R&S®NRQ6
Frequency Selective
Power Sensor
Getting Started

NRQ6
Frequency Selective
Power Sensor

LAN PoE+

Host
Interface

50 MHz to 6 GHz
100 aW to 100 mW (~130 dBm to +20 dBm)
Max. 1 W (+30 dBm) avg
Max. 2 W (+33 dBm) pk (< 1 µs)

Trigger 2 I/O
In: 3 V or 5 V logic
Out: > 2 V into 50 Ω, max. 5.3 V

Reference I/O
In: > –10 dBm
Out: > +7 dBm (Default 10 MHz)

CE

1178370502

Getting Started   Version 07

ROHDE & SCHWARZ

https://allice.de/rohde-schwarz/value-instruments/

This document describes the following power sensor:

- R&S®NRQ6 (1421.3509.02)

Contents

https://allice.de/rohde-schwarz/value-instruments/

https://allice.de/rohde-schwarz/value-instruments/

R&S®NRQ6   **Contents**

https://allice.de/rohde-schwarz/value-instruments/

1   Safety Information

The product documentation helps you use the R&S NRQ6 safely and efficiently. Follow the instructions provided here and in the printed "Basic Safety Instructions". Keep the product documentation nearby and offer it to other users.

Intended use

The R&S NRQ6 is intended for the development, production and verification of electronic components and devices in industrial, administrative, and laboratory environments. Use the R&S NRQ6 only for its designated purpose. Observe the operating conditions and performance limits stated in the data sheet.

Where do I find safety information?

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

- The printed "Basic Safety Instructions" provide safety information in many languages and are delivered with the R&S NRQ6.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

https://allice.de/rohde-schwarz/value-instruments/

2   Documentation Overview

This section provides an overview of the R&S NRQ6 user documentation.

Unless specified otherwise, you find the documents on the R&S NRQ6 product page at:

www.rohde-schwarz.com/manual/NRQ6

2.1   Getting Started Manual

Introduces the R&S NRQ6 and describes how to set up and start working with the product. A printed version is delivered with the R&S NRQ6.

2.2   User Manual

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, instrument interfaces and error messages. Includes the contents of the getting started manual.

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

2.3   CD-ROM

Provides quick access to valuable information about the usage of the R&S NRQ6. Delivered with the R&S NRQ6. Most of the information is also provided at the R&S Internet site, but on different pages.

- Useful software for installation, operation and remote control
- Product documentation (including open source acknowledgment document)
- Certificates

- Links to useful sites on the Rohde & Schwarz website

2.4   Application Sheets

Deal with special tasks and their practical solution.

2.5   Tutorials

Tutorials offer guided examples and demonstrations on operating the R&S NRQ6. They are provided on the product page of the internet.

2.6   Instrument Security Procedures

Deals with security issues when working with the R&S NRQ6 in secure areas. It is available for download on the Internet.

2.7   Basic Safety Instructions

Contains safety instructions, operating conditions and further important information. The printed document is delivered with the R&S NRQ6.

2.8   Data Sheets and Brochures

The data sheet contains the technical specifications of the R&S NRQ6. It also lists the options and their order numbers, and optional accessories.

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

See www.rohde-schwarz.com/brochure-datasheet/NRQ6

2.9   Release Notes and Open Source Acknowledgment (OSA)

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

The "Open Source Acknowledgment" is provided on the user documentation CD-ROM, included in the delivery. It contains verbatim license texts of the used open source software.

See www.rohde-schwarz.com/firmware/NRQ6

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

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

See www.rohde-schwarz.com/application/NRQ6

https://allice.de/rohde-schwarz/value-instruments/

R&S®NRQ6 **Documentation Overview**

Application Notes, Application Cards, White Papers, etc.

https://allice.de/rohde-schwarz/value-instruments/

3   Key Features

The R&S NRQ6 frequency selective power sensor sets standards in RF performance and usability. Outstanding key features are:

- Combines the advantages of a measurement receiver (dynamic range, linearity & video bandwidth) and a conventional diode-based or thermal power sensor (stability, absolute accuracy & source match).

- Easy operation with features such as browser-based user interface, autoset configuration, automatic frequency tracking or spectral preview (signal check).

- Measurements in low RF level ranges that are beyond the range of classical power meters. Faster measurements in the RF level range close to the lower boundary of classical power meters.

- Frequency selective measurements with adjustable bandwidth including a built-in ACLR measurement function

For a detailed specification, refer to the data sheet.

4   Preparing for Use

4.1   Unpacking and Checking the Power Sensor

Check the equipment for completeness using the delivery note and the accessory lists for the various items. Check the R&S NRQ6 for any damage. If there is damage, immediately contact the carrier who delivered the power sensor. Make sure not to discard the box and packing material.

Packing material

Retain the original packing material. If the instrument needs to be transported or shipped later, you can use the material to protect the control elements and connectors.

4.1.1   Accessory List

The R&S NRQ6 comes with the following accessories:

- Printed getting started manual
- Multilingual safety brochure
- CD-ROM
- Additive data sheet ref. China ROHS

4.2   Operating Conditions

Specific operating conditions are required to ensure accurate measurements and to avoid damage to the power sensor and connected devices. Before switching

https://allice.de/rohde-schwarz/value-instruments/

on the power sensor, observe the information on appropriate operating conditions provided in the basic safety instructions and the data sheet of the R&S NRQ6.

In particular, ensure the following:

- The power sensor is dry and shows no sign of condensation.
- The ambient temperature does not exceed the range specified in the data sheet.
- Signal levels at the input connectors are all within the specified ranges.
- Signal outputs are connected correctly and are not overloaded.

4.3   Considerations for Test Setup

Preventing electrostatic discharge (ESD)

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

► **NOTICE!** Risk of electrostatic discharge (ESD). Electrostatic discharge (ESD) can damage the electronic components of the power sensor and the device under test (DUT).

Ground yourself to avoid electrostatic discharge (ESD) damage:

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

EMI impact on measurement results

Electromagnetic interference (EMI) may affect the measurement results.

To suppress generated electromagnetic interference (EMI):

- Use suitable shielded cables of high quality. For example, use double-shielded RF and LAN cables.
- Always terminate open cable ends.
- Note the EMC classification in the data sheet.

https://allice.de/rohde-schwarz/value-instruments/

4.4   Connecting to a DUT

The R&S NRQ6 has fan openings at both sides of the casing, as shown in Figure 5-1. When connecting the R&S NRQ6 to a DUT and setting up the measurement assembly, be careful to allow sufficient airflow.

NOTICE

Risk of damage due to insufficient airflow

If the R&S NRQ6 is run with insufficient airflow for a longer period, the R&S NRQ6 overheats. Overheating can disturb the operation, even cause damage and lead to wrong measurement results.

Make sure of the following:

- All fan openings are unobstructed.
- Airflow perforations are unimpeded.
- Minimum distance between the fan openings and any object is 10 cm.

To connect to the DUT

For connecting the R&S NRQ6 to a DUT, use the RF connector of the R&S NRQ6. For details, see Chapter 5.1, "RF Connector", on page 32.

1. Ensure that the RF connector of your DUT is compatible with the RF connector of the R&S NRQ6.

2. Insert the RF connector straight into the RF output of your DUT. Take care not to tilt it.
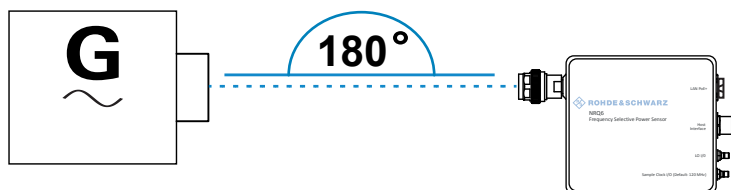
3. **NOTICE!** Risk of damaging the center pin of the RF connector. Only rotate the hex nut of the RF connector. Never rotate the R&S NRQ6 itself.

   Tighten the RF connector manually.

4. Tighten the RF connector using a torque wrench with the nominal torque of 1.36 Nm (12" lbs) to ensure maximum measurement accuracy.

To disconnect from the DUT

1. **NOTICE!** Risk of damaging the center pin of the RF connector. Only rotate the hex nut of the RF connector. Never rotate the R&S NRQ6 itself.

   Carefully loosen the union nut at the front of the RF connector of the R&S NRQ6.

2. Remove the R&S NRQ6.

4.5   Connecting to a Power Supply

The power for the R&S NRQ6 is supplied over the LAN PoE+ interface. See also Chapter 5.3, "LAN PoE+ Interface", on page 33.

NOTICE

Risk of R&S NRQ6 damage

Make sure to use only PoE+ power sourcing equipment (PSE) as specified in the IEEE 802.3at standard. Otherwise, the following consequences can occur:

● If too much power is supplied, the R&S NRQ6 can get overheated which can result in damage.

● If the supplied power is not sufficient, the R&S NRQ6 does not work properly or not at all.

To connect to a LAN PoE+ interface

1. Use a suitable cable as described in Chapter 5.3, "LAN PoE+ Interface", on page 33.

2. Connect one end of the cable to the LAN interface of the R&S NRQ6.

3. Connect the other end of the cable to one of the following:
   ● PoE+ port of a LAN switch:
     See Chapter 4.6.1.1, "Setup with a PoE+ Ethernet Switch", on page 20.
   ● Output of a PoE+ injector:
     See Chapter 4.6.1.2, "Setup with a PoE+ Injector and a Non-PoE+ Ethernet Switch", on page 21.

4.6 Connecting to a Controlling Host

For operating the R&S NRQ6, you can choose from various possibilities. For details, see Chapter 6, "Operating Concepts", on page 39.

The suitable interface depends on the controlling host:

- Computer
  LAN interface
  USB interface
- R&S NRX
  Host interface

Contents:

4.6.1 Computer Using a LAN Connection

There are different ways to connect the R&S NRQ6 to a computer according to the available equipment. The power for the R&S NRQ6 is supplied over the LAN PoE+ interface.
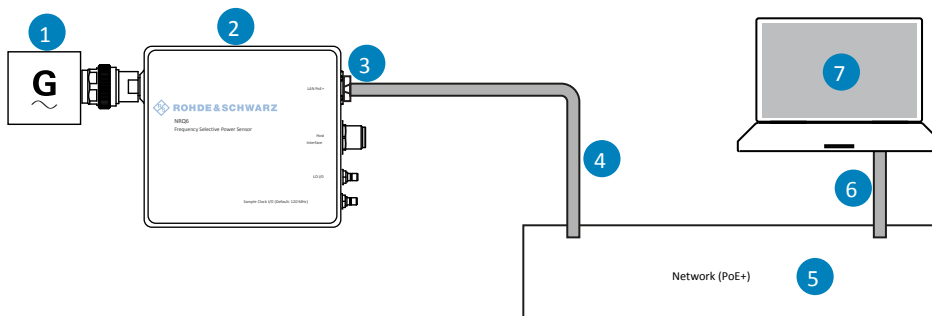
Further information:

- Chapter 4.5, "Connecting to a Power Supply", on page 18
- Chapter 7, "Remote Control Interfaces and Protocols", on page 51

Contents:

4.6.1.1   Setup with a PoE+ Ethernet Switch

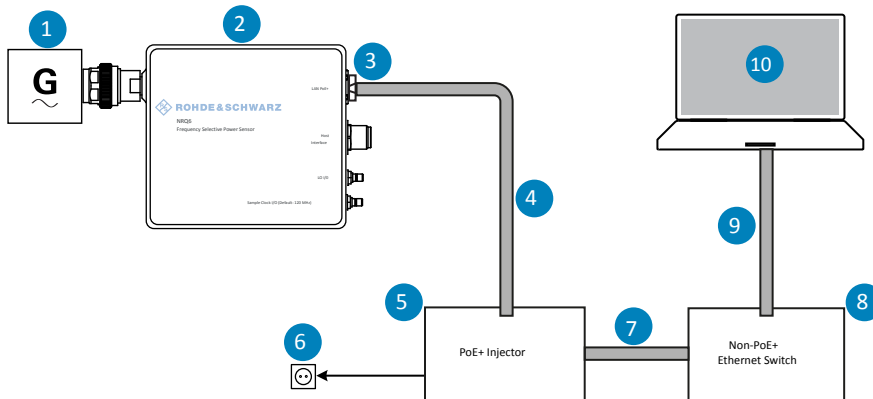
Figure 4-1: Setup with a PoE+ Ethernet switch

1   = Signal source (DUT)
2   = R&S NRQ6
3   = RJ.45 Ethernet connector
4, 6 = RJ.45 Ethernet cable
5   = Ethernet switch supporting PoE+ power delivery
7   = Computer

1. Connect the [RF] connector of the R&S NRQ6 to the DUT, see Chapter 4.4, "Connecting to a DUT", on page 17.

2. Connect the RJ.45 Ethernet connector of the R&S NRQ6 to an Ethernet switch that supports PoE+ power delivery.

3. Connect the computer to the Ethernet switch.

4. Establish a connection between the R&S NRQ6 and the network, see Chapter 4.6.1.4, "Establishing a Connection", on page 22.

https://allice.de/rohde-schwarz/value-instruments/

4.6.1.2 Setup with a PoE+ Injector and a Non-PoE+ Ethernet Switch
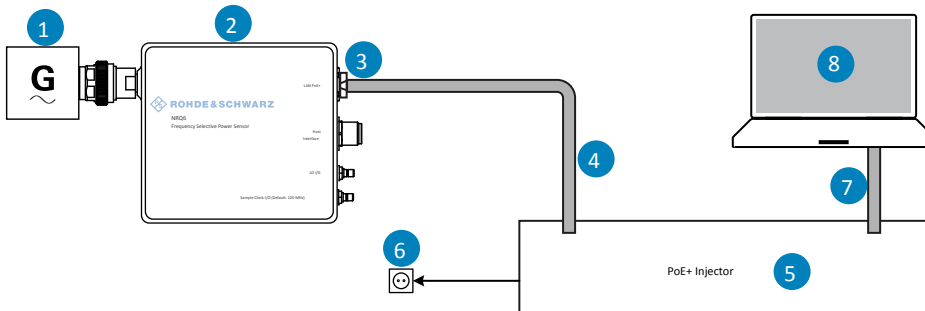

Figure 4-2: Setup with a PoE+ injector and a Non-PoE+ Ethernet switch

1 = Signal source (DUT)
2 = R&S NRQ6
3 = RJ.45 Ethernet connector
4, 7,9 = RJ.45 Ethernet cable
5 = PoE+ injector
6 = AC supply
8 = Non-PoE+ Ethernet switch
10 = Computer

1. Connect the [RF] connector of the R&S NRQ6 to the DUT, see Chapter 4.4, "Connecting to a DUT", on page 17.

2. Connect the RJ.45 Ethernet connector of the R&S NRQ6 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 R&S NRQ6 and the network, see Chapter 4.6.1.4, "Establishing a Connection", on page 22.

https://allice.de/rohde-schwarz/value-instruments/

4.6.1.3   Setup with a PoE+ Injector

Figure 4-3: Setup with a PoE+ injector

1   = Signal source (DUT)
2   = R&S NRQ6
3   = RJ.45 Ethernet connector
4, 7 = RJ.45 Ethernet cable
5   = PoE+ injector
6   = AC supply
8   = Computer

1. Connect the [RF] connector of the R&S NRQ6 to the DUT, see Chapter 4.4, "Connecting to a DUT", on page 17.

2. Connect the RJ.45 Ethernet connector of the R&S NRQ6 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 connection between the R&S NRQ6 and the network, see Chapter 4.6.1.4, "Establishing a Connection", on page 22.

4.6.1.4   Establishing a Connection

There are two methods to establish a network connection:

● R&S NRQ6 and computer are connected to a common network (infrastructure network).

● R&S NRQ6 and computer are connected only over the switch (peer-to-peer network).

In both cases, you can address the R&S NRQ6 as follows:

● Chapter 4.6.1.5, "Using Hostnames", on page 23

-

To set up a network Ethernet connection

1. Connect the R&S NRQ6 to the network or to a single computer.

   By default, the R&S NRQ6 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 R&S NRQ6 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:
   -

4.6.1.5   Using Hostnames

In a LAN that uses a domain name system (DNS) server, you can address each computer or instrument connected in the LAN using its unique hostname instead of the IP address. The DNS server translates the hostname into the IP address. This is especially useful when using a DHCP server, as a new IP address can be assigned each time the instrument is restarted.

The R&S NRQ6 is delivered with a default hostname that you can change.

Default hostname

The default hostname follows the syntax:

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

- `<device name>` is the short name of your R&S NRQ6.
  For example, the `<device name>` of an R&S NRQ6 is `nrq6`.

- `<serial number>` is the individual serial number of the R&S NRQ6. The serial number is printed on the bar code sticker at the rear side of the R&S NRQ6. It is the third part of the device ID:

ID: 1421.3509K02 - 101441 - Zd   Serial Number

https://allice.de/rohde-schwarz/value-instruments/
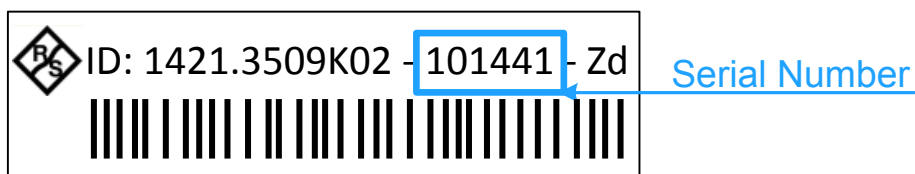
Example:

Serial number of the R&S NRQ6: *101441*

Default hostname: `nrq6-101441`

Hostname in zero configuration networks, including peer-to-peer networks

The R&S NRQ6 supports zero configuration networking, used in networks without DHCP server, such as peer-to-peer networks. Thus, you can connect the R&S NRQ6 to a network without setting up services such as dynamic host configuration protocol (DHCP) and domain name system (DNS), or configuring the network settings manually.

For establishing a connection to the R&S NRQ6, try the default hostname and the hostname 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 hostname: `nrq6-101441`

Extended hostname: `nrq6-101441.local`

4.6.1.6   Assigning the IP Address

Depending on the network capabilities, the TCP/IP address information for the R&S NRQ6 is obtained in different ways:

- If the network supports dynamic TCP/IP configuration using the dynamic host configuration protocol (DHCP), the address information is assigned automatically.

- If the network does not support DHCP, the R&S NRQ6 tries to obtain the IP address via the Zeroconf (APIPA = automatic private IP addressing) protocol. If this attempt does not succeed or if the R&S NRQ6 is set to use alternate TCP/IP configuration, you have to set the IP address manually.
  For a description on how to set the IP address manually, refer to the user manual.

Identify the R&S NRQ6 using hostnames

In networks using a DHCP server, it is recommended that you address the R&S NRQ6 by its unique hostname, see Chapter 4.6.1.5, "Using Hostnames", on page 23.

A hostname is a unique identifier of the R&S NRQ6 that remains permanent as long as it is not explicitly changed. Hence, you can address an R&S NRQ6 by the same identification, irrespective of whether it is a network or a point-to-point connection.

4.6.2   Computer Using a USB Connection

You can connect an R&S NRQ6 to a computer using the host interface and control it as described in Chapter 6, "Operating Concepts", on page 39.
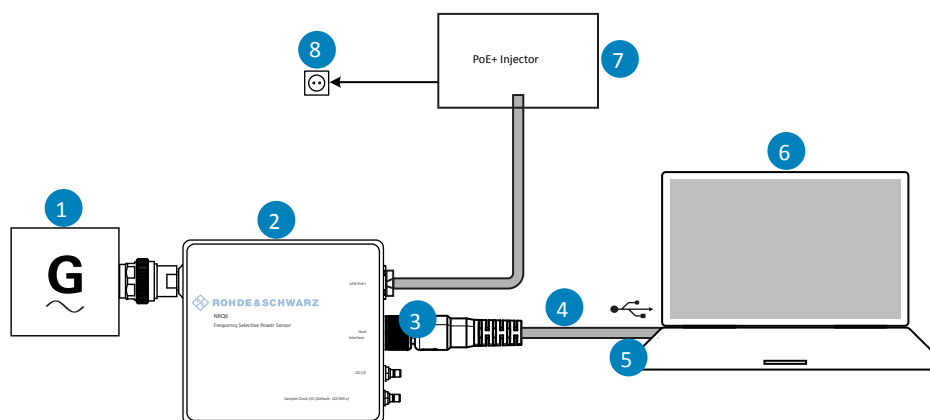
Further information:

- Chapter 7, "Remote Control Interfaces and Protocols", on page 51

Contents:

4.6.2.1   Simple USB Connection

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

1 = Signal source (DUT)
2 = R&S NRQ6
3 = Host interface connector
4 = R&S NRP-ZKU cable cable

5 = USB connector
6 = Computer with installed VISA driver or R&S NRP Toolkit
7 = PoE+ injector
8 = AC supply

1. Connect the R&S NRQ6 to the signal source (DUT), see Chapter 4.4, "Connecting to a DUT", on page 17.

2. Connect the R&S NRQ6 to the power supply, see Chapter 4.5, "Connecting to a Power Supply", on page 18.

3. Connect the R&S NRP-ZKU cable cable to the host interface connector of the R&S NRQ6:

    a) Insert the screw-lock cable connector of the R&S NRP-ZKU cable 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.

    1 = Guide lug

    b) 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.
    c) Tighten the union nut carefully without using any force.

4. Connect the USB connector of the R&S NRP-ZKU cable to the USB host.

► If you want to disconnect the cable from the host interface:
    a) Loosen the union nut of the screw-lock cable connector.
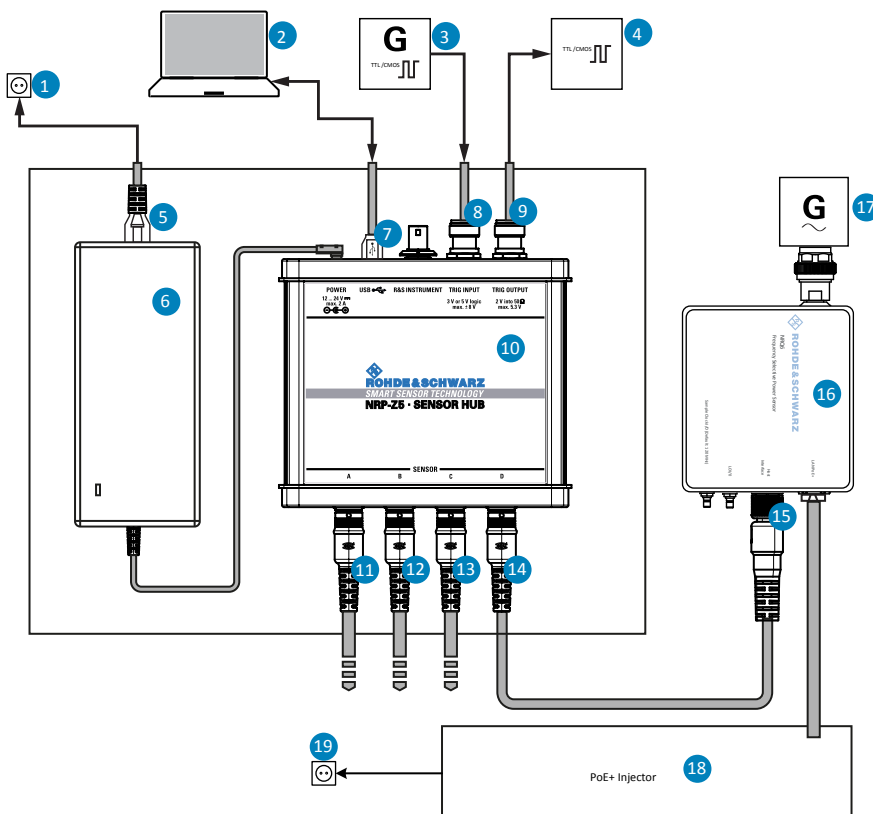   b) Remove the cable.

4.6.2.2   R&S NRP-Z5 Sensor Hub Setup

The R&S NRP-Z5 sensor hub (high-speed USB 2.0) can host up to four R&S NRQ6 power sensors and provides simultaneous external triggering to all connected sensors. It comes with an external power supply unit, a power cable and a USB cable.

https://allice.de/rohde-schwarz/value-instruments/

Figure 4-5: Configuration with an R&S NRP-Z5 sensor hub

1   = AC power supply
2   = Computer with USB host interface
3   = Trigger source (optional)
4   = Triggered device (optional)
5   = Power cable
6   = External power supply unit
7   = USB cable
8, 9   = BNC cable (optional)
10   = R&S NRP-Z5 sensor hub
11-14 = R&S NRP-ZK6 cable
15   = Host interface connector
16   = R&S NRQ6
17   = Signal source (DUT)
18   = PoE+ injector
19   = AC supply

1. Connect each R&S NRQ6 to:

   a) Signal source (DUT), see Chapter 4.4, "Connecting to a DUT",
      on page 17.
   b) Power supply, see Chapter 4.5, "Connecting to a Power Supply",
      on page 18.

https://allice.de/rohde-schwarz/value-instruments/

   c) R&S NRP-Z5 using a R&S NRP-ZK8 cable.

2. Connect the R&S NRP-Z5 to the computer using a USB cable.

3. Connect the delivered 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 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 to the trigger device using a BNC cable.
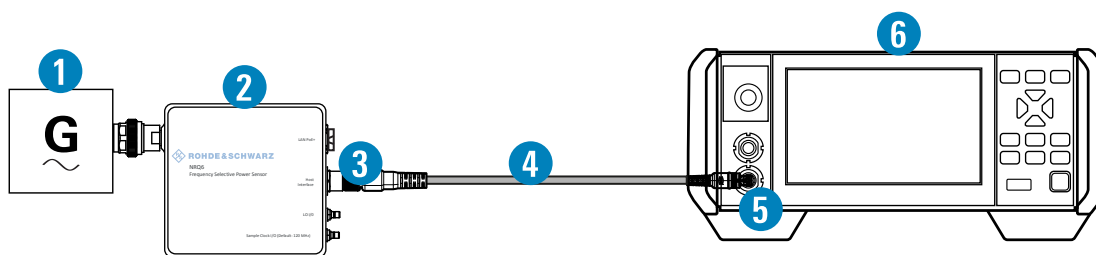
4.6.3   R&S NRX Base Unit

You can use an R&S NRX base unit as controlling host. Connect the R&S NRQ6 to the R&S NRX using the host interface. The R&S NRX supports the configuration of 2 directly connected R&S NRQ6, if enhanced accordingly. For details, see the user manual and the data sheet of the R&S NRX.

The R&S NRX supplies an external reference signal that is provided by the LVDS wire pair of the 8-pole sensor connector (M12).

Further information:
* R&S NRX user manual

Setup

Figure 4-6: Setup with an R&S NRX base unit and one R&S NRQ6

1 = Signal source
2 = R&S NRQ6
3 = Host interface connector
4 = R&S NRP-ZK8
5 = Sensor input connector of the R&S NRX
6 = R&S NRX base unit

Use an R&S NRP-ZK8 cable.

1. 8-pin female connector of R&S NRP-ZK8:

   a) Insert the screw-lock cable connector into the host interface of the R&S NRQ6.
   b) Tighten the union nut manually.

2. 8-pin male connector of R&S NRP-ZK8:

   a) Insert this connector into one of the sensor ports of the R&S NRX.

► If you want to disconnect the cable from the host interface of the R&S NRQ6:

   a) Loosen the union nut of the screw-lock cable connector.
   b) Remove the cable.

https://allice.de/rohde-schwarz/value-instruments/

https://allice.de/rohde-schwarz/value-instruments/

5   R&S NRQ6 Tour

This chapter provides an overview of the available connectors and LEDs of the R&S NRQ6.

Figure 5-1: R&S NRQ6 frequency selective power sensor

1   = RF connector, see Chapter 5.1, "RF Connector", on page 32
2   = Status display, see Chapter 5.2, "Status Information", on page 32
3   = LAN interface, see Chapter 5.3, "LAN PoE+ Interface", on page 33
4   = Host interface, see Chapter 5.4, "Host Interface", on page 35
5   = Trigger connector, see Chapter 5.5, "Trigger 2 I/O (TRIG2)", on page 35
6   = Reference clock, see Chapter 5.6, "Reference I/O (REF)", on page 35
7   = Sampling clock connector, see Chapter 5.7, "Clock I/O (CLK)", on page 36
8   = Local oscillator connector, see Chapter 5.8, "Local Oscillator I/O (LO)", on page 36
9, 10 = Fan openings, see Chapter 5.9, "Fan Openings", on page 37

5.1   RF Connector

See (1) in Figure 5-1.

The male N connector is used to connect the R&S NRQ6 to the device under test (DUT) or a signal generator, see Chapter 4.4, "Connecting to a DUT", on page 17.

For maximum measurement accuracy, tighten the RF connector using a torque wrench with the recommended nominal torque. For details, see "To connect to the DUT" on page 17.

NOTICE

Risk of overloading the sensor

Using the R&S NRQ6 at a level above its upper measuring limit can damage the sensor head. To avoid this risk, make sure not to exceed the test limit.

5.2   Status Information

See (2) in Figure 5-1.

The status LED shows the state of the R&S NRQ6 by color and blinking frequency.

Table 5-1: Possible states

	Color	Illumination	State
○	White	Steady	Idle The sensor performs no measurement and is ready for use.
○	White	Blinking	Firmware update is in progress.
●	Yellow	Steady	Waiting for trigger state.
●	Green	Steady	Measurement is running.
●	Turquoise blue	Steady	Zeroing is in progress.

R&S®NRQ6   **R&S NRQ6 Tour**

LAN PoE+ Interface

	Color	Illumination	State
🔴	Red	Slow blinking	Static error
🔴	Red	Fast blinking	Critical static error **Note:** If this state occurs after a firmware update, the update was not successful.

Further information:

● Troubleshooting in the user manual.

5.3   LAN PoE+ Interface

See (3) in Figure 5-1.

1 Gigabit LAN interface (1000 Base-T). The assignment of the RJ.45 CAT5 connector supports twisted-pair UTP/STP cables in a star configuration (UTP stands for "unshielded twisted pair", and STP for "shielded twisted pair").

> Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, use category 5 cables or better.

The power for the R&S NRQ6 is supplied over the LAN PoE+ interface.

The LAN PoE+ interface also connects the R&S NRQ6 to a local area network (LAN) for remote control, remote operation and data transfer.

> **R&S NRQ6 requires PoE+**
>
> The electrical power for the R&S NRQ6 is provided by PoE+, power over Ethernet. The IEEE 802.3at standard specifies 25.4 W per port. For details, see Chapter 4.5, "Connecting to a Power Supply", on page 18.
>
> The power delivery at a USB host interface is not sufficient to run the R&S NRQ6 properly. Therefore, you cannot use it as power supply for the R&S NRQ6.

https://allice.de/rohde-schwarz/value-instruments/
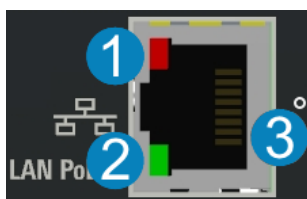
Figure 5-2: LAN [PoE+] interface

1 = Network status LED
2 = PoE+ status LED
3 = LAN reset button

Network status LED

See (1) in Figure 5-2.

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

Color	State
Green	The power sensor is correctly connected to the network.
	It has been assigned a valid IP address, either manually or via DHCP.
Red	The power 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.

PoE+ status LED

See (2) in Figure 5-2.

Shows whether the R&S NRQ6 is correctly powered over PoE+ or not.

Color	State
Green	The sensor is powered over PoE+. You can operate it using the Ethernet interface.
No light	No PoE+ power is present.

LAN reset button

See (3) in Figure 5-2.

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

After a LAN reset, the Ethernet interface is set DHCP mode where automatic address allocation is attempted.

5.4 Host Interface

See (4) in Figure 5-1.

The 8-pole male sensor connector (M12) is used to connect the R&S NRQ6 to a computer or an R&S NRX base unit.

Further information:

- Chapter 4.6.1, "Computer Using a LAN Connection", on page 19
- Chapter 4.6.2, "Computer Using a USB Connection", on page 25
- Chapter 4.6.3, "R&S NRX Base Unit", on page 28
- Chapter 7, "Remote Control Interfaces and Protocols", on page 51

5.5 Trigger 2 I/O (TRIG2)

See (5) in Figure 5-1.

The female SMA connector is used as an input or output for a trigger signal.

For input and output specifications, read the label on the R&S NRQ6 casing and the data sheet.

Further information:

- For details on configuration, see the user manual.

5.6 Reference I/O (REF)

See (6) in Figure 5-1.

The female SMA connector is used as an input or output for the reference clock.

By default, the R&S NRQ6 generates a 10 MHz reference signal and uses it as reference clock. You can use this signal as a reference clock for other devices

(output). Also, you can supply an external reference signal and use it as reference clock instead of the internal reference signal (input).

For input and output specifications, read the label on the R&S NRQ6 casing and the data sheet.

Further information:

* For details on configuration, see the user manual.

5.7 Clock I/O (CLK)

See (7) in Figure 5-1.

The female SMA connector is used as an input or output for the sampling clock. By default, the R&S NRQ6 generates its sampling clock internally. You can use this signal for other devices (output).

If you supply the local oscillator signal externally, you can use an external signal as sampling clock instead of the internal signal (input).

For input and output specifications, read the label on the R&S NRQ6 casing and the data sheet.

Further information:

* For details on configuration, see the user manual.

5.8 Local Oscillator I/O (LO)

See (8) in Figure 5-1.

The female SMA connector is used as an input or output for the local oscillator (LO) signal.

For input and output specifications, read the label on the R&S NRQ6 casing and the data sheet.

Further information:

* For details on usage and configuration, see the user manual.

5.9   Fan Openings

See (9, 10) in Figure 5-1.

The R&S NRQ6 has fan openings on the top and on the bottom of the casing. When connecting the R&S NRQ6, be careful to allow sufficient airflow as specified in Chapter 4.4, "Connecting to a DUT", on page 17.

https://allice.de/rohde-schwarz/value-instruments/

6   Operating Concepts

For operating the R&S NRQ6, you can choose from the following possibilities:

- Chapter 6.2, "Browser-Based User Interface", on page 41
- Chapter 6.3, "R&S NRX", on page 47
- Chapter 6.4, "Remote Control", on page 48

Also, the R&S NRQ6 is supported by the R&S Power Viewer. The R&S Power Viewer is provided on your documentation CD-ROM and on the Rohde & Schwarz website as a separate standalone installation package.

6.1   R&S NRP Toolkit

Before you start using the power sensor, it is recommended to install the R&S NRP Toolkit.

The R&S NRP Toolkit is the basic software package that supplies low-level drivers and tools for all power sensors. The components of the R&S NRP Toolkit depend on the operating system.

6.1.1   Versions and Downloads

The R&S NRP Toolkit is available for the Microsoft Windows operating systems listed under Chapter 6.1.2, "System Requirements", on page 40, Linux distributions and MacOSX. Several R&S NRP Toolkit versions are available on your documentation CD-ROM.

The latest version for Windows is available at www.rohde-schwarz.com/software/nrp-toolkit.

To obtain an R&S NRP Toolkit for an operating system other than Microsoft Windows, contact the Rohde & Schwarz customer support: customersupport@rohde-schwarz.com

6.1.2   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 Chapter 4.6.1, "Computer Using a LAN Connection", on page 19.

Supported operating systems:

- Microsoft Windows versions

  – Microsoft Windows Vista 32/64-bit

  – Microsoft Windows 7 32/64-bit

  – Microsoft Windows 8/ 8.1 32/64-bit

  – Microsoft Windows 10 32/64-bit

- For information on other operating systems, see Chapter 6.1.1, "Versions and Downloads", on page 39.

6.1.3   R&S NRP Toolkit for Windows

The R&S NRP Toolkit installer for Windows-based systems contains the components described in the release notes available at www.rohde-schwarz.com/software/nrp-toolkit.

Installing on a computer

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 components you want to install.
   - "NRP-Toolkit (SDK)"
     The software development kit (SDK) provides programming examples for the R&S power sensors.
   - "IVI Shared Components"
     Installs the USBTMC driver. Enabled by default because the installation is recommended.
     See also Table 7-1.

https://allice.de/rohde-schwarz/value-instruments/
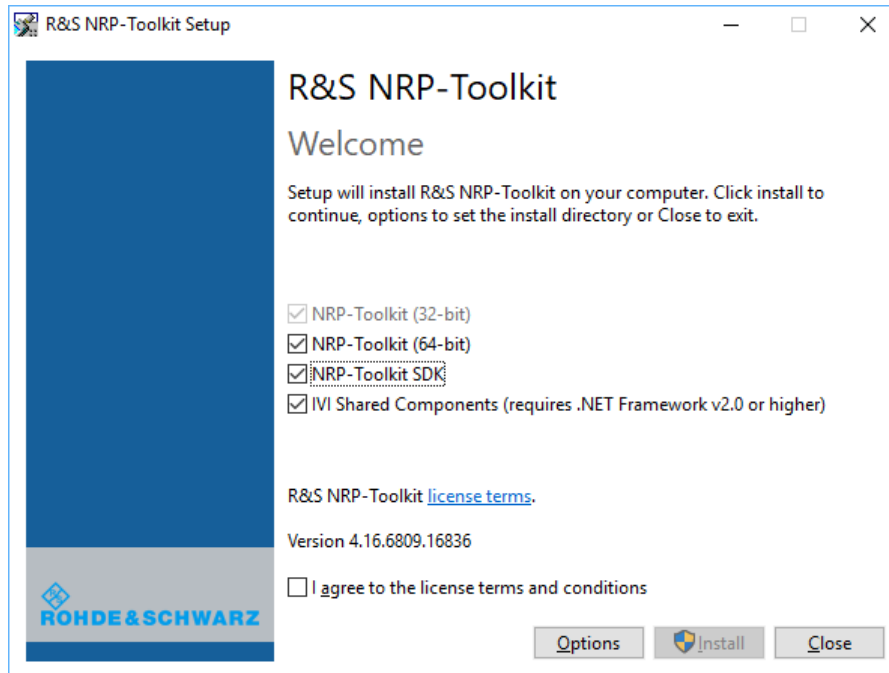
3. Accept the license terms to continue with the installation.

4. Click "Next" and complete the installation process.

6.1.3.1 Performing a Firmware Update

The Firmware Update for NRP Family program is part of the R&S NRP Toolkit for Windows. You can use the Firmware Update for NRP Family program to load new firmware for the power sensors.

For further details, refer to the user manual.

6.2 Browser-Based User Interface

With the integrated, browser-based graphical user interface of the R&S NRQ6, you can easily configure the settings and measure in the provided measurement modes. Open a web browser on your controlling host and connect to the R&S NRQ6. No extra installation is required.

Requirements

- Controlling host:

https://allice.de/rohde-schwarz/value-instruments/

You can use the web user interface with all devices and operating systems, including tablets and smart phones.

- Supported web browser:
    - Mozilla Firefox 56 or later
    - Google Chrome 61 or later
    - Microsoft Internet Explorer 11 or later
    - Microsoft Edge 40

Setup

1. Set up a LAN connection.
   For an example, see Chapter 4.6.1, "Computer Using a LAN Connection", on page 19.

   Note: Make sure to power the R&S NRQ6 with PoE+. See "R&S NRQ6 requires PoE+" on page 33.

2. Connect the R&S NRQ6 to the DUT as described in Chapter 4.4, "Connecting to a DUT", on page 17.

To display the Web user interface

1. Open a supported web browser.

2. Enter the hostname of the R&S NRQ6 you want to connect to. See Chapter 4.6.1.5, "Using Hostnames", on page 23.
   Example: If the hostname is *nrq6-900045*, enter *http://nrq6-900045*.
   You can also use the IP address, see Chapter 4.6.1.6, "Assigning the IP Address", on page 24.

   The main dialog of the web user interface opens. See also Figure 6-1.

Reloading the web browser page

After a firmware update or a reboot, you need to reload the web browser page.

► Press [F5].

Parameter description

The parameters of the web user interface are described together with background information in the user manual.

6.2.1   Layout of the Main Dialog

The main dialog of the web user interface gives access to all available settings.
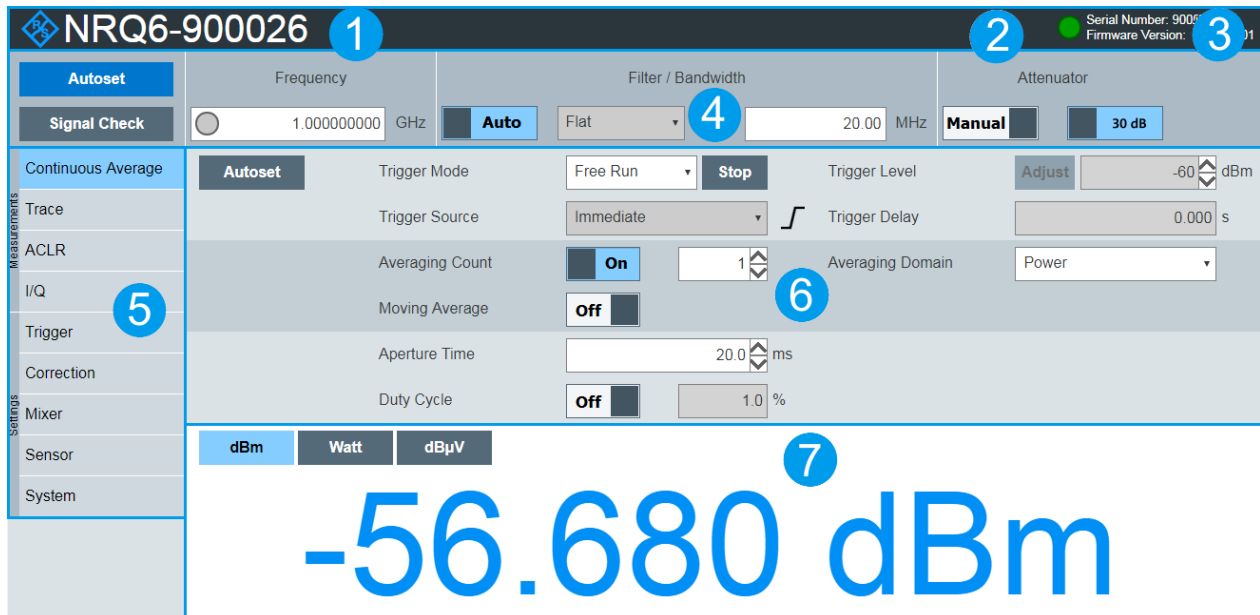
Figure 6-1: Layout of the web user interface

1 = Sensor name or hostname
2 = Status information
3 = Sensor information
4 = Top pane
5 = Navigation pane
6 = Settings pane
7 = Result pane

Sensor name or hostname

(1) in Figure 6-1

If you do not specify a sensor name, the hostname is displayed.

For details, see the user manual.

Status information

(2) in Figure 6-1

Displays the status of the R&S NRQ6. The colors are explained in Chapter 5.2, "Status Information", on page 32.

You can also display detailed information.

https://allice.de/rohde-schwarz/value-instruments/

If the R&S NRQ6 is in remote mode, the status is displayed next to the status LED, see Figure 6-2.

Sensor information

(3) in Figure 6-1

Serial number of the R&S NRQ6 and installed firmware version

Top pane

(4) in Figure 6-1

Stays always visible.

Navigation pane

(5) in Figure 6-1

For displaying measurement and system settings in the settings pane.

Settings pane

(6) in Figure 6-1

Displays the settings you have selected in the navigation pane.

Result pane

(7) in Figure 6-1

Displays the result for the selected measurement mode.

6.2.2   Tooltips

The web user interface provides tooltips on parameter functions and remote control commands.

If you place the cursor over the name of a parameter field, a short description of the parameter function is displayed.
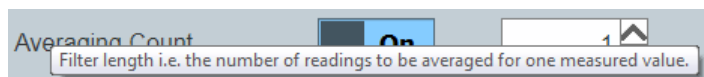
If you place the cursor over a parameter field, the short form of the corresponding remote control command is displayed.

Averaging Count	**On**	1 Averag
		(SENS:AVER:COUNT <value>)

6.2.3   Toolbar in Charts

If you move the mouse into a chart, a toolbar becomes visible in the upper right corner. Use the toolbar to analyze the chart in detail.

Table 6-1: Icons for chart analysis

Icon	Description
📷	Downloads the chart in PNG format.
🔍	Zooms into the selected window.
✛	Moves the chart in the direction of both axes.
➕	Enlarges the chart.
➖	Minimizes the chart.
⤢	Adjusts the y-axis of the chart constantly to the signal. To go back to an optimized setting of the y-axis, click 🏠.
🏠	Resets the axes.

6.2.4   Setting Parameters

If a parameter is not grayed, you can change its setting.

To enter quantities with units

The default unit is displayed next to the parameter field, for example:

5.038886599	GHz

1. If you enter just a number, the default unit remains.
    Example: *2* + [ENTER] -> 2 GHz

2. If you enter the number with a short form of the unit, the short form overrules the default unit.

    Examples:
    ● *123M* + [ENTER] -> 123 MHz
    ● *1234M* + [ENTER] -> 1.234 GHz (= 1234 MHz)

See Table 6-2 for the available short forms of units.

Table 6-2: Short forms of units

Quantity	Short forms *	Corresponding unit
Frequency	*G*	GHz
	M	MHz
	K	kHz
	H	Hz
Time	*S*	s
	M	ms
	U	µs
	N	ns
	P	ps
* Both capital and small letters are accepted.		

► If you want to change a number, you can also:

- Use the spinner. One click changes the number by one increment. If you keep the arrow pressed, you can quickly scroll through the possible values.
- Use the right or left arrow key of your keyboard. Select the digit you want to change. Press the key.

To select a parameter value from a list

1. Click ▼ to open the list.

   A list with all available values is displayed.

2. Click a value to select it.

   The change takes effect immediately.

https://allice.de/rohde-schwarz/value-instruments/
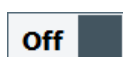
To toggle between two possible values

If only two values are possible, you can toggle between these values. Toggling works for the pairs "Off"/"On", "Auto"/"Manual", "Left"/"Right", etc.

► Click the value to change to the other value.

6.3   R&S NRX

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 power sensor.

Setup

1. Connect the power sensor to the R&S NRX.
   See Chapter 4.6.3, "R&S NRX Base Unit", on page 28.

2. Connect the power sensor to the signal source.
   See Chapter 4.4, "Connecting to a DUT", on page 17.

Starting a measurement

1. Preset the R&S NRX and the connected R&S power sensors.

   a) Press the [Preset] key.
   b) Tap "Preset".
      All parameters are set to their defaults.

2. If measuring in zero-IF mode (RBW > 40 MHz), consider to zero the power sensor:
   Note: Turn off all measurement signals before zeroing. An active measurement signal during zeroing causes an error.

   a) Switch off the power of the signal source.
   b) Press the [Zero] key of the R&S NRX.
   c) Tap "Zero All Sensors".

3. Configure the measurement.

   a) In the "Measurement Settings" dialog, select the "Measurement Type", for example "Continuous Average".
   b) Tap "Quick Setup" > "Auto Set".

4. Switch on the signal source.

R&S®NRQ6   **Operating Concepts**

Remote Control

The measurement starts, and the result is displayed in dBm.

5. If necessary, perform further settings.

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

6.4   Remote Control

You can remote control the R&S NRQ6 easily. The change to remote control occurs "on the fly".

Switching to remote control

1. Establish a link between the controller and the R&S NRQ6.

2. Send a SCPI command to the R&S NRQ6.

   The R&S NRQ6 changes into remote mode.
   The web user interface is locked and becomes darker. The status is displayed next to the status LED.
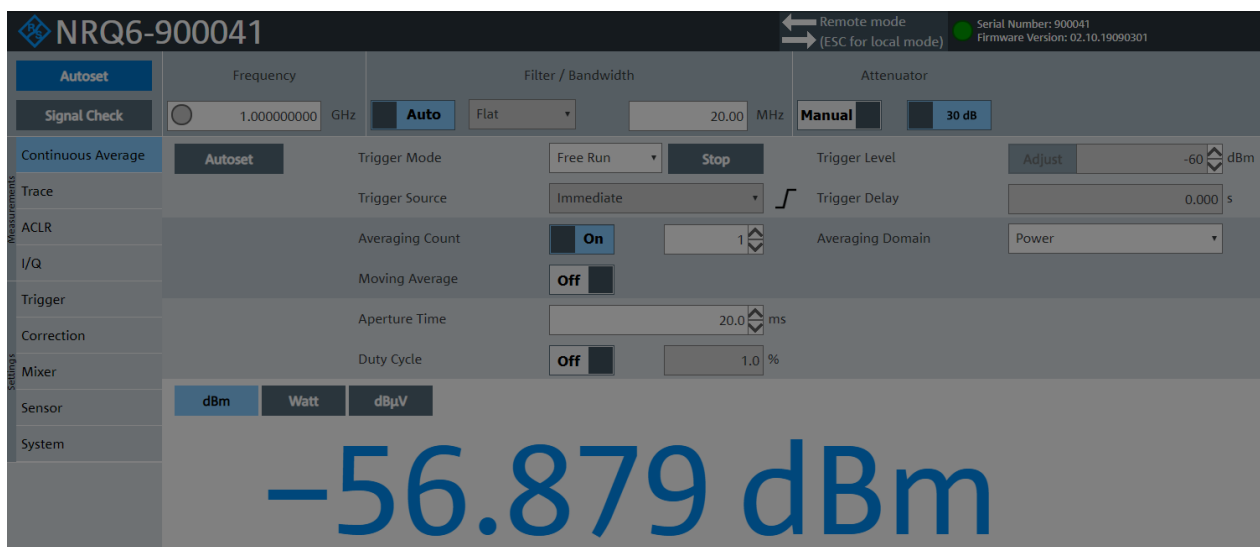
Figure 6-2: Locked web user interface during remote control

Returning to manual operation (local)

► Press [Esc] at the controller keyboard.

https://allice.de/rohde-schwarz/value-instruments/

The R&S NRQ6 changes into local mode. The lock of the web user interface is removed.

Further information:

- See the user manual for details.
- Chapter 7, "Remote Control Interfaces and Protocols", on page 51
- Chapter 4.6, "Connecting to a Controlling Host", on page 19

https://allice.de/rohde-schwarz/value-instruments/

7   Remote Control Interfaces and Protocols

For remote control, communication between the R&S NRQ6 and the controlling host is established based on the following interfaces and protocols.

Table 7-1: Supported interfaces and protocols

Interface	Protocol	VISA[*)] address string	Library	Further information
USB	USBTMC	USB::<vendor ID>::<product ID>:: <serial number>[::INSTR]	VISA	Chapter 7.1, "USB Interface", on page 51
Ethernet	VXI-11	TCPIP::host address[::LAN device name][::INSTR]	VISA	Chapter 7.2.2, "VXI-11 Protocol", on page 55
	HiSLIP High-speed LAN instrument protocol (IVI-6.1)	TCPIP::host address::hislip0[::INSTR]	VISA	Chapter 7.2.3, "HiSLIP Protocol", on page 55
	Socket communication (LAN Ethernet)	TCPIP::host address[::LAN device name]::<port>::SOCKET		Chapter 7.2.4, "Socket Communication", on page 56
	*) 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 protocol) and USBTMC interfaces. See also Chapter 7.2.1, "VISA Resource Strings", on page 53.			

7.1   USB Interface

Computer requirements

- VISA library
  A USB connection requires the VISA library to be installed. VISA detects and configures the R&S NRQ6 automatically when the USB connection is established.
- USBTMC driver

https://allice.de/rohde-schwarz/value-instruments/

Apart from the USBTMC driver, which comes with the installation of the R&S NRP Toolkit, you do not have to install a separate driver.

Setup

1. Connect the host interface of the R&S NRQ6 and the USB interface of the computer, see Chapter 4.6.2, "Computer Using a USB Connection", on page 25.

2. Make sure that the R&S NRQ6 is powered by PoE+. For details, see "R&S NRQ6 requires PoE+" on page 33.

USBTMC protocol

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. R&S NRQ6 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.

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

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

- *<vendor ID>* is the vendor ID for Rohde & Schwarz.
- *<product ID>* is the product ID for the R&S NRQ6.
- *<serial number>* is the individual serial number of the , printed on the casing.

Example:

`USB::0x0AAD::0x015B::100001`

0x0AAD is the vendor ID for Rohde & Schwarz.

0x015B is the product ID for the R&S NRQ6.

100001 is the serial number of the particular R&S NRQ6.

7.2   Ethernet Interface

The Ethernet interface of the R&S NRQ6 allows you to integrate it in a local area network (LAN).

Requirements

- TCP/IP network protocol
  The local area network must support the TCP/IP network protocol.
  The TCP/IP network protocol and the associated network services are precon-figured on the R&S NRQ6.

- VISA library
  Installed on the computer.

- Software for device control
  Installed on the computer.

Setup

1. Using the Ethernet interface, connect the computer and the R&S NRQ6 to a local area network, see Chapter 4.6.1, "Computer Using a LAN Connection", on page 19.

2. Make sure that the R&S NRQ6 is powered by PoE+. For details, see "R&S NRQ6 requires PoE+" on page 33.

7.2.1   VISA Resource Strings

The VISA resource string for network device communication is required to estab-lish a communication session between the controller and the power sensor in a LAN. The resource string is a unique identifier, composed of the specific IP address of the sensor and some network and VISA-specific keywords.

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

- *TCPIP* designates the network protocol used

- *<IP address or hostname>* is the IP address or hostname of the device

- *[::<LAN device name>]* defines the protocol and the instance number of a sub-instrument:

- *[::INSTR]* indicates the power sensors resource class (optional)

The IP address or hostname is used by the programs to identify and control the sensor. While the hostname is determined by settings in the sensor, the IP address is assigned by a DHCP server when the sensor 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 hostname>*[::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.

For further details, see Chapter 7.2.2, "VXI-11 Protocol", on page 55.

HiSLIP

TCPIP::<IP address or hostname>*::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.

For further details, see Chapter 7.2.3, "HiSLIP Protocol", on page 55 .

Socket communication

TCPIP::<IP address or hostname>*::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.

For further details, see Chapter 7.2.4, "Socket Communication", on page 56.

Example:

A power sensor has the IP address *10.111.11.20*; the valid resource string using VXI-11 protocol is:

TCPIP::10.111.11.20::INSTR

The DNS hostname is *nrq6-100001*; the valid resource string is:

TCPIP::nrq6-100001::hislip0 (HiSLIP)

TCPIP::nrq6-100001::inst0 (VXI-11)

A raw socket connection can be established using:

TCPIP::10.111.11.20::5025::SOCKET

TCPIP::nrq6-100001::5025::SOCKET

7.2.2   VXI-11 Protocol

The VXI-11 standard is based on the ONC RPC (Open Network Computing Remote Procedure Call) protocol which in turn relies on TCP/IP as the network/transport layer. The TCP/IP network protocol and the associated network services are preconfigured. TCP/IP ensures connection-oriented communication, where the order of the exchanged messages is adhered to and interrupted links are identified. With this protocol, messages cannot be lost.

7.2.3   HiSLIP Protocol

The HiSLIP (high-speed LAN instrument protocol) is the successor protocol for VXI-11 for TCP-based instruments specified by the IVI foundation. The protocol uses two TCP sockets for a single connection - the first for fast data transfer, the second one for non-sequential control commands (e.g. `Device Clear` or `SRQ`).

HiSLIP has the following characteristics:

- High performance as with raw socket network connections
- Compatible IEEE 488.2 support for Message Exchange Protocol, Device Clear, Serial Poll, Remote/Local, Trigger, and Service Request.
- Uses a single IANA registered port (4880), which simplifies the configuration of firewalls.
- Supports simultaneous access of multiple users by providing versatile locking mechanisms.
- Usable for IPv6 or IPv4 networks.

> The HiSLIP data is sent to the device using the "fire and forget" method with immediate return. Opposed to VXI-11, where each operation is blocked until a VXI-11 device handshake returns. Thus, a successful return of a VISA operation such as `viWrite()` does not guarantee that the sensor has finished (or even started) executing the requested command. It just indicates that the command has been delivered to the TCP/IP buffers.

For more information see also the application note at:

http://www.rohde-schwarz.com/appnote/1MA208.

7.2.4 Socket Communication

An alternative way for remote control of the software is to establish a simple TCP/IP connection to the device using the standard network drivers of your operating system. The so-called "socket" on Linux, "winsock" on Windows. The socket communication, also referred to as "raw Ethernet communication", does not necessarily require a VISA installation on the remote controller side.

Socket connections are established on a specially defined port. The socket address is a combination of the IP address or hostname of the sensor and the number of the port configured for remote control. The power sensors use port number 5025 for this purpose.

https://allice.de/rohde-schwarz/value-instruments/

8   Contacting Customer Support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz product, contact our customer support center. A team of highly qualified engineers provides support and works with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz products.

Contact information

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

Figure 8-1: QR code to the Rohde & Schwarz support page

https://allice.de/rohde-schwarz/value-instruments/

Index

https://allice.de/rohde-schwarz/value-instruments/