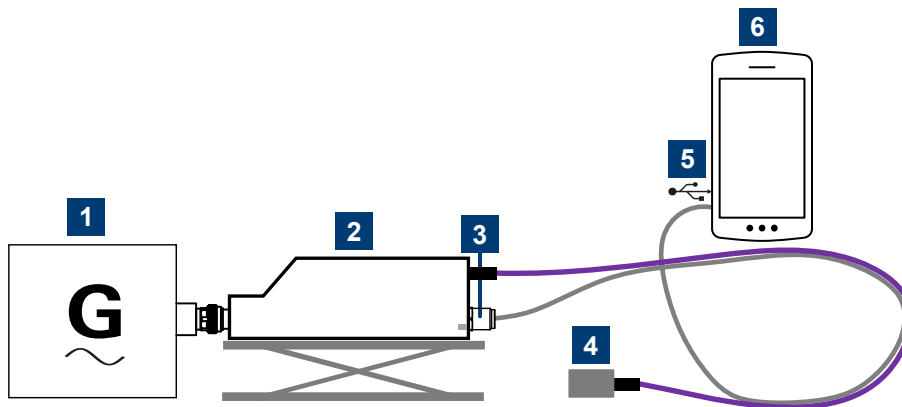


Figure 3-6: R&S NRP-Z47 with an R&S NRP-ZKC cable

- 1 = Signal source
- 2 = Sensor
- 3 = Host interface
- 4 = Terminated RF output
- 6 = USB type C connector
- 7 = Android smartphone with installed R&S Power Viewer Mobile

1. Connect the R&S NRP-ZKC cable to the sensor host interface.
See ["To connect a cable to the host interface of the sensor"](#) on page 15.
2. Connect the R&S NRP-ZKC cable to the Android smartphone or tablet with a USB type C connector.
3. **NOTICE!** Incorrectly connecting or disconnecting the sensor can damage the sensor or lead to incorrect results. Follow the instructions in ["To connect to the DUT"](#) on page 13.
Connect the sensor to the signal source.
4. On the Android smartphone or tablet, start a software application to view the measurement results.
See [Section 5, "Operating concepts"](#), on page 29.

4 Sensor tour

This section provides an overview of the available connectors and LEDs of the sensor.

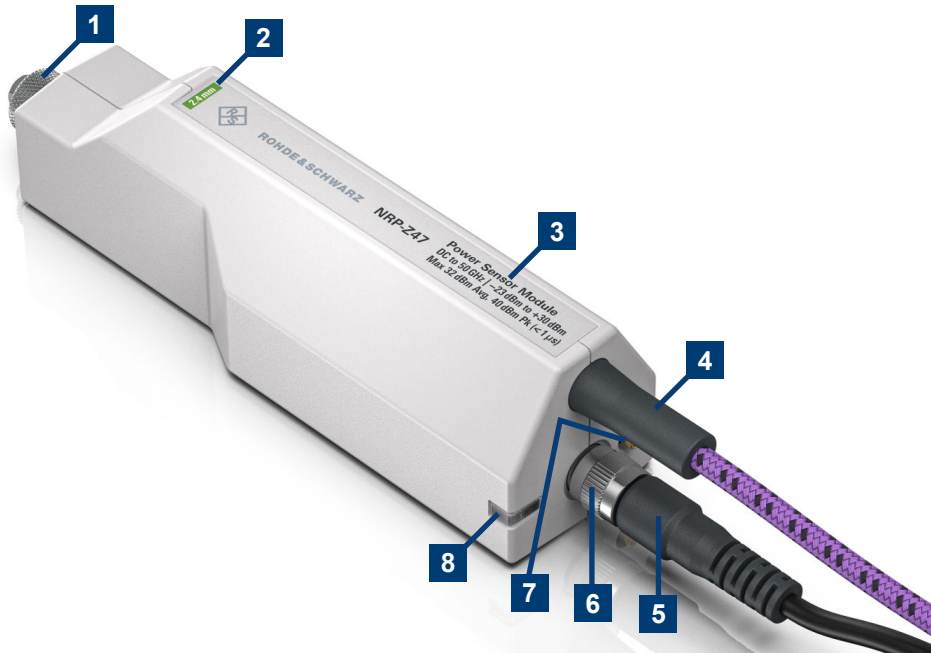


Figure 4-1: R&S NRP-Z47 model

- 1 = RF connector, see [Section 4.1, "RF connector"](#), on page 26
- 2 = RF connector information, color-coded
- 3 = Operating limits and damage levels
- 4 = RF output, see [Section 4.3, "RF output"](#), on page 27
- 5 = R&S NRP-ZK6 cable connected to host interface
- 6 = Host interface connector, see [Section 4.2, "Host interface"](#), on page 27
- 7 = Trigger I/O connector, see [Section 4.5, "Trigger I/O connector"](#), on page 28
- 8 = Status LED, see [Section 4.4, "Status information"](#), on page 27



Figure 4-2: R&S NRP-Z27, R&S NRP-Z37 models

1 = RF connector, see [Section 4.1, "RF connector"](#), on page 26

2 = Permanently attached cable with host interface, see [Section 4.2, "Host interface"](#), on page 27

3 = RF output, see [Section 4.3, "RF output"](#), on page 27

4.1 RF connector

Used to connect the sensor to a device under test (DUT) or a signal generator.

See [Section 3.4, "Connecting to a DUT"](#), on page 13.

For maximum measurement accuracy, tighten the RF connector using a torque wrench with a nominal torque as specified in the RF connector characteristics table.

Table 4-1: R&S NRP-Zx7 RF connector characteristics

Model	Male connector	Matching female connector	Tightening torque	Color code
R&S NRP-Z27	N	N	1.5 Nm (12" lbs)	
R&S NRP-Z37	3.50 mm	3.50 mm/2.92 mm/ SMA	0.90 Nm (8" lbs)	
R&S NRP-Z47	2.4 mm	2.4 mm/1.85 mm	0.90 Nm (8" lbs)	Green

4.2 Host interface

Used to connect the sensor and a host.

R&S NRP-Z47 model:


An external cable is needed. The R&S NRP-ZK6 cable is delivered with the sensor. See ["To connect a cable to the host interface of the sensor"](#) on page 15.

R&S NRP-Z27, R&S NRP-Z37 models:

The host interface is permanently attached to the sensor by a cable. It fits to the sensor interface of base units and Rohde & Schwarz instruments. If you want to connect the sensor to a USB interface, you need an adapter. See [Section 3.7.2.1, "Preparing for a USB connection"](#), on page 19.

4.3 RF output

Used to connect the sensor to the RF input of a measuring instrument of which the input port voltage reflection coefficient S_{11} is known; for example, the R&S FSMR. See [Section 3.7.1.1, "R&S FSMR series"](#), on page 16.

 In setups where you do not connect the RF output to a measuring instrument, terminate the RF output with a matched load. See ["Preventing incorrect measurement results"](#) on page 13.

4.4 Status information

 Only applies to the R&S NRP-Z47 model.

The status LED shows the state of the sensor by color and flashing frequency.

Table 4-2: Possible states

	Color	Illumination	State
○	White	Steady	Idle The sensor performs no measurement and is ready for operation.
☀	White	Fast flashing	Firmware update or reboot is in progress. When the firmware update or reboot is finished, the LED changes to glowing white steadily, indicating the idle state.
🔍	White	Slow flashing	Sanitizing in progress.
●	Yellow	Steady	Waiting for the trigger state.
●	Green	Steady	Measurement is running.
●	Turquoise blue	Steady	Zeroing is in progress.
⊗	Red	Slow flashing	Static error
⊗	Red	Fast flashing	Critical static error Note: If this state occurs after a firmware update, the update was not successful. Perform the firmware update again.

Further information:

- Troubleshooting in the user manual.

4.5 Trigger I/O connector



Only applies to the R&S NRP-Z47 model.

The SMB connector is used as an input for signals if the trigger source parameter is set to `EXTERNAL2`. It is used as an output for trigger signals if the sensor is operated in the trigger sender mode.


Further information:

- For details on configuration, see the user manual.

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5.1 R&S NRP-Toolkit

 Before you start using an R&S sensor or sensor module, we recommend installing the latest R&S NRP-Toolkit.

The R&S NRP-Toolkit is the basic software package that supplies low-level drivers and tools for all R&S sensors, sensor modules and power standards.

5.1.1 Versions and downloads

The R&S NRP-Toolkit is available for:

- Microsoft Windows® operating system, as listed in [Section 5.1.2, "System requirements"](#), on page 30
- macOS

The latest versions for Windows and macOS are available at:

www.rohde-schwarz.com/software/nrp-zx7

To obtain an R&S NRP-Toolkit for other operating systems, contact the Rohde & Schwarz customer support, see [Section 7, "Contacting customer support"](#), on page 38.

5.1.2 System requirements

Hardware requirements:

- Desktop computer or laptop, or an Intel-based Apple Mac

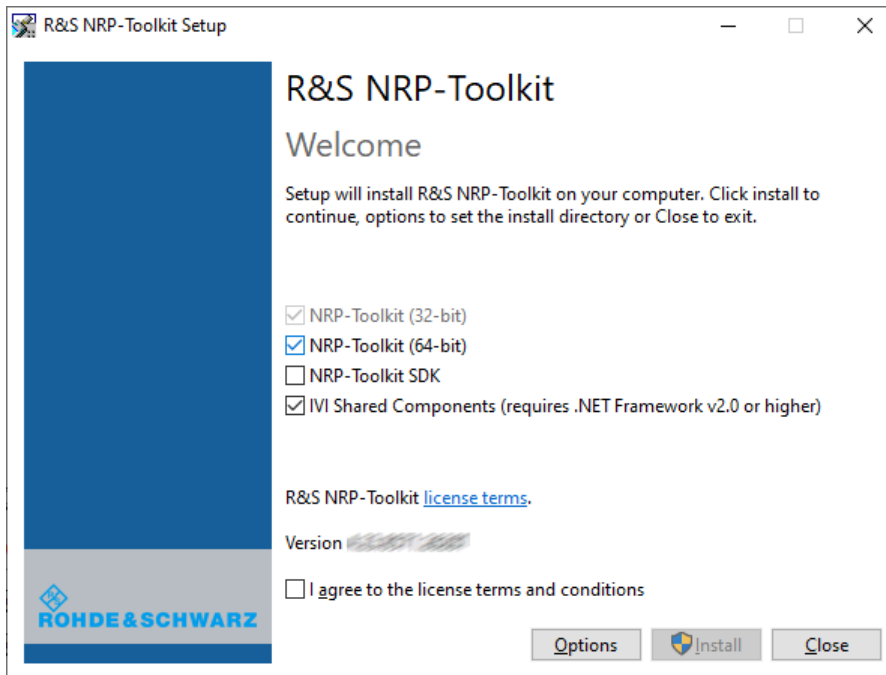
For supported Microsoft Windows versions, see the release notes.

5.1.3 R&S NRP-Toolkit for Windows

The R&S NRP-Toolkit installer for Windows-based systems contains the components described in the release notes.

To install the R&S NRP-Toolkit

1. Start the R&S NRP-Toolkit installer on the Windows-based computer.
In the "NRP-Toolkit Setup" dialog, the correct R&S NRP-Toolkit version for your operating system, 32-bit or 64-bit, is already selected.
2. Enable the packages that you want to install.
 - "NRP-Toolkit (SDK)"
See [Section 5.1.3.1, "Software development kit \(SDK\)"](#), on page 31.
 - "IVI Shared Components"
Installs the USBTMC driver. Enabled by default because the installation is recommended.
See also ["Computer requirements"](#) on page 36



3. Accept the license terms to continue with the installation.
4. Click "Next" and complete the installation process.

To uninstall the R&S NRP-Toolkit

Use the Windows functionality for removing apps and features. The R&S NRP-Toolkit itself has no uninstall functionality.

5.1.3.1 Software development kit (SDK)

The software development kit (SDK) is a package of the R&S NRP-Toolkit. It provides programming examples for the R&S sensors.

5.1.3.2 Components of the R&S NRP-Toolkit for Windows

Access: "Start" > "NRP-Toolkit"

The components of the R&S NRP-Toolkit depend on the operating system. The following tools are part of the R&S NRP-Toolkit for Windows.

Firmware Update

Installs new firmware on the sensor.

The Firmware Update program is supported by the R&S NRP-Z47 model.

For further details, see the user manual.

5.2 Remote control

You can remote control the R&S NRP-Zx7 easily. The R&S NRP-Z47 model supports the USBTMC protocol and the NRP legacy protocol.

The R&S NRP-Z27, R&S NRP-Z37 models support only the NRP legacy protocol.

Further information:

- See the user manual for details.
- [Section 3.7, "Connecting to a controlling host"](#), on page 15

5.3 R&S FSMR

The required equipment and the setup are described in [Section 3.7.1.1, "R&S FSMR series"](#), on page 16.

For information on measurements, see the user manual of the R&S FSMR series.

5.4 R&S NRX

The required equipment and the setup are described in [Section 3.7.1.2, "R&S NRX base unit"](#), on page 17.

In a measurement, the R&S NRX uses all sensor-dependent measurement functions and displays the results. Thus, you can configure both the measurement and the sensor.

Starting a measurement

1. Preset the R&S NRX and the connected R&S sensor.
 - a) Press the [Preset] key.
 - b) Select "Preset".

All parameters are set to their defaults.

2. Execute zeroing:
 - a) Turn off all test signals before zeroing. An active test signal during zeroing causes an error.
 - b) Press the [Zero] key of the R&S NRX.
 - c) Select "Zero All Sensors".
3. Configure the measurement.
 - a) In the "Measurement Settings" dialog, select the "Measurement Type", for example "Continuous Average".
 - b) Select "Quick Setup" > "Auto Set".
4. Switch on the signal source.

The measurement starts, and the result is displayed in dBm.
5. If necessary, perform further settings. For further information, see the R&S NRX user manual.

5.5 R&S NRPV

The R&S NRPV enables you to measure power in all available measurement modes. Also, you can use up to four sensors simultaneously.

The R&S NRPV software is a separate standalone installation package. The installation package is provided on the Rohde & Schwarz website at:

www.rohde-schwarz.com/software/nrp-zx7



R&S NRP-Z27, R&S NRP-Z37 models:

Requires the R&S NRPZ-K1 option. For details, see the specifications document.

Setup

1. Install the following on the computer:
 - Latest version of R&S NRP-Toolkit. See [Section 5.1, "R&S NRP-Toolkit"](#), on page 29.
 - Latest version of R&S NRPV. For information on installation, see the operating manual of the R&S NRPV.

2. Proceed as described in:

- [Section 3.7.2.2, "Using a simple USB connection"](#), on page 19
- [Section 3.7.2.3, "Using R&S NRP-Z5 sensor hub setup"](#), on page 21

Starting a measurement

For a detailed description of how to measure in this setup, refer to the operating manual of the R&S NRPV.

1. Start the R&S NRPV.
2. Turn off all test signals before zeroing. An active test signal during zeroing causes an error.
3. Execute zeroing.
4. Switch on the test signal of the signal source.
5. Start a measurement.

5.6 R&S Power Viewer

The R&S Power Viewer is software that simplifies many measurement tasks.

The R&S Power Viewer is a separate standalone installation package. The installation package is provided on the Rohde & Schwarz website at:

www.rohde-schwarz.com/software/nrp-zx7

Setup

1. Install the following on the computer:
 - Latest version of R&S NRP-Toolkit. See [Section 5.1, "R&S NRP-Toolkit"](#), on page 29.
 - Latest version of R&S Power Viewer. For information on installation, see the operating manual of the R&S Power Viewer.
2. Proceed as described in:
 - [Section 3.7.2.2, "Using a simple USB connection"](#), on page 19
 - [Section 3.7.2.3, "Using R&S NRP-Z5 sensor hub setup"](#), on page 21

Starting a measurement

For a detailed description, refer to the operating manual of the R&S Power Viewer. The manual is installed automatically during the installation of the R&S Power Viewer.

1. Start the R&S Power Viewer.
2. Turn off all test signals before zeroing. An active test signal during zeroing causes an error.
3. Execute zeroing.
4. Switch on the test signal of the signal source.
5. Select a measurement type.
6. Start the measurement.

5.7 R&S Power Viewer Mobile

The R&S Power Viewer Mobile extends the functionality of the R&S Power Viewer to Android-based devices, such as a smartphone and tablets.



For connecting the sensor to Android mobile phones with USB type C connector, use an R&S NRP-ZKC cable. It enables the R&S Power Viewer Mobile to take power measurements via the connection.

For further details, see [Section 3.7.3, "Android smartphone or tablet with USB type C"](#), on page 23.

You can download the R&S Power Viewer Mobile free of charge from the Google play store.

The 1MA215 "Using R&S®NRP Series Power Sensors with Android™ Handheld Devices" application note gives a detailed description on installation and features of the R&S Power Viewer Mobile. The application note is provided on the Rohde & Schwarz website. Search for "1MA215".

6 Remote control interfaces and protocols

For remote control, communication between the sensors and the controlling host is established based on various interfaces and protocols.

6.1 USB interface

Connect the computer and the sensors as described in:

- [Section 3.7.2.2, "Using a simple USB connection"](#), on page 19
- [Section 3.7.2.3, "Using R&S NRP-Z5 sensor hub setup"](#), on page 21

6.1.1 USBTMC protocol

The USB test & measurement class specification (USBTMC) is a protocol that is built on top of USB for communication with USB devices from the test & measurement category. It defines a dedicated class code that identifies a device's functionality. The device also uses this class code to identify itself as a member of the test & measurement class. Using a VISA library, such devices support service request, trigger and other operations that are commonly found in GPIB devices.

Computer requirements

- VISA library
VISA is a standardized software interface library providing input and output functions to communicate with instruments. A VISA installation on the controller is a prerequisite for remote control over USBTMC.
VISA detects and configures the product automatically when the USB connection is established.
- USBTMC driver
Apart from the USBTMC driver, which comes with the installation of VISA, you do not have to install a separate driver.

USB resource string

The VISA resource string for USBTMC device communication represents an addressing scheme that is used to establish a communication session with the

product. It is based on the product address and some product- and vendor-specific information. The syntax of the used USB resource string is:

USB[board]::<vendor ID>::<product ID>::<serial number>[:INSTR]

- <vendor ID> is the vendor ID for Rohde & Schwarz, 0x0AAD.
- <product ID> is the product ID for the product.
- <serial number> is the individual serial number of the product, printed on the casing.

Example:

```
USB0::0x0AAD::0x02EB::100001::INSTR
```

0x0AAD is the vendor ID for Rohde & Schwarz.

0x02EB is the product ID.

100001 is the serial number of the product.

6.1.2 NRP legacy protocol

The NRP legacy protocol is available to ensure the compatibility of the sensors with the older models. The usage of this protocol is not recommended for new applications.

Computer requirements

- VISA library
VISA is a standardized software interface library providing input and output functions to communicate with instruments. A VISA installation on the controller is a prerequisite for remote control over USB.
VISA detects and configures the product automatically when the USB connection is established.
- USB device drivers
Apart from the USB device drivers that come with the installation of the R&S NRP-Toolkit, you do not have to install a separate driver.

7 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 7-1: QR code to the Rohde & Schwarz support page

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