NRP
Power Sensors
Getting Started

1419017002
Version 28

ROHDE&SCHWARZ
Make ideas real

This document describes the NRP power sensors:

- R&S®NRPxA(N) average sensors
- R&S®NRPxE diode sensors
- R&S®NRPxP pulse power sensors
- R&S®NRPxS(N) three-path diode sensors
- R&S®NRP18S-xx high-power three-path diode sensors
- R&S®NRPxT(N) thermal sensors
- R&S®NRPxTWG(N) thermal waveguide sensors

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1419.0170.02 | Version 28 | NRP

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

Contents

1 Safety and regulatory information

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

Intended use

The sensors are intended for accurate and uncomplicated power measurements in production, R&D and calibration labs as well as for installation and maintenance tasks.

The sensors are suitable for numerous power measurement applications. Their application depends on the sensor type and the frequency range of the sensor. For details, see the user manual or the specifications document.

The supported base units are listed in the specifications document.

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 8. 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.

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.

	Potential hazard Read the product documentation to avoid personal injury or product damage.

	Hot surface Do not touch. Risk of skin burns. Risk of fire.

1.2 Labels on the product

Labels on the product inform about:

- Personal safety
  See "Meaning of safety labels" on page 8.
- Environment safety
  See Table 1-2.
- 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.
  See also "Default host name" on page 33.
- Sensitive components
  See Table 1-1.

Table 1-1: Labels regarding product damage

	Potential product damage Read the product documentation to avoid product damage.
	Electrostatically sensitive components Indicates sensitivity to touch. Follow the instructions in the product documentation to avoid product damage. For more information, see the user manual.

Table 1-2: Labels regarding environment safety

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

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.

CAUTION

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

NOTICE

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

1.4 CE declaration of conformity

The CE declaration of conformity is delivered with the product. Keep the document for further reference.

The current version of this CE declaration of conformity is available at:

www.rohde-schwarz.com/product/nrp-a-an

www.rohde-schwarz.com/product/nrpxe

www.rohde-schwarz.com/product/nrpxxp

www.rohde-schwarz.com/product/nrp_s_sn

www.rohde-schwarz.com/product/nrp-t-tn

1.5 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 and power sensor are used synonymously.

2.1 Documentation overview

This section provides an overview of the NRP power sensor user documentation. Unless specified otherwise, you find the documents at:

www.rohde-schwarz.com/manual/nrp-a-an

www.rohde-schwarz.com/manual/nrpxe

www.rohde-schwarz.com/manual/nrpxxp

www.rohde-schwarz.com/manual/nrp_s_sn

www.rohde-schwarz.com/manual/nrp-t-tn

Further documents are available at:

www.rohde-schwarz.com/product/nrp-a-an

www.rohde-schwarz.com/product/nrpxe

www.rohde-schwarz.com/product/nrpxxp

www.rohde-schwarz.com/product/nrp_s_sn

www.rohde-schwarz.com/product/nrp-t-tn

2.1.1 Getting started manual

Introduces the NRP power sensor 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 NRP power sensor 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 NRP power sensor. 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.

www.rohde-schwarz.com/brochure-datasheet/nrp-a-an

www.rohde-schwarz.com/brochure-datasheet/nrpxe

www.rohde-schwarz.com/brochure-datasheet/nrpxxp

www.rohde-schwarz.com/brochure-datasheet/nrp_s_sn

www.rohde-schwarz.com/brochure-datasheet/nrp-t-tn

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

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

www.rohde-schwarz.com/application/nrp_s_sn

www.rohde-schwarz.com/application/nrp-t-tn

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-a-an

www.rohde-schwarz.com/firmware/nrpxe

www.rohde-schwarz.com/firmware/nrpxxp

www.rohde-schwarz.com/firmware/nrp_s_sn

www.rohde-schwarz.com/firmware/nrp-t-tn

2.2 Key features

The most important features for accurate and uncomplicated power measurements are top measurement accuracy and speed as well as simple operation on a base unit or a computer. The NRP sensors provide these characteristics in a comprehensive portfolio of LAN and USB power sensors.

All NRP sensors are independent measuring instruments. Using a USB adapter, you can directly connect them to a computer and operate them via the R&S NRPV software.

Functions and performance features:

- Fully characterized power sensors
- Minimized measurement uncertainty
- Intelligent averaging function minimizes measurement time
- Versatile measurement functions

Additional features:

- USBTMC for easy system integration
- Built-in trigger I/O port
- Sensor status at a glance with status LED
- Detachable cables for flexible operation

Almost every NRP sensor is available as LAN model. These sensors with networking capabilities are marked with a trailing N in their names.

R&S NRPxSN

Special LAN model features:

- Remote monitoring via LAN over any distance
- Power supply via power over Ethernet (PoE)
- Built-in web user interface with full power measurement support

R&S NRPxA(N) average power sensors

The average power sensors support accurate average power measurements.

R&S NRPxE diode power sensors

The diode power sensors support continuous average, burst average, timeslot average, gate average and trace measurements.

R&S NRPxP pulse power sensors

With their high sampling rate, the pulse power sensors analyze signals fast. They support a wide range of measurements – average, continuous or gated peak power, trace, statistical signal analysis, automatic pulse analysis.

R&S NRPxSN three-path diode power sensors

The three-path diode power sensors support continuous average, burst average, timeslot average, gate average and trace measurements. They provide outstanding performance and unprecedented measurement speed and accuracy. Their dynamic range reaches up to 93 dB.

The TVAC-compliant three-path diode power sensors are specially designed for use in thermal vacuum (TVAC) chambers. They function in a high vacuum and are also able to withstand certain temperature fluctuations.

R&S NRP18S-xx high-power three-path diode power sensors

The high-power three-path diode power sensors consist of an R&S NRP18S and a 10/20/25 dB upstream attenuator. They are able to perform power measurements up to 2 W, 15 W and 30 W.

When used with the attenuator, mismatch errors between the sensor and attenuator are automatically corrected. The S-parameters for the attenuator are determined and stored in the sensor during production. They are automatically considered when measuring.

R&S NRPxT(N) and R&S NRPxTWG(N) thermal power sensors

The thermal power sensors are especially used for complex measurement tasks where highest accuracy counts.

For a detailed specification, refer to the specifications document and the brochure.

3 Preparing for use

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

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 R&S NRP18S-xx sensor

► **CAUTION!** Hot surfaces. Under certain conditions, the maximum surface temperatures of the sensor can exceed the limits defined in the EN 61010-1 standard, safety requirements for electrical equipment for measurement, control and laboratory use.

Provide protection as follows:

a) Ensure that unintentional contact with the sensor is impossible.
b) Wear heat-protective gloves when touching the sensor after operation.

Handling the TVAC-compliant sensor

1. **NOTICE!** Avoid contamination.

   Always wear clean protective gloves when handling the TVAC-compliant sensor to protect the sensor and its environment from contamination.

2. **NOTICE!** Reduce outgassing to a minimum by following this bake-out procedure.

Vacuum bake the TVAC-compliant sensor for 100 hours at 85 °C at a pressure lower than 10^{-5} mbar.

Handling the sensor

If you connect a sensor to a DUT, the entire weight of the main body rests on the RF connector of the sensor. The RF connector of the R&S NRP150T model is not designed for this load and gets damaged as a result. Therefore, it is important to support the main body of this sensor model before connecting the RF connector and to remove the support only after disconnecting. As a support, use a laboratory jack, see Figure 3-1.

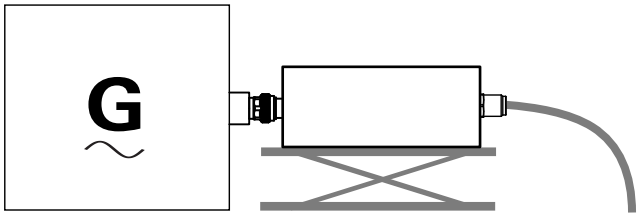


Figure 3-1: R&S NRP150T supported by laboratory jack

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.

The following applies only to the R&S NRP18S-xx sensors:

The test limits specified on the name plate apply only if the sensor is operated together with the RF power attenuator supplied. If the sensor is operated without attenuator, the lower test limits of the R&S NRP18S sensor apply, as specified in the specifications document.

3.4 Connecting to a DUT

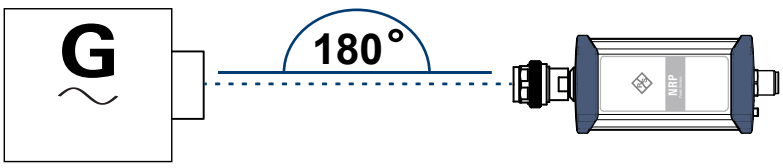
For connecting the sensor to a DUT, use the RF connector. See also Section 4.1, "RF connector", on page 35.

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 35.
2. **NOTICE!** Do not touch the inner conductor of the RF connector. See "Preventing electrostatic discharge (ESD)" on page 19.

   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. Insert the RF connector straight into the RF output of your DUT. Take care not to tilt it.



4. **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.

5. 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 35.

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 one of the following interfaces:

- Host interface
  See Section 4.3, "Host interface", on page 39.
- LAN PoE interface
  Available only for LAN sensors. See Section 4.5, "LAN PoE interface", on page 40.

If you use the Ethernet interface of the LAN sensor, you have to provide the electrical power over Ethernet - by power over Ethernet (PoE). You *cannot* provide the electrical power over the host interface instead.

Choose the power sourcing equipment (PSE) with care

Only use PoE power sourcing equipment (PSE) as specified in the IEEE standards 802.3af or IEEE 802.3at.

Otherwise, the following can happen:

- If too much power is supplied, the LAN sensor can get overheated and become damaged as a result.
- If the supplied power is not sufficient, the LAN sensor does not work properly or not at all.

3.6 Connecting a cable to the host interface

For connecting the sensor to a host, use the host interface. The required cable depends on the host. The cable types and lengths are listed in the specifications document. See also Section 4.3, "Host interface", on page 39.

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:

- Computer
- Base units and Rohde & Schwarz instruments
- 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 41.

3.7.1 Computer

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

- Host interface
  See Section 3.7.1.1, "Using a simple USB connection", on page 23.
  See Section 3.7.1.2, "Using R&S NRP-Z5 sensor hub setup", on page 24.

- LAN interface, if the sensor is a LAN sensor.
  See Section 3.7.4, "Using a LAN connection", on page 28.

3.7.1.1 Using a simple USB connection

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

Required equipment

- Sensor
- R&S NRP-ZKU or R&S NRP-ZKC cable
- Computer with USB type A or USB type C interface, respectively

Setup

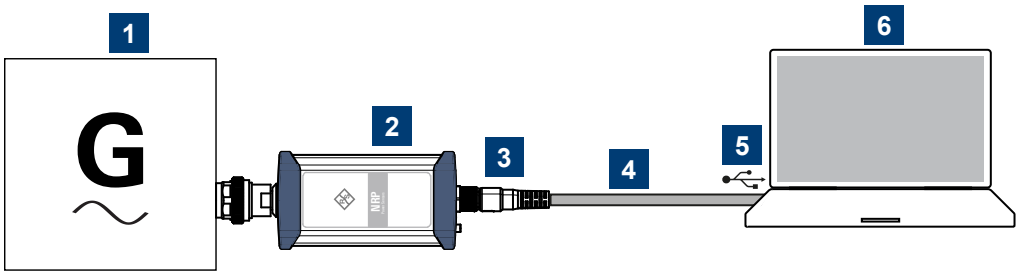


Figure 3-2: Setup with an R&S NRP-ZKU cable

1 = Signal source
2 = Sensor
3 = Host interface
4 = R&S NRP-ZKU or R&S NRP-ZKC cable
5 = USB connector
6 = Computer with installed VISA driver or R&S NRP-Toolkit

1. Connect the R&S NRP-ZKU cable to the sensor.
   See "To connect a cable to the host interface of the sensor" on page 22.
2. Connect the USB connector to the computer.
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 20.

   Connect the sensor to the signal source (DUT).

4. On the computer, start a software application to view the measurement results.
   See Section 5, "Operating concepts", on page 41.

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

3.7.1.2 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
- 1 R&S NRP-ZK6 cable per sensor
- 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

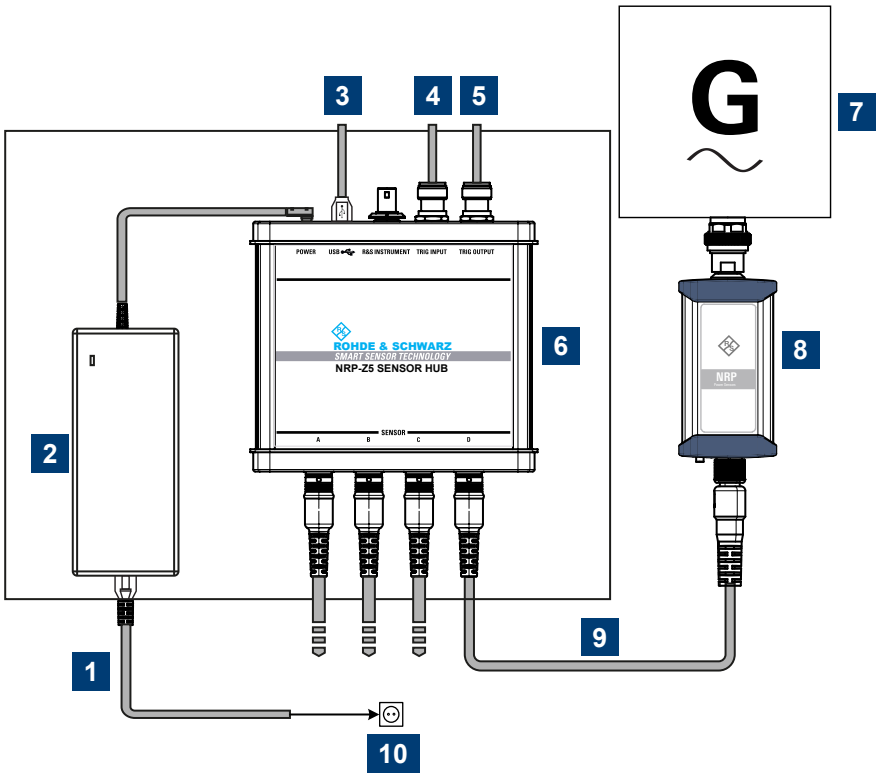


Figure 3-3: Setup with an R&S NRP-Z5 sensor hub

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

1. Connect each sensor to the R&S NRP-Z5 using a R&S NRP-ZK6 cable.
   See "To connect a cable to the host interface of the sensor" on page 22.
2. Connect the R&S NRP-Z5 to the computer using a USB cable.
3. Connect the external power supply unit to the R&S NRP-Z5 and to an AC supply connector.
4. 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.

5. 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.
6. **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 20.

   Connect each sensor to the signal source (DUT).
7. On the computer, start a software application to view the measurement results.
   See Section 5, "Operating concepts", on page 41.

3.7.2 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 41.

Required equipment

- Sensor
- R&S NRP-ZKC cable
- Android smartphone or tablet with USB type C

Setup

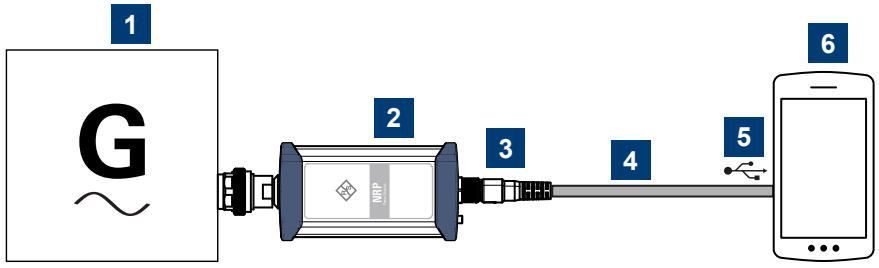


Figure 3-4: Setup with an R&S NRP-ZKC cable

1 = Signal source
2 = Sensor
3 = Host interface
4 = R&S NRP-ZKC cable
5 = USB type C connector
6 = 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 22.

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 20.

   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 41.

3.7.3 Base units and Rohde & Schwarz instruments

You can use the following instruments as a controlling host:

- R&S NRX base units
  See Section 3.7.3.1, "R&S NRX base unit", on page 27.
- Supported Rohde & Schwarz instruments with a sensor connector
  See the user manual of the instrument.

3.7.3.1 R&S NRX base unit

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

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 46
- R&S NRX user manual

Required equipment

- Sensor
- R&S NRP-ZK8 cable to connect the sensor to the R&S NRX.
- R&S NRX

Setup

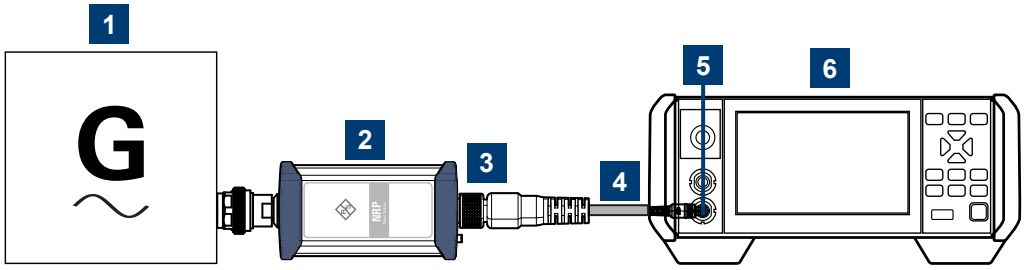


Figure 3-5: Setup with an R&S NRX base unit

1 = Signal source
2 = Sensor
3 = Host interface
4 = R&S NRP-ZK8 cable
5 = Sensor input connector of the R&S NRX
6 = R&S NRX base unit

1. Connect the sensor to the R&S NRX using the R&S NRP-ZK8 cable.
   See "To connect a cable to the host interface of the sensor" on page 22.
2. **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 20.

   Connect the sensor to the signal source (DUT).

If the sensor is a LAN sensor, you can set up a LAN connection instead of using the sensor input connector of the R&S NRX. See Section 3.7.4, "Using a LAN connection", on page 28.

3.7.4 Using a LAN connection

Requires a sensor with networking capabilities, a LAN sensor.

Do not establish a LAN connection if the sensor is operated over an R&S NRP-ZKU, R&S NRP-ZKC, R&S NRP-ZK6, or R&S NRP-ZK8.

The Ethernet interface of a LAN sensor requires PoE (power over Ethernet). See Section 3.5, "Powering the sensor", on page 21.

Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, use category 5 cables or better. For Ethernet cables available from Rohde & Schwarz, see the specifications document.

Depending on the available equipment, you can choose from different ways to connect a LAN sensor to a computer.

3.7.4.1 Setup with a PoE Ethernet switch

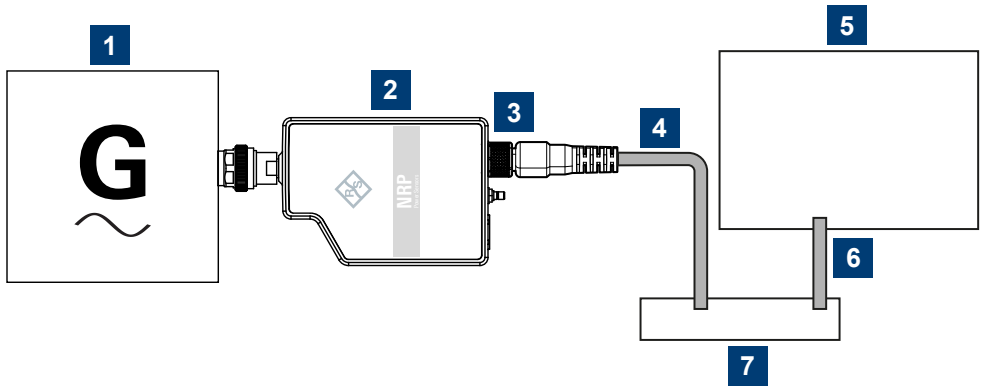


Figure 3-6: Setup with a PoE Ethernet switch

1 = Signal source
2 = Sensor
3 = RJ-45 Ethernet connector
4, 6 = RJ-45 Ethernet cable
5 = Computer
7 = Ethernet switch supporting PoE power delivery

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 20.

   Connect the sensor to the signal source.

2. **NOTICE!** Risk of damaging the sensor. Only use PoE power sourcing equipment (PSE) as described in "Choose the power sourcing equipment (PSE) with care" on page 21.

Connect the RJ-45 Ethernet connector of the sensor to an Ethernet switch that supports PoE power delivery.

3. Connect the computer to the Ethernet switch.
4. Establish a connection between the sensor and the network.
   See Section 3.7.4.2, "Establishing a connection to the network", on page 32.

Setup with a PoE injector and a non-PoE Ethernet switch

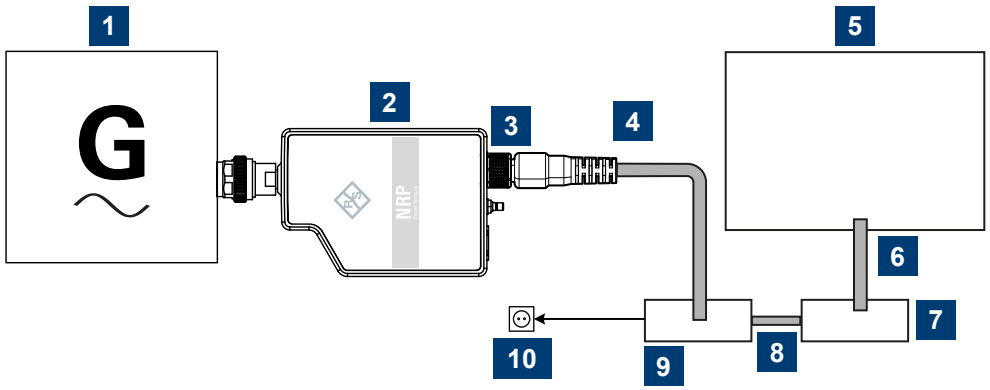


Figure 3-7: Setup with a PoE injector and a non-PoE Ethernet switch

1 = Signal source
2 = Sensor
3 = RJ-45 Ethernet connector
4,6,8 = RJ-45 Ethernet cable
5 = Computer
7 = Non-PoE Ethernet switch
9 = PoE injector
10 = AC supply

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 20.

   Connect the sensor to the signal source.
2. **NOTICE!** Risk of damaging the sensor. Only use PoE power sourcing equipment (PSE) as described in "Choose the power sourcing equipment (PSE) with care" on page 21.

   Connect the RJ-45 Ethernet connector of the sensor to the output of the PoE injector.
3. Connect the PoE injector to a power supply.
4. Connect the input of the PoE injector to the non-PoE Ethernet switch.

5. Connect the computer to the non-PoE Ethernet switch.
6. Establish a connection between the sensor and the network.
   See Section 3.7.4.2, "Establishing a connection to the network", on page 32.

Setup with a PoE injector

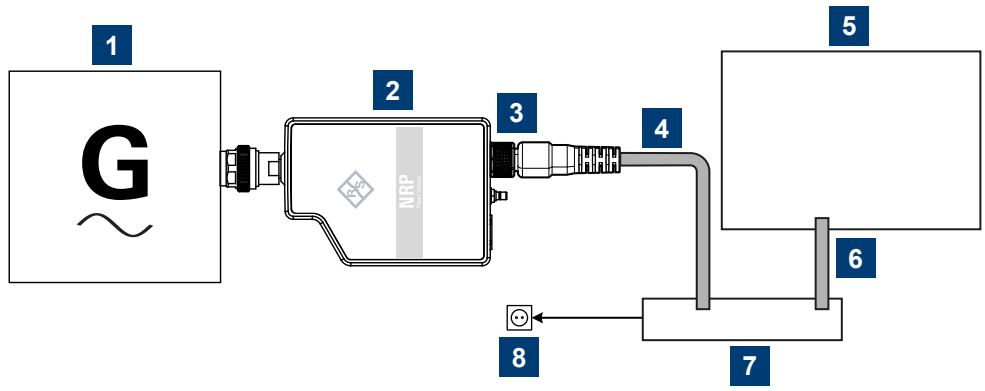


Figure 3-8: Setup with a PoE injector

1 = Signal source
2 = Sensor
3 = RJ-45 Ethernet connector
4, 6 = RJ-45 Ethernet cable
5 = Computer
7 = PoE injector
8 = AC supply

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 20.

   Connect the sensor to the signal source.
2. **NOTICE!** Risk of damaging the sensor. Only use PoE power sourcing equipment (PSE) as described in "Choose the power sourcing equipment (PSE) with care" on page 21.

   Connect the RJ-45 Ethernet connector of the sensor to the output of the PoE injector.
3. Connect the PoE injector to a power supply.
4. Connect the computer to the input of the PoE injector.
5. Establish a network connection between the sensor and the computer.

3.7.4.2 Establishing a connection to the network

There are two methods to establish a network connection:

- Sensor and computer are connected to a common network. (Infrastructure network).
- Sensor and computer are connected only over the switch. (Peer-to-peer network).

In both cases, you can address the sensor as follows:

- Section 3.7.4.3, "Using host names", on page 33
- Section 3.7.4.4, "Assigning the IP address", on page 34

To set up a network Ethernet connection

1. Connect the sensor as described in Section 3.7.4.1, "Setup with a PoE Ethernet switch", on page 29.

   By default, the sensor is configured to use dynamic TCP/IP configuration (DHCP) and to obtain the address information automatically.

   If both LAN status LEDs are illuminated in green color, the sensor is correctly connected to the network.

   Note: Establishing a connection can take up to 2 minutes per device.

2. If the LAN status LEDs show another state, no connection is possible. For possible solutions, see:
   - "Network status LED" on page 40
   - "Troubleshooting for peer-to-peer connections" on page 32

Troubleshooting for peer-to-peer connections

1. Allow a waiting time, especially if the computer has been used in a network before.
2. Check that only the main network adapter is active on the computer. If the computer has more than one network interfaces, explicitly disable all other network interfaces if you plan to utilize a peer-to-peer connection to the sensor.
3. Check that the IP address assigned to the remaining main network adapter starts with `169.254`. The IANA (Internet-assigned numbers authority) has reserved the range `169.254.0.0` to `169.254.255.255` for the allocation of automatic private IP addresses (APIPA). Addresses from this range assuredly cause no conflicts with any routable IP address.

4. Try to establish a connection to the sensor with both the default host name and the host name extended with `.local`, for example:
   `nrp18sn-123456`
   `nrp18sn-123456.local`

3.7.4.3 Using host names

In a LAN that uses a domain name system (DNS) server, each connected computer or instrument can be accessed via a unique host name instead of an IP address. The DNS server translates the host name to the IP address. Using the host name is especially useful when a DHCP server is used, as a new IP address can be assigned each time the instrument is restarted.

Each sensor is delivered with a default host name assigned. You can change the default host name.

Default host name

The default host name follows the syntax:

`<device name>-<serial number>`, where:

- `<device name>` is the short name of your sensor.
  For example, the `<device name>` of the R&S NRP18SN is `nrp18sn`.
- `<serial number>` is the individual serial number of the sensor and is part of the product ID. The product ID is printed above the QR code on the product ID sticker. The product ID sticker is on the rear side of the sensor.

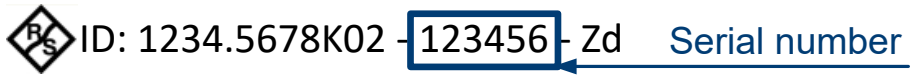


Figure 3-9: Product ID (example)

Example:

Serial number of the sensor: 123456

Default host name: nrp18sn-123456

Host name in zero configuration networks, including peer-to-peer networks

The sensor supports zero configuration networking, used in networks without DHCP server, such as peer-to-peer networks. Thus, you can connect the sensor to a network without setting up services such as dynamic host configuration pro-

tocol (DHCP) and domain name system (DNS), or configuring the network settings manually.

For establishing a connection to the sensor, try the default host name and the host name extended with `.local` as shown in the example below. All communication for resolving names in the top-level-domain (TLD) `.local` are defined to be executed using dedicated local services and ports if no other DNS (domain name server) is available.

Example:

Default host name: `nrp18sn-123456`

Extended host name: `nrp18sn-123456.local`

3.7.4.4 Assigning the IP address

Depending on the network capabilities, the TCP/IP address information for the sensor can be obtained in different ways:

- If the network supports dynamic TCP/IP configuration using the dynamic host configuration protocol (DHCP), the address information can be assigned automatically.
- If the network does not support DHCP, the sensor tries to obtain the IP address via the zeroconf (APIPA = automatic private IP addressing) protocol. If this attempt does not succeed or if the sensor is set to use an alternate TCP/IP configuration, the IP address must be set manually.
  For a description on how to set the IP address manually, refer to the user manual.

Use host names to identify the sensor

In networks using a DHCP server, it is recommended that you address the sensor by its unique host name, see Section 3.7.4.3, "Using host names", on page 33.

A *host name* is a unique identifier of the sensor that remains permanent as long as it is not explicitly changed. Hence, you can address a sensor by the same identification, irrespectively if a network or a point-to-point connection is used.

4 Sensor tour

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

In the following figure, the USB sensor is shown on the left, the LAN sensor is shown on the right.

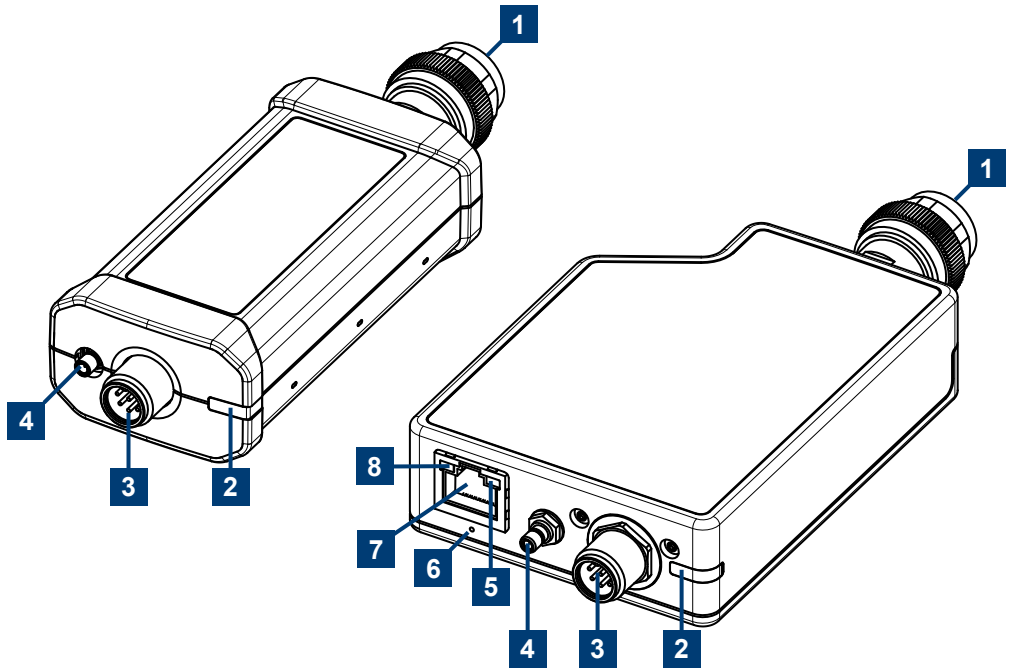


Figure 4-1: NRP sensor (example)

1 = RF connector, see Section 4.1, "RF connector", on page 35
2 = Status LED, see Section 4.2, "Status information", on page 38
3 = Host interface connector, see Section 4.3, "Host interface", on page 39
4 = Trigger I/O connector, see Section 4.4, "Trigger I/O connector", on page 39
5 = Network status LED, see "Network status LED" on page 40
6 = LAN reset button, see "LAN reset button" on page 40
7 = LAN connector, see Section 4.5, "LAN PoE interface", on page 40
8 = Power over Ethernet status LED, see "PoE status LED" on page 40

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 20.

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 NRPxA(N) RF connector characteristics

Model	Male connector	Matching female connector	Tightening torque
R&S NRP6A	N	N	1.5 Nm (12" lbs)
R&S NRP6AN			
R&S NRP18A			
R&S NRP18AN			

Table 4-2: R&S NRPxE RF connector characteristics

Model	Male connector	Matching female connector	Tightening torque	Color code
R&S NRP8E	N	N	1.5 Nm (12" lbs)	Red
R&S NRP18E				Red

Table 4-3: R&S NRPxP RF connector characteristics

Model	Male connector	Matching female connector	Tightening torque	Color code
R&S NRP18P	N	N	1.5 Nm (12" lbs)	Red
R&S NRP40P	2.92 mm	3.50 mm/2.92 mm/ SMA	0.90 Nm (8" lbs)	Yellow
R&S NRP50P	2.4 mm	2.4 mm/1.85 mm		Green

Table 4-4: R&S NRPxS(N) RF connector characteristics

Model	Male connector	Matching female connector	Tightening torque
R&S NRP8S	N	N	1.5 Nm (12" lbs)
R&S NRP8SN			
R&S NRP18S			
R&S NRP18SN			
R&S NRP33S	3.50 mm	3.50 mm/2.92 mm/ SMA	0.90 Nm (8" lbs)
R&S NRP33SN			
R&S NRP33SN-V			

Model	Male connector	Matching female connector	Tightening torque
R&S NRP40S	2.92 mm	3.50 mm/2.92 mm/ SMA	
R&S NRP40SN			
R&S NRP50S	2.4 mm	2.4 mm/1.85 mm	
R&S NRP50SN			
R&S NRP67S	1.85 mm	1.85 mm	
R&S NRP67SN			
R&S NRP67SN-V			
R&S NRP90S, model 03	1.0 mm	1.0 mm	0.23 Nm (2" lbs)
R&S NRP90S, model 02	1.35 mm	1.35 mm	0.90 Nm (8" lbs)
R&S NRP90SN			

Table 4-5: R&S NRP18S-xx RF connector characteristics

Model	Male connector	Matching female connector	Tightening torque
R&S NRP18S	N	N	1.5 Nm (12" lbs)

Table 4-6: R&S NRPxT(N) RF connector characteristics

Model	Male connector	Matching female connector	Tightening torque	Color code
R&S NRP18T	N	N	1.5 Nm (12" lbs)	
R&S NRP18TN				
R&S NRP33T	3.50 mm	3.50 mm/2.92 mm/ SMA	0.90 Nm (8" lbs)	
R&S NRP33TN				
R&S NRP40T	2.92 mm			
R&S NRP40TN				
R&S NRP50T	2.4 mm	2.4 mm/1.85 mm		
R&S NRP50TN				
R&S NRP67T	1.85 mm			
R&S NRP67TN				
R&S NRP90T	1.35 mm	1.35 mm		

Model	Male connector	Matching female connector	Tightening torque	Color code
R&S NRP90TN				
R&S NRP110T	1.0 mm	1.0 mm	0.23 Nm (2" lbs)	
R&S NRP125T	1.0 mm	1.0 mm		White
R&S NRP150T	0.8 mm	0.8 mm		Dark gray

Table 4-7: R&S NRPxTWG(N) RF connector characteristics

Model	Waveguide size	Frequency range	Tightening torque*
R&S NRP75TWG	WR-15	50 GHz to 75 GHz	0.58 Nm (5" lbs)
R&S NRP75TWGN			
R&S NRP90TWG	WR-12	60 GHz to 90 GHz	
R&S NRP90TWGN			
R&S NRP110TWG	WR-10	75 GHz to 110 GHz	
R&S NRP110TWGN			
R&S NRP140TWG	WR-8	90 GHz to 140 GHz	
R&S NRP140TWGN			
R&S NRP170TWG	WR-6.5	110 GHz to 170 GHz	
R&S NRP170TWGN			
* Use the torque wrench for waveguide flanges, R&S ZCTW, part number 1175.2014.02.			

4.2 Status information

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

Table 4-8: 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.

	Color	Illumination	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.

4.3 Host interface

Used to connect the sensor and a USB host. For this purpose, an external cable is needed.

See Section 3.6, "Connecting a cable to the host interface", on page 22.

4.4 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.

4.5 LAN PoE interface

Available only for LAN sensors.

The Ethernet RJ-45 connector is used to connect the LAN connector to a local area network (LAN).

If you use the Ethernet interface of the LAN sensor, you have to provide the electrical power over Ethernet - by power over Ethernet (PoE). You *cannot* provide the electrical power over the host interface instead.

See also Section 3.5, "Powering the sensor", on page 21.

LAN reset button

Resets the Ethernet connection parameters of the sensor to their default values.

PoE status LED

Shows whether the sensor is correctly powered over PoE or not.

Indication		State
●	Green	The sensor is powered over PoE. You can operate it using the Ethernet interface.
Off	Not illumina-ted	No PoE power is present.

Network status LED

Shows whether the LAN connection to the network is established properly or not.

Indication		State
●	Green	The sensor is correctly connected to the network. It has been assigned a valid IP address, either manually or via DHCP.
●	Red	The sensor is not connected to the network correctly. Either the connection is erroneous or the sensor has not been assigned a valid IP address yet.

5 Operating concepts

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 42
- macOS

The latest versions for Windows and macOS are available at:

www.rohde-schwarz.com/software/nrp-a-an

www.rohde-schwarz.com/software/nrpxe

www.rohde-schwarz.com/software/nrpxxp

www.rohde-schwarz.com/software/nrp_s_sn

www.rohde-schwarz.com/software/nrp-t-tn

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 57.

5.1.2 System requirements

Hardware requirements:

- Desktop computer or laptop, or an Intel-based Apple Mac
- LAN interface and equipment for setting up a LAN connection.
  See Section 3.7.4, "Using a LAN connection", on page 28.

For supported Microsoft Windows versions, see the release notes.

5.1.3 R&S NRP-Toolkit for Windows

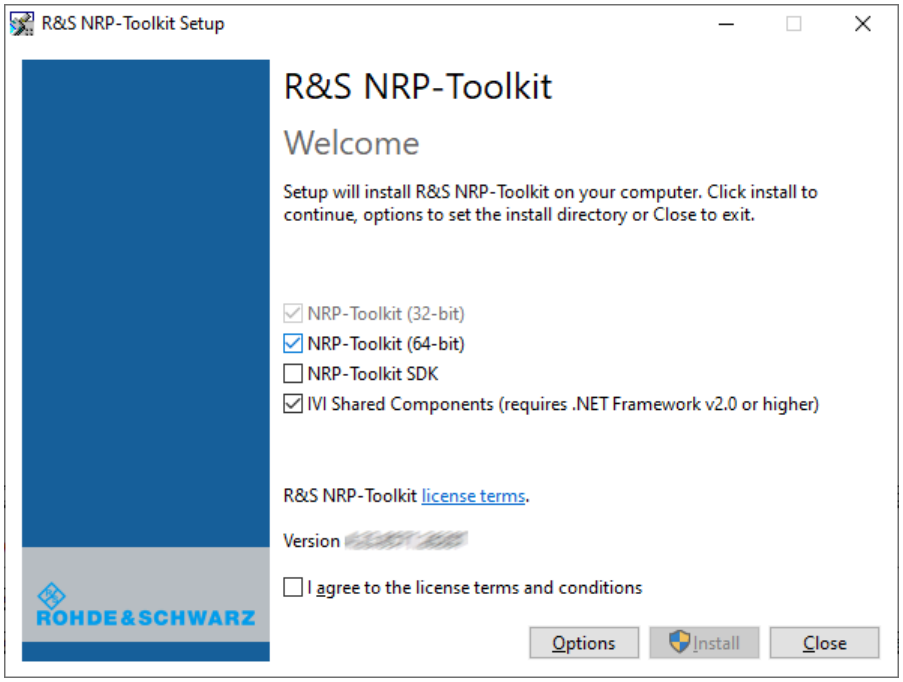
The R&S NRP-Toolkit installer for Windows-based systems contains the components described in the release notes.

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 43.
   - "IVI Shared Components"
     Installs the USBTMC driver. Enabled by default because the installation is recommended.
     See also "Computer requirements" on page 50



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.

Configure Network Sensor

Useful if you have trouble establishing a LAN connection with a LAN sensor.

The tool provides the following functions:

- Configuring the network settings by temporarily using a USB connection.
- Discovering the sensors that have been configured via the zeroconf (APIA) protocol.

The tool comes with a guide (PDF) that is also available in the "Start" menu. The guide explains the network setup.

Firmware Update

Installs new firmware on the sensor.

For further details, see the user manual.

NRP Uncertainty Calculator

Determines the expanded measurement uncertainty. The tool comes with a manual (PDF) that is also available in the "Start" menu.

NRP Version Display

Displays version information of all installed, power measurement-relevant software packages.

S2P Wizard

Helps to import S-parameters into an NRP sensor.

S-Parameter Update Multi

Helps to load an S-parameter table into the sensor.

For further details, see the user manual.

Terminal

Low-level communication program for sending commands to the sensor.

5.2 Web user interface

Requires a sensor with networking capabilities, a LAN sensor.

On the sensor, there is no installation required. With the integrated web user interface, you can easily configure the most common settings of the sensor and measure in the provided measurement modes.

You can use the web user interface with all devices and operating systems, including tablets and smartphones that are connected to the same network as the sensor.

The following browsers are supported:

- Mozilla Firefox
- Google Chrome
- Microsoft Edge
- Safari

Setup

Possible setups are described in Section 3.7.4, "Using a LAN connection", on page 28.

To display the web user interface

1. Open a supported browser.
2. Enter the host name or the IP address of the sensor that you want to connect to.
   `Example: http://nrp33sn-123456`
   For details on how to find out the IP address or host name, refer to Section 3.7.4.4, "Assigning the IP address", on page 34 and Section 3.7.4.3, "Using host names", on page 33.
   The main dialog of the web user interface opens.

For a detailed description of the web user interface, refer to the corresponding section in the user manual.

To reload the webpage

After a firmware update or a reboot, you need to reload the webpage.

► Press [F5].

5.3 Remote control

You can remote control the NRP power sensor easily. The change to remote control occurs "on the fly" and has no influence on the manual operation.

Further information:

- See the user manual for details.
- Section 3.7.1, "Computer", on page 22

5.4 R&S NRX

The required equipment and the setup are described in Section 3.7.3.1, "R&S NRX base unit", on page 27.

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-a-an

www.rohde-schwarz.com/software/nrpxe

www.rohde-schwarz.com/software/nrpxxp

www.rohde-schwarz.com/software/nrp_s_sn

www.rohde-schwarz.com/software/nrp-t-tn

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 41.
   - 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 3.7.1.1, "Using a simple USB connection", on page 23
   - Section 3.7.1.2, "Using R&S NRP-Z5 sensor hub setup", on page 24

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-a-an

www.rohde-schwarz.com/software/nrpxe

www.rohde-schwarz.com/software/nrpxxp

www.rohde-schwarz.com/software/nrp_s_sn

www.rohde-schwarz.com/software/nrp-t-tn

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 41.
   - 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 3.7.1.1, "Using a simple USB connection", on page 23
   - Section 3.7.1.2, "Using R&S NRP-Z5 sensor hub setup", on page 24

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 3.7.2, "Android smartphone or tablet with USB type C", on page 26.

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.

Depending on the sensor type, the sensors support different interfaces for remote control.

- USB sensors are always accessed using USB.
  See Section 6.1, "USB interface", on page 50.
- LAN sensors can be accessed using USB or Ethernet.
  See Section 6.2, "Ethernet interface", on page 54.

6.1 USB interface

Connect the computer and the sensors as described in:

- Section 3.7.1.1, "Using a simple USB connection", on page 23
- Section 3.7.1.2, "Using R&S NRP-Z5 sensor hub setup", on page 24

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:

```
USB::0x0AAD::0x00E2::100001
```

0x0AAD is the vendor ID for Rohde & Schwarz.

0x00E2 is the product ID.

100001 is the serial number of the product.

Table 6-1: R&S NRPxA(N) USB product IDs

Model	USB product ID
R&S NRP6A	0x0178
R&S NRP6AN	0x0179
R&S NRP18A	0x014E
R&S NRP18AN	0x014F

Table 6-2: R&S NRPxE USB product IDs

Model	USB product ID
R&S NRP8E	0x02C9
R&S NRP18E	0x02CA

Table 6-3: R&S NRPxP USB product IDs

Model	USB product ID
R&S NRP18P	0x0143
R&S NRP40P	0x017C
R&S NRP50P	0x017E

Table 6-4: R&S NRPxS(N) USB product IDs

Model	USB product ID
R&S NRP8S	0x00E2
R&S NRP8SN	0x0137
R&S NRP18S	0x0138
R&S NRP18SN	0x0139
R&S NRP33S	0x0145
R&S NRP33SN	0x0146
R&S NRP33SN-V	0x0168
R&S NRP40S	0x015F
R&S NRP40SN	0x0160
R&S NRP50S	0x0161
R&S NRP50SN	0x0162
R&S NRP67S	0x024A
R&S NRP67SN	0x024B
R&S NRP67SN-V	0x026A
R&S NRP90S, model 02 R&S NRP90S, model 03	0x024C
R&S NRP90SN	0x026B

Table 6-5: R&S NRP18S-xx USB product IDs

Model	USB product ID
R&S NRP18S-10	0x0148
R&S NRP18S-20	0x014A
R&S NRP18S-25	0x014C

Table 6-6: R&S NRPxT(N) USB product IDs

Model	USB product ID
R&S NRP18T	0x0150
R&S NRP18TN	0x0151
R&S NRP33T	0x0152
R&S NRP33TN	0x0153
R&S NRP40T	0x0154
R&S NRP40TN	0x0155
R&S NRP50T	0x0156
R&S NRP50TN	0x0157
R&S NRP67T	0x0158
R&S NRP67TN	0x0159
R&S NRP90T	0x026C
R&S NRP90TN	0x026D
R&S NRP110T	0x015A
R&S NRP125T	0x02BE
R&S NRP150T	0x02BF

Table 6-7: R&S NRPxTWG(N) USB product IDs

Model	USB product ID
R&S NRP75TWG	0x01D1
R&S NRP75TWGN	0x0294
R&S NRP90TWG	0x01D2
R&S NRP90TWGN	0x0295
R&S NRP110TWG	0x01D3
R&S NRP110TWGN	0x0296
R&S NRP140TWG	0x02AD
R&S NRP140TWGN	0x02AE
R&S NRP170TWG	0x02AF
R&S NRP170TWGN	0x02B0

6.1.2 NRP legacy protocol

The NRP legacy protocol is available to ensure the compatibility of the sensors with the R&S NRP-Z sensors. 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.

6.2 Ethernet interface

Requires a sensor with networking capabilities, a LAN sensor.

Using the Ethernet interface, you can integrate the product in a local area network (LAN).

Connect the computer and the sensors as described in Section 3.7.4, "Using a LAN connection", on page 28.

6.2.1 Requirements

Local area network

The local area network must support the TCP/IP network protocol.

The TCP/IP network protocol and the associated network services are preconfigured on the product.

Computer

- 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 LAN when using VXI-11 or HiSLIP protocols.

- Software for device control

6.2.2 Protocols

- VXI-11
  See "VXI-11" on page 56.
- HiSLIP: High-speed LAN instrument protocol (IVI-6.1)
  See "HiSLIP" on page 56.
- Socket communication (LAN Ethernet)
  See "Socket communication" on page 56.

6.2.3 VISA resource strings

The VISA resource string is required to establish a communication session between the controller and the product in a LAN. The resource string is a unique identifier, composed of the specific IP address of the product and some network and VISA-specific keywords.

TCPIP::<IP address or host name>[::<LAN device name>][::INSTR]

- *TCPIP* designates the network protocol used.
- *<IP address or host name>* is the IP address or host name of the device.
- *[::<LAN device name>]* defines the protocol and the instance number of a subinstrument.
- *[::INSTR]* indicates the product resource class (optional).

The IP address or host name is used by the programs to identify and control the product. While the host name is determined by settings in the product, the IP address is assigned by a DHCP server when the product requests one. Alternatively the IP address is determined with a procedure called zeroconf.

You can also assign a *LAN device name* which defines the protocol characteristics of the connection. See the description of the VISA resource string below for the corresponding interface protocols. The string of the *LAN device name* is emphasized in italics.

VXI-11

TCPIP::<IP address or host name>*[::inst0]*[::INSTR]

inst0 is the LAN device name, indicating that the VXI-11 protocol is used (optional)

inst0 currently selects the VXI-11 protocol by default and can be omitted.

Examples:

- If the product has the IP address *10.111.11.20*, the valid resource string is TCPIP::10.111.11.20::INSTR
- If the DNS host name is *nrp18sn-100001*, the valid resource string is TCPIP::nrp18sn-100001::inst0

HiSLIP

TCPIP::<IP address or host name>*::hislip0*[::INSTR]

hislip0 is the HiSLIP device name, designates that the interface protocol HiSLIP is used (mandatory)

hislip0 is composed of [::HiSLIP device name[,HiSLIP port]] and must be assigned.

Example:

If the DNS host name is *nrp18sn-100001*, the valid resource string is

TCPIP::nrp18sn-100001::hislip0

Socket communication

TCPIP::<IP address or host name>*::port::SOCKET*

- *port* determines the used port number.
- *SOCKET* indicates the raw network socket resource class.

Socket communication requires the specification of the port (commonly referred to as port number) and of *SOCKET* to complete the VISA resource string with the associated protocol used.

The default port for socket communication is port 5025.

Examples:

- TCPIP::10.111.11.20::5025::SOCKET
- TCPIP::nrp18sn-100001::5025::SOCKET

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

Index

Z