# R&S®ZNLE
# Vector Network Analyzer
# Getting Started

**ROHDE & SCHWARZ**
Make ideas real

This manual applies to the following R&S®ZNLE models with firmware version 1.61 and higher:

- R&S®ZNLE3, 1 MHz* to 3 GHz, 2 ports, N(f) connectors, order no. 1323.0012K53

- R&S®ZNLE4, 1 MHz* to 4.5 GHz, 2 ports, N(f) connectors, order no. 1323.0012K54

- R&S®ZNLE6, 1 MHz* to 6 GHz, 2 ports, N(f) connectors, order no. 1323.0012K56

- R&S®ZNLE14, 1 MHz* to 14 GHz, 2 ports, N(f) connectors, order no. 1323.0012K64

- R&S®ZNLE18, 1 MHz* to 18 GHz, 2 ports, N(f) connectors, order no. 1323.0012K70

* 100 kHz with R&S®ZNLE-B100 low frequency extension option

# 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 chapters.

**Intended use**

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

**Where do I find safety information?**

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

- In Chapter 1.1, "Safety instructions", on page 5. The same information is provided in many languages as printed "Safety Instructions". The printed "Safety Instructions" are delivered with the product.

- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

## 1.1 Safety instructions

Products from the Rohde & Schwarz group of companies are manufactured according to the highest technical standards. To use the products safely, follow the instructions provided here and in the product documentation. Keep the product documentation nearby and offer it to other users.

Use the product only for its intended use and within its performance limits. Intended use and limits are described in the product documentation such as the data sheet, manuals and the printed "Safety Instructions". If you are unsure about the appropriate use, contact Rohde & Schwarz customer service.

Using the product requires specialists or specially trained personnel. These users also need sound knowledge of at least one of the languages in which the user interfaces and the product documentation are available.

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 service at http://www.customersupport.rohde-schwarz.com.

**Lifting and carrying the product**

The maximum weight of the product is provided in the data sheet. To move the product safely, you can use lifting or transporting equipment such as lift trucks and forklifts. Follow the instructions provided by the equipment manufacturer.

**Choosing the operating site**

Only use the product indoors. The product casing is not waterproof. Water that enters can electrically connect the casing with live parts, which can lead to electric shock, serious personal injury or death if you touch the casing. If Rohde & Schwarz provides accessories designed for your product, e.g. a carrying bag, you can use the product outdoors.

Unless otherwise specified, you can operate the product up to an altitude of 2000 m above sea level. The product is suitable for pollution degree 2 environments where nonconductive contamination can occur. For more information on environmental conditions such as ambient temperature and humidity, see the data sheet.

**Setting up the product**

Always place the product on a stable, flat and level surface with the bottom of the product facing down. If the product is designed for different positions, secure the product so that it cannot fall over.

If the product has foldable feet, always fold the feet completely in or out to ensure stability. The feet can collapse if they are not folded out completely or if the product is moved without lifting it. The foldable feet are designed to carry the weight of the product, but not an extra load.

If stacking is possible, keep in mind that a stack of products can fall over and cause injury.

If you mount products in a rack, ensure that the rack has sufficient load capacity and stability. Observe the specifications of the rack manufacturer. Always install the products from the bottom shelf to the top shelf so that the rack stands securely. Secure the product so that it cannot fall off the rack.

**Connecting to power**

The product is an overvoltage category II product. Connect the product to a fixed installation used to supply energy-consuming equipment such as household appliances and similar loads. Keep in mind that electrically powered products have risks, such as electric shock, fire, personal injury or even death.

Take the following measures for your safety:

● Before switching on the product, ensure that the voltage and frequency indicated on the product match the available power source. If the power adapter does not adjust automatically, set the correct value and check the rating of the fuse.

● Only use the power cable delivered with the product. It complies with country-specific safety requirements. Only insert the plug into an outlet with protective conductor terminal.

● Only use intact cables and route them carefully so that they cannot be damaged. Check the power cables regularly to ensure that they are undamaged. Also ensure that nobody can trip over loose cables.

● If the product needs an external power supply, use the power supply that is delivered with the product or that is recommended in the product documentation or a power supply that conforms to the country-specific regulations.

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

● Ensure that you can disconnect the product from the power source at any time. Pull the power plug to disconnect the product. The power plug must be easily accessible. If the product is integrated into a system that does not meet these requirements, provide an easily accessible circuit breaker at the system level.

**Cleaning the product**

Use a dry, lint-free cloth to clean the product. When cleaning, keep in mind that the casing is not waterproof. Do not use liquid cleaning agents.

**Meaning of safety labels**

Safety labels on the product warn against potential hazards.

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

## 1.2     Labels on R&S ZNLE

Labels on the casing inform about:

- Personal safety, see "Meaning of safety labels" on page 7
- Product and environment safety, see Table 1-1
- Identification of the product, see Chapter 4.2.8, "Device ID", on page 39

*Table 1-1: Labels regarding R&S ZNLE and environment safety*

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

## 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 Korea certification class A

이 기기는 업무용(A급) 전자파 적합기기로서 판매자 또는 사용자는 이 점을 주의하시기 바라며, 가정외의 지역에서 사용하는 것을 목적으로 합니다.

# 2     Documentation overview

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

www.rohde-schwarz.com/manual/ZNLE

## 2.1     Getting started manual

Introduces the R&S ZNLE and describes how to set up and start working with the product. Includes basic operations, typical measurement examples, and general information, e.g. safety instructions, etc.

A printed version is delivered with the instrument. A PDF version is available for download on the Internet.

## 2.2     User manuals and help

The 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 contents of the user manual are available as help in the R&S ZNLE. The help offers quick, context-sensitive access to the complete information for the instrument and its firmware.

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

## 2.3     Service manual

Describes the performance test for checking the rated specifications, module replacement and repair, firmware update, troubleshooting and fault elimination, and contains mechanical drawings and spare part lists.

The service manual is available for registered users on the global Rohde & Schwarz information system (GLORIS):

https://gloris.rohde-schwarz.com/irj/portal/SearchDetailView?downloadContainerID=454954

## 2.4 Instrument security procedures

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

## 2.5 Printed safety instructions

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

## 2.6 Data sheets and brochures

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

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

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

## 2.7 Release notes and open source acknowledgment (OSA)

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

The open-source acknowledgment document provides verbatim license texts of the used open source software.

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

## 2.8 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/ZNLE

## 2.9 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 rear panel.

# 3     Preparing for use

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

## 3.1     Lifting and carrying

The carrying handles are designed to lift or carry the instrument. Do not apply excessive external force to the handles.

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

## 3.2     Unpacking and checking

1. Unpack the R&S ZNLE carefully.

2. Retain the original packing material. Use it when transporting or shipping the R&S ZNLE 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.

## 3.3    Choosing the operating site

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

See also "Choosing the operating site" on page 6.

**Electromagnetic compatibility classes**

The electromagnetic compatibility (EMC) class indicates where you can operate the product. The EMC class of the product is given in the data sheet under "General data".

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

## 3.4    Setting up the R&S ZNLE

The R&S ZNLE is designed for use on a bench top or in a rack.

See also:
● "Setting up the product" on page 6
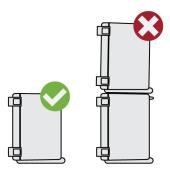● "Intended use" on page 5

### 3.4.1    Placing the R&S ZNLE on a bench top

**To place the product on a bench top**

1.  Place the product on a stable, flat and level surface. Ensure that the surface can support the weight of the product. For information on the weight, see the data sheet.

2.  **CAUTION!** Foldable feet can collapse. See "Setting up the product" on page 6.

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

3.  **CAUTION!** The product can fall over and cause injury. The top surface is too small for stacking. Never stack another product on top of the product.

    

    As an alternative, you can mount several products in a rack.

4.  **NOTICE!** Overheating can damage the product.

    Prevent overheating as follows:
    *   Keep a minimum distance of 10 cm between the fan openings of the product and any object in the vicinity.
    *   Do not place the product next to heat-generating equipment such as radiators or other products.

### 3.4.2    Mounting the R&S ZNLE in a rack

**To prepare the rack**

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

2. **NOTICE!** Insufficient airflow can cause overheating and damage the product. Design and implement an efficient ventilation concept for the rack.

**To mount the R&S ZNLE in a rack**

1. Use an adapter kit to prepare the R&S ZNLE for rack mounting.
   a) Order the rack adapter kit designed for the R&S ZNLE. For the order number, see the data sheet.
   b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.

2. Lift the R&S ZNLE to shelf height.

3. Grab the handles and push the R&S ZNLE onto the shelf until the rack brackets fit closely to the rack.

4. Tighten all screws in the rack brackets with a tightening torque of 1.2 Nm to secure the R&S ZNLE in the rack.

**To unmount the R&S ZNLE from a rack**

1. Loosen the screws at the rack brackets.

2. Remove the R&S ZNLE from the rack.

3. If placing the R&S ZNLE on a bench top again, unmount the adapter kit from the R&S ZNLE. Follow the instructions provided with the adapter kit.

# 3.5 Connecting to power

The R&S ZNLE is equipped with an AC power supply connector.

## 3.5.1 Connecting the AC power

The R&S ZNLE can be used with different AC power voltages and adapts itself automatically to it. Refer to the datasheet for the requirements of voltage and frequency.

For safety information, see "Connecting to power" on page 7.

**R&S®ZNLE**
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**To connect the AC power**

1. Plug the AC power cable into the AC power connector on the rear panel of the instrument. Only use the AC power cable delivered with the R&S ZNLE.

2. Plug the AC power cable into a power outlet with ground contact.

   The required ratings are listed next to the AC power connector and in the data sheet.

For details on the connector, refer to Chapter 4.2.1, "AC power supply connection and main power switch", on page 37.

# 3.6    Switching on or off

*Table 3-1: Overview of power states*

| Status | LED on Power key | Position of main power switch |
|--------|------------------|-------------------------------|
| Off | ⚪ gray | [0] |
| Standby | 🟠 orange | [I] |
| Ready | 🟢 green | [I] |

**To switch on the R&S ZNLE**

The R&S ZNLE is off but connected to power.

1. Set the switch on the power supply to position [I].
   See Chapter 4.2.1, "AC power supply connection and main power switch", on page 37.

   The LED of the Power key is orange.

   See Chapter 4.1.2, "Power key", on page 31.

   **Note:** If the R&S ZNLE was disconnected from power before it was switched off regularly, it automatically switches back on when the power is reconnected.

Using a LAN-controlled power switch, you can take advantage of this behavior to switch the device on and off remotely.

2. Press the Power key.

The LED changes to green.
The R&S ZNLE boots.

After booting, the instrument is ready for operation.

**To shut down the product**

The product is in the ready state.

► Press the [Power] key.

The operating system shuts down. The LED changes to orange.

**To disconnect from power**

The R&S ZNLE is in the standby state.

1. **NOTICE!** Risk of data loss. If you disconnect the product from power when it is in the ready state, you can lose settings and data. Shut it down first.

   Set the switch on the power supply to position [0].
   See Chapter 4.2.1, "AC power supply connection and main power switch", on page 37.

   The LED of the standby key is switched off.

2. Disconnect the R&S ZNLE from the power source.

# 3.7    Connecting to LAN

You can connect the instrument to a LAN for remote operation via a PC.

Provided the network administrator has assigned you the appropriate rights and adapted the Windows firewall configuration, you can use the interface, for example:

● To transfer data between a controlling device and the test device, e.g. to run a remote control program

● To access or control the measurement from a remote computer using the "Remote Desktop" application (or a similar tool)

● To connect external network devices (e.g. printers)

● To transfer data from a remote computer and back, e.g. using network folders

**Network environment**

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

● Install the latest firmware to reduce security risks.

● For internet or remote access, use secured connections, if applicable.

● Ensure that the network settings comply with the security policies of your company. Contact your local system administrator or IT department before connecting your product to your company LAN.

● When connected to the LAN, the product may potentially be accessed from the internet, which may be a security risk. For example, attackers might misuse or damage the product. For more information about IT security and how to operate the product in a secure LAN environment, see the Rohde & Schwarz white paper 1EF96: Malware Protection Windows 10.

► **NOTICE!** Risk of network failure.
Consult your network administrator before performing the following tasks:
  ● Connecting the instrument to the network
  ● Configuring the network
  ● Changing IP addresses
  ● Exchanging hardware

Errors can affect the entire network.

Connect the R&S ZNLE to the LAN via the LAN interface on the rear panel of the instrument.

Windows automatically detects the network connection and activates the required drivers.

By default, the R&S ZNLE is configured to use DHCP and no static IP address is configured.

The default instrument name is <Type><variant>-<serial_number>, for example, ZNLE3-123456. For information on determining the serial number, see Chapter 4.2.8, "Device ID", on page 39.

For more information on LAN configuration, see the R&S ZNLE user manual.

## 3.8     Connecting a keyboard

The keyboard is detected automatically when it is connected. The default input language is English – US.

However, you can also connect foreign language keyboards; currently the following languages are supported for the R&S ZNLE:

● German

● Swiss

● French

● Russian

**To configure the keyboard language**

1. To access the Windows operating system, press the Windows key on the external keyboard.

2. Select "Start > Settings > Time & language > Region & language > Add a language" .

## 3.9     Connecting an external monitor

You can connect an external monitor (or projector) to the "DVI" connector on the rear panel of the R&S ZNLE (see also Chapter 4.2.7, "DVI", on page 39).

**Screen resolution and format**

The touchscreen of the R&S ZNLE is calibrated for a 16:10 format. If you connect a monitor or projector using a different format (e.g. 4:3), the calibration is not correct and the screen does not react to your touch actions properly.

The touchscreen has a screen resolution of 1280x800 pixels. Usually, the display of the external monitor is a duplicate of the instrument's monitor.

If you configure the external monitor to be used as the *only* display in the Windows configuration dialog box ("Show only on 2"), the maximum screen resolution of the monitor is used. In this case, you can maximize the R&S ZNLE application window and see even more details. You cannot change the monitor's screen resolution via the standard Windows configuration dialog box.

The R&S ZNLE supports a minimum resolution of 1280x768 pixels.

1. Connect the external monitor to the R&S ZNLE.

2. Press the [Setup] key.

3. Press the "Display" softkey.

4. Select the "Configure Monitor" tab in the "Display" dialog box.

   The standard Windows "Screen Resolution" dialog box is displayed.

5. If necessary, change the screen resolution. Consider the information in the note above.

6. Select the instrument for display:
   - "Display 1" : internal monitor only
   - "Display 2" : external monitor only
   - "Duplicate" : both internal and external monitor

7. Tap "Apply" to try out the settings before they are accepted permanently, then you can easily return to the previous settings, if necessary.

8. Select "OK" if the settings are suitable.

**Fixing a wrong touchscreen mapping**

For instruments that are equipped with a system image version < 0.8, the touchscreen function is erroneously mapped to the external monitor by default. This mismatch is particularly inconvenient in extended display mode, where touch gestures on the instrument screen actually operate on the external screen. In duplicate monitor mode, touch screen operation also malfunctions if the resolutions of the internal and external display do not match.

To fix the mapping between touchscreen and display, connect an external monitor to the R&S ZNLE and proceed as follows:

1.  Select [Setup] > "Display" > "Configure Monitor" > "Display Switch" to bring up the Windows 10 "PROJECT" notification window.
    Or press [Win]+[P] on a connected keyboard.

2.  Select "Extend".

3.  In the Windows task bar, search for "tablet" and select "Tablet PC Settings"

4.  In the "Tablet PC Settings" dialog, select "Setup…". Enter the administrator password to proceed.

    Observe the message "Touch this screen to identify it as the touchscreen" on the **internal** touch screen.

5.  Tap on the internal touch screen.

6.  Press [ENTER].

    Observe the message "Touch this screen to identify it as the touchscreen" on the **external** screen.

7.  If the external monitor is also a touchscreen, tap on it.

8.  Press [ENTER].

    Touch screen operation functions correctly now. Use the "PROJECT" flyout again to select the appropriate display mode.

Refer to the "Versions + Options" tab of the [Setup] > "System Configuration" dialog to determine the "Image" version of your instrument.

## 3.10   Windows operating system

The instrument contains the Windows operating system which has been configured according to the instrument's features and needs. Changes in the system setup are only required when peripherals like a keyboard or a printer are installed or if the network configuration does not comply with the default settings. After the R&S ZNLE is started, the operating system boots and the instrument firmware is started automatically.

**Tested software**

The drivers and programs used on the instrument under Windows are adapted to the instrument. Only install update software released by Rohde & Schwarz to modify existing instrument software.

You can install additional software on the instrument; however, additional software can impair instrument function. Thus, run only programs that Rohde & Schwarz has tested for compatibility with the instrument software.

The following program packages have been tested:

- Symantec Endpoint Security – virus-protection software
- FileShredder - for reliable deletion of files on the hard disk

**Service packs and updates**

Microsoft regularly creates security updates and other patches to protect Windows-based operating systems. They are released through the Microsoft Update website and associated update server. Update instruments using Windows regularly, especially instruments that connect to a network.

**Firewall settings**

A firewall protects an instrument by preventing unauthorized users from gaining access to it through a network. Rohde & Schwarz highly recommends using the firewall on your instrument. Rohde & Schwarz instruments are shipped with the Windows firewall enabled. All ports and connections for remote control are enabled.

Note that changing firewall settings requires administrator rights.

**Virus protection**

Take appropriate steps to protect your instruments from infection. Use strong firewall settings and scan any removable storage device used with a Rohde & Schwarz instrument regularly. It is also recommended that you install anti-virus software on the instrument. Rohde & Schwarz does NOT recommend running anti-virus software in the background ("on-access" mode) on Windows-based instruments, due to potentially degrading instrument performance. However, Rohde & Schwarz does recommend running it during non-critical hours.

For details and recommendations, see the following Rohde & Schwarz white paper:

- 1EF96: Malware Protection Windows 10

**To access the "Start" menu**

The Windows "Start" menu provides access to the Windows functionality and installed programs.

► Press the "Windows" key on the front panel, or press the "Windows" key or the [CTRL + ESC] key combination on the (external) keyboard.

The "Start" menu and the Windows taskbar are displayed.

The Windows taskbar also provides quick access to commonly used programs, for example Paint or WordPad. IECWIN, the auxiliary remote control tool provided free of charge and installed by Rohde & Schwarz, is also available from the taskbar or "Start" menu.

For details on the IECWIN tool, see the "Network and Remote Control" chapter of the R&S ZNLE user manual.

All necessary system settings can be defined in the "Start > Settings" menu.

For required settings, refer to the Windows documentation and to the hardware description.

## 3.11    Logging on

Windows requires that users identify themselves by entering a user name and password in a login window. By default, the R&S ZNLE provides two user accounts:

- **"Instrument"** : a standard user account with limited access
- **"Admin"** or **"Administrator"** (depends on firmware image): an administrator account with unrestricted access to the computer/domain

Some administrative tasks require administrator rights (e.g. the configuration of a LAN network). Refer to the description of the basic instrument Setup ([Setup] menu) to find out which functions are affected.

**Passwords**

For all default user accounts, the initial password is *894129*. Note that this password is very weak, and we strongly recommend that you change the password for both users after initial login. An administrator can change the password in Win-

dows for any user at any time via "Start > Settings > Account > SignIn Options > Password > Change".

**Auto-login**

When shipped, the instrument automatically logs on the default "Instrument" user to Windows using the default password. This function is active until an administrator explicitly deactivates it or changes the password.

ⓘ **Changing the password and use of auto-login function**

Note that when you change the default password, the default auto-login function no longer works!

In this case, you must enter the new password manually to log on.

**Adapting the auto-login function to a new password**

If you change the password that is used during auto-login, this function no longer works. Adapt the settings for the auto-login function first.

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S ZNLE (see also ).

2. Open the
   `C:\Users\Public\Documents\Rohde-Schwarz\ZNL\user\user\ AUTOLOGIN.REG` file in any text editor (e.g. Notepad).

3. In the line `"DefaultPassword"="894129"`, replace the default password (`894129`) by the new password for automatic login.

4. Save the changes to the file.

5. In the Windows "Start" menu, select "Run".
   The "Run" dialog box is displayed.

6. Enter the command
   `C:\Users\Public\Documents\Rohde-Schwarz\ZNL\user\user\ AUTOLOGIN.REG`.

7. Press the [ENTER] key to confirm.
   The auto-login function is reactivated with the changed password. It will be applied the next time the instrument is switched on.

**Switching users when using the auto-login function**

Which user account is used is defined during login. If auto-login is active, the login window is not displayed. However, you can switch the user account to be used even when the auto-login function is active.

1. Select the "Windows" icon in the toolbar to access the operating system of the R&S ZNLE (see also ).

2. Press [CTRL] + [ALT] + [DEL], then select "Sign out".

   The "Login" dialog box is displayed, in which you can enter the different user account name and password.

For information on deactivating and reactivating the auto-login function, see the R&S ZNLE user manual.

## 3.12    Considerations for test setup

**Cable selection and electromagnetic interference (EMI)**

Electromagnetic interference (EMI) can affect the measurement results.

To suppress electromagnetic radiation during operation:

● Use high-quality shielded cables, for example, double-shielded RF and LAN cables.
● Always terminate open cable ends.
● Ensure that connected external devices comply with EMC regulations.

**Preventing electrostatic discharge (ESD)**

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

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

   Ground yourself to prevent electrostatic discharge damage:

   a) Use a wrist strap and cord to connect yourself to ground.

b) Use a conductive floor mat and heel strap combination.

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**NOTICE**

**Instrument damage caused by electrostatic discharge**

If you are working in an environment where strong ESD discharges are possible, for additional protection Rohde & Schwarz recommends using broadband limiters R&S ZN-B13 (stock number 1303.7840.02) at each port of your R&S ZNLE3|4|6.

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**Signal input and output levels**

Information on signal levels is provided in the data sheet and on the instrument, next to the connector. Keep the signal levels within the specified ranges to avoid damage to the R&S ZNLE and connected devices.

# 4 Instrument tour

## 4.1 Front panel view

This chapter describes the front panel, including all function keys and connectors.



*Figure 4-1: Front panel view*
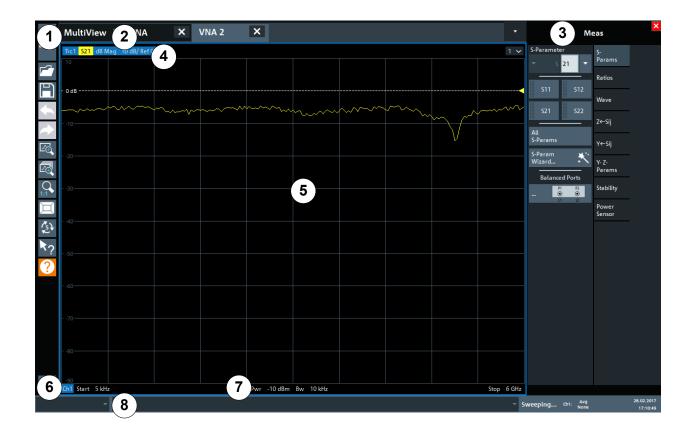
1 = Power key
2 = USB (2.0) connectors
3 = System keys
4 = Touchscreen
5 = Function keys
6 = Keypad
7 = Navigation controls
8 = Port 1
9 = Port 2

## 4.1.1 Touchscreen

All measurement results are displayed on the screen on the front panel. Additionally, the screen display provides status and setting information and allows you to switch between various measurement tasks. The screen is touch-sensitive, offering an alternative means of user interaction for quick and easy handling of the instrument.

*Figure 4-2: Touchscreen elements*

1 = Toolbar with standard application functions, e.g. print, save/open file etc.
2 = Tabs for individual channel setups
3 = Softtool panel (a.k.a. softkey bar)
4 = Window title bar with diagram-specific (trace) information
5 = Measurement results (diagram) area
6 = Channel list
7 = Diagram footer with diagram-specific information
8 = Instrument status bar for error messages and date/time display

Any user interface elements that react to a click by a mouse pointer also react to a tap on the screen, and vice versa. Using touchscreen gestures, you can perform the following tasks (among others).

(See Chapter 5, "Trying out the instrument", on page 40)

- Changing a setting
- Changing the display
- Changing the displayed result range in a diagram
- Moving a marker

- Zooming into a diagram
- Selecting a new evaluation method
- Scrolling through a result list or table
- Saving or printing results and settings

To imitate a right-click by mouse using the touchscreen, for example to open a context-sensitive menu for a specific item, press the screen for about 1 second.

For details on touchscreen gestures, see Chapter 6.4, "Touchscreen gestures", on page 64.

### 4.1.2    Power key

The [Power] key is located on the lower left corner of the front panel. It starts up and shuts down the instrument.

See also "Connecting to power" on page 7 and Chapter 3.5, "Connecting to power", on page 16.

### 4.1.3    USB

The front panel provides two female USB connectors (USB-A, 2.0 standard) to connect devices like a keyboard or a mouse. A memory stick can be connected to store and reload instrument settings and measurement data.

The rear panel provides further USB connectors (standard 3.0), see Chapter 4.2.5, "USB", on page 38.

### 4.1.4    System keys

System keys set the instrument to a predefined state, change basic settings, and provide print and display functions.

A detailed description of the corresponding functions is provided in the R&S ZNLE user manual.

*Table 4-1: System keys*

| System key | Assigned functions |
|---|---|
| [Preset] | Resets the instrument to the default state. |
| [Setup] | Provides basic instrument configuration functions, e.g.:<br>• Reference frequency (external/internal)<br>• Date, time, display configuration<br>• LAN interface<br>• Firmware update and enabling of options<br>• Information about instrument configuration incl. firmware version and system error messages<br>• Service support functions (self-test etc.) |
| [Mode] | Manages channel setups |
| [Print] | Provides configuration settings for the print function |
| [FILE] | Provides save/recall functions for instrument settings and measurement results |
|  | Switches between the on-screen keyboard display:<br>• At the top of the screen<br>• At the bottom of the screen<br>• Off |

## 4.1.5    Function keys

Function keys provide access to the most common measurement settings and functions.

A detailed description of the corresponding functions is provided in the R&S ZNLE user manual.

The labels indicated in *italics* (blue font color on the instrument) are not relevant for the R&S ZNLE.

*Table 4-2: Function keys*

| Function key | Assigned functions |
|---|---|
| [Freq] | Defines the sweep range. |
| [Span] | |
| [Scale]<br>*[Ampt]* | Defines the scaling and zooming of diagrams. |

| Function key | Assigned functions |
|---|---|
| [Mkr] | Defines and positions absolute and relative measurement markers (markers and delta markers).<br><br>Selects special marker functions |
| [Mkr->] | Used for search functions of the measurement markers (maximum/minimum of the trace).<br><br>Assigns the marker frequency to the center frequency, and the marker level to the reference level.<br><br>Restricts the search area (Search Limits) and characterizes the maximum points and minimum points (Peak Excursion). |
| [Bw Avg Power] | Defines the power of the internal signal sources, selects the IF bandwidths, and sets up averaging. |
| [Sweep] | Defines the sweep type and other sweep parameters; controls sweep execution. |
| [Trace] | Configures the graphical analysis of measurement results. |
| [Trig] | Defines how measurement sweeps are triggered. |
| [Offset Embed] | Contains functions for deembedding/embedding the DUT from/into physical/virtual (matching) networks placed between the calibrated reference plane and the DUT. |
| [Meas] | Selects the quantities to be measured and displayed. |
| [Format]<br>*[Config]* | Selects the trace format (dB magnitude, Smith, etc.). |
| [Display Lines] | Configures display lines and limit lines. |
| [Cal]<br>*[Single]* | Provides all functions related to system error calibration. |
| [Channel]<br>*[Cont]* | Creates and deletes channel setups and optimize the measurement process. |

## 4.1.6 Keypad

The keypad is used to enter numeric parameters, including the corresponding units. It contains the following keys:

*Table 4-3: Keys on the keypad*

| Type of key | Description |
|---|---|
| Decimal point | Inserts a decimal point "." at the cursor position. |
| Sign key | Changes the sign of a numeric parameter. For alphanumeric parameters, inserts a "-" at the cursor position. |

| Type of key | Description |
|---|---|
| Unit keys (G/n, M/µ, k/m, x1) | Adds the selected unit to the entered numeric value and complete the entry. |
| | For level entries (e.g. in dB) or dimensionless values, all units have the value "1" as multiplying factor. Thus, they have the same function as an [ENTER] key. |
| [ESC] | Closes all kinds of dialog boxes, if the edit mode is not active. Quits the edit mode, if the edit mode is active. In dialog boxes that contain a "Cancel" button it activates that button. |
| | For "Edit" dialog boxes the following mechanism is used: <br>• If data entry has been started, it retains the original value and closes the dialog box. <br>• If data entry has not been started or has been completed, it closes the dialog box. |
| ⌫ <br><br>(BACKSPACE) | If an alphanumeric entry has already been started, this key deletes the character to the left of the cursor. |
| [ENTER] | • Concludes the entry of dimensionless entries. The new value is accepted. <br>• With other entries, this key can be used instead of the "Hz/dB" unit key. <br>• In a dialog box, selects the default or focused element. |

## 4.1.7  Navigation controls

The navigation controls include a rotary knob and navigation keys. They allow you to navigate within the display or within dialog boxes.

💡 **Navigating in tables**

The easiest way to navigate within tables (both in result tables and configuration tables) is to scroll through the entries with your finger on the touchscreen.

### 4.1.7.1  Rotary knob



The rotary knob has several functions:

• For numeric entries: increments (clockwise direction) or decrements (counterclockwise direction) the instrument parameter at a defined step width

- In lists: toggles between entries
- For markers, limit lines, and other graphical elements on the screen: moves their position
- For active scroll bars: moves the scroll bar vertically
- For dialog boxes: Same effect as the Enter key when pressed

### 4.1.7.2    Navigation keys

The navigation keys can be used alternatively to the rotary knob to navigate through dialog boxes, diagrams or tables.

**Arrow Up/Arrow Down Keys**

The <arrow up> or <arrow down> keys do the following:
- For numeric entries: increments (Arrow Up) or decrements (Arrow Down) the instrument parameter at a defined step width
- In a list: scrolls forward and backward through the list entries
- In a table: moves the selection bar vertically
- In windows or dialog boxes with a vertical scroll bar: moves the scroll bar

**Arrow Left/Arrow Right Keys**

The <arrow left> or <arrow right> keys do the following:
- In an alphanumeric edit dialog box, move the cursor.
- In a list, scroll forward and backward through the list entries.
- In a table, move the selection bar horizontally.
- In windows or dialog boxes with horizontal scroll bar, move the scroll bar.

### 4.1.8    Port 1 and port 2



Numbered type N female connectors.

The test ports serve as outputs for the RF stimulus signal and as inputs for the measured RF signals from the DUT (response signals).

● With a single test port, it is possible to generate a stimulus signal and measure the response signal in reflection. For a measurement example, refer to Chapter 5.1.2, "Reflection S-parameter measurement", on page 48.

● With 2 test ports, it is possible to perform full two-port measurements; see Chapter 5.1.1, "Transmission S-parameter measurement", on page 41.

---

**NOTICE**

**Maximum input levels**

The maximum input levels at all test ports according to the front panel labeling or the data sheet must not be exceeded.

In addition, the maximum input voltages of the other input connectors at the rear panel must not be exceeded.

---
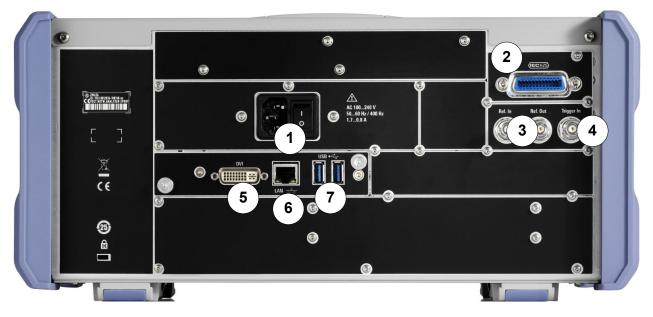
ⓘ  It is recommended that you use a torque wrench when screwing RF cables on the test port connectors.

## 4.2    Rear panel view

This figure shows the rear panel view of the R&S ZNLE. The individual elements are described in more detail in the subsequent sections.

*Figure 4-3: Rear panel view*

1 = AC power supply connection and main power switch
2 = GPIB ("IEC") interface
3 = Reference clock connectors
4 = Trigger input connector
5 = "DVI" connector for external display
6 = "LAN" connector
7 = "USB" (3.0) connectors

ⓘ The meanings of the labels on the R&S ZNLE are described in Chapter 1.2, "Labels on R&S ZNLE", on page 8.

## 4.2.1   AC power supply connection and main power switch

An AC power supply connector and main power switch are located in a unit on the rear panel of the instrument.

Main power switch function:

Position 1: The instrument is in operation.

Position O: The entire instrument is disconnected from the AC power supply.

For details, refer to "Connecting to power" on page 7 and Chapter 3.5, "Connecting to power", on page 16.

### 4.2.2    GPIB interface

The optional GPIB interface (R&S FPL1-B10) is in compliance with IEEE488 and SCPI. A computer for remote control can be connected via this interface. To set up the connection, a shielded cable is recommended.

### 4.2.3    Ref. In / Ref. Out

The Ref. In connectors are used to provide an external reference signal to the R&S ZNLE.

The Ref. Out connectors can be used to provide a reference signal from the R&S ZNLE to other devices that are connected to this instrument.

Various connectors are provided for different reference signals:

| Connector | Reference signal | Usage |
|-----------|-----------------|-------|
| Ref. In | 10 MHz<br>10 dBm | To provide an external reference signal on the R&S ZNLE. |
| Ref. Out | 10 MHz<br>10 dBm | To provide the internal reference signal from the R&S ZNLE to another device continuously. |

### 4.2.4    Trigger In

Use the female Trigger In connector to input an external trigger or gate data. Thus, you can control the measurement using an external signal. The voltage level is 1.4 V. The typical input impedance is 10 kΩ.

### 4.2.5    USB

The rear panel provides two additional female USB (3.0 standard) connectors to connect devices like a keyboard, a mouse or a memory stick (see also Chapter 4.2.5, "USB", on page 38).

### 4.2.6    LAN

The R&S ZNLE is equipped with a 1 GBit Ethernet IEEE 802.3u network interface with Auto-MDI(X) functionality. The assignment of the RJ-45 connector supports

twisted-pair category 5 UTP/STP cables in a star configuration (UTP stands for *unshielded twisted pair*, and STP for *shielded twisted pair*).

For details, see the R&S ZNLE user manual.

## 4.2.7    DVI

You can connect an external monitor or other display device to the R&S ZNLE via the DVI (Digital visual interface) connector to provide an enlarged display.

For details, see Chapter 3.12, "Considerations for test setup", on page 27.

## 4.2.8    Device ID

The unique device identifier is provided as a barcode sticker on the rear panel of the R&S ZNLE.

It consists of the device order number and a serial number.



The serial number is used to define the **default instrument name**, which is:

<Type><variant>-<serial_number>

For example, `ZNLE3-123456`.

The instrument name is required to establish a connection to the instrument in a LAN.

# 5     Trying out the instrument

This chapter introduces the most important functions and settings of the R&S ZNLE step by step. The complete description of the functionality and its usage is given in the R&S ZNLE User Manual. Basic instrument operation is described in Chapter 6, "Operating the instrument", on page 55.

**Prerequisites**

● The instrument is set up, connected to the mains system, and started up as described in Chapter 3, "Preparing for use", on page 13.

## 5.1     Performing measurements

This chapter takes you through a sample session with a R&S ZNLE network analyzer and describes basic operation tasks.

(i) **Prerequisite**

The instrument is set up, connected to the mains system, and started up as described in Chapter 3, "Preparing for use", on page 13.

Use the "S-Parameter Wizard" accessible via [Meas] > "S-Params" > "S-Param Wizard..." to measure S-parameters in a straightforward way. The wizard provides a series of dialogs where you can select the test setup, screen configuration and measurement parameters, configure the essential channel settings and perform a guided calibration.

**Measurement stages in the wizard**

The individual dialogs of the "S-Parameter Wizard" correspond to the typical stages of any measurement:

1. Select the test setup.

2. Define port impedances.

3. Select the measurement parameters and the diagrams.

4. Define the sweep range.

5. Adjust the receiver and source settings (measurement bandwidth, source power).

6. Perform a calibration.

## 5.1.1 Transmission S-parameter measurement

In a transmission measurement, the analyzer transmits a stimulus signal to the input port of the device under test (DUT) and measures the transmitted wave at the DUT's output port. The trace settings allow you to select the measured quantities and display formats, depending on what you want to learn from the data. A minimum of two analyzer test ports are required for transmission measurements.
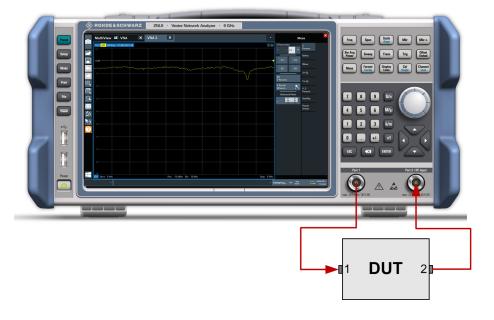
In the following example, the analyzer is set up for a two-port transmission measurement. A frequency sweep range is selected, the instrument is calibrated and the measurement result is analyzed using various display formats.

### 5.1.1.1 Connecting the instrument for transmission measurements

To prepare a transmission measurement, you have to connect your DUT (which for simplicity we assume to have appropriate connectors) in-between a pair of analyzer test ports. It is recommended that you preset the R&S ZNLE to start from a well-defined instrument state.

1. Connect the DUT between test ports 1 and 2 of the network analyzer as shown above.

2. Use the [Preset] key to restore a well-defined instrument state.

   The analyzer is now set to its default state. The default measured quantity is the transmission S-parameter $S_{21}$.



💡 Select [Trace] and use the control elements in the "Traces" softtool tab if you wish to create additional traces and diagrams.

### 5.1.1.2   Selecting the sweep range and other parameters

After a system preset the display shows a diagram with a dB magnitude scale, and the S-parameter $S_{21}$ is selected as a measured quantity. This S-parameter is the forward transmission coefficient of the DUT. It is defined as the ratio of the transmitted wave at the DUT's output port (port no. 2) to the incident wave at the DUT's input port (port no. 1).

The R&S ZNLE automatically adjusts its internal source and receiver to the selected measured quantities: For an $S_{21}$ measurement, a stimulus signal (termed $a_1$) is transmitted at the analyzer port no. 1; the transmitted wave (termed $b_2$) is measured at port 2. The stimulus signal from the analyzer port no. 2 is not needed except for some calibration types.
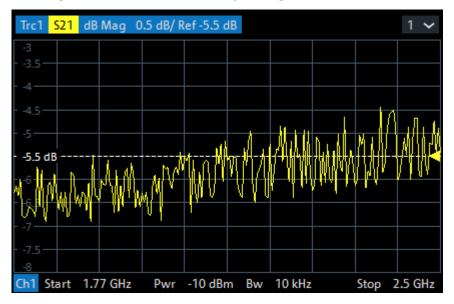
By default the sweep range is set to the frequency range of the analyzer, which can be unsuitable for your DUT. The following procedure shows you how to configure a smaller sweep range.

1. Select [Freq] and set the "Start Frequency" to the lowest frequency you want to measure (e.g. 1.77 GHz). For convenient data entry, double-tap/click the input field to open the "Numeric Editor".

   **Tip:** If you use the keypad at the front panel for data entry, type [1][.][7][7] and terminate the entry with the [G/n] key.
   Refer to Chapter 6.3, "Entering data", on page 62 to learn more about entering numeric values and characters.

2. In the "Stop Frequency" input field, enter the highest frequency you want to measure (e.g. 2.5 GHz).

3. Select [Scale] > "Scale Values" and activate the "Auto Scale Trace" function. The analyzer adjusts the scale of the diagram to fit in the entire $S_{21}$ trace, leaving an appropriate display margin.

### 5.1.1.3  Calibrating the instrument

Calibration (system error correction) is the process of eliminating systematic, reproducible errors from the measurement results. E.g., in the current test setup, the connecting cables between the analyzer ports and the DUT introduce an attenuation and a phase shift of the waves. Both effects impair the accuracy of the S-parameter measurement.

The analyzer provides a wide range of sophisticated calibration methods for all types of measurements. The calibration method to select depends on the expected system errors, the accuracy requirements of the measurement, on the test setup and on the types of calibration standards available.

The following example requires a calibration kit with a male Through standard with known transmission characteristics for the related test port connector type and gender. With a single Through, it is possible to perform a transmission normalization, compensating for a frequency-dependent attenuation and phase shift in the signal paths.

Due to the R&S ZNLE's calibration wizard, calibration is a straightforward, guided process.

1. Replace the DUT by the Through standard of your calibration kit. Make sure to disconnect all calibration units.

2. Select [Cal] > "Start... (Manual)" to open the "Calibration Setting" wizard.

3. Select the port combination Port 1 (P1) and Port 2 (P2) and the calibration type "Trans Norm". Make sure to define port 1 as the source port.

4. Select "Next" to proceed to the next page of the "Calibration Setting" wizard.

5. Select the test port connector type and gender (here: N 50 Ω, female, corresponding to a male Through standard), and the calibration kit (here: R&S ZV-Z121).



6. Tap"Start".

7. The calibration dock widget indicates the standard measurements that make up a "Trans Norm" calibration.
   Select "Through (mm)" to initiate the measurement of the connected Through standard. Measuring the isolation between ports 1 and 2 is optional. Skip it for now.



The analyzer performs a calibration sweep for the measured quantity $S_{21}$. The magnitude and phase of the result is displayed in two diagrams, together with the expected typical result for a Through standard. The similarity of real and expected traces indicates that the Through standard has been properly connected. After the R&S ZNLE has completed the calibration sweep and calculated the correction data, the "Apply" button is enabled.

8. Select "Apply" to close the wizard.

   The system error correction is calculated and applied to the current channel. A "Cal" label appears in the trace list.
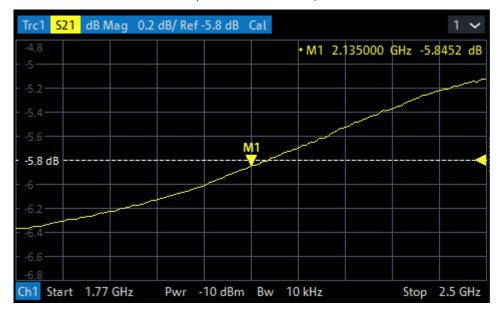
To proceed with the measurement, remove the Through standard and connect the DUT again.

### 5.1.1.4    Evaluating data

The analyzer provides various tools to optimize the display and analyze the measurement data. For instance, you can use markers to determine maxima and minima on the trace, and change the display format to obtain information about the group delay of the transmitted wave.

1. Select [Mkr] > [Mkr] > "Mkr 1".
   This places marker "M1" to its default position (center of the sweep range). A marker symbol (triangle) appears on the trace, a marker info field in the upper right corner of the diagram. The marker info field displays the stimulus value (frequency) and response value (magnitude of the transmission coefficient converted to a dB value) at the marker position.
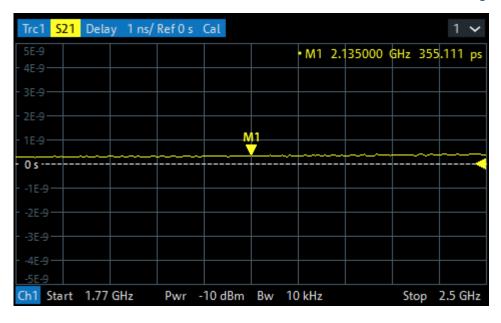


2. Open the [Mkr->] > "Peak" softtool tab and activate "Min" search.
   The marker jumps to the absolute minimum of the curve in the entire sweep range. The marker info field shows the coordinates of the new marker position.

3. Select [Format] and choose the "Delay" of the transmission coefficient as displayed quantity.

   The group delay represents the propagation time of the wave through the DUT; it is displayed in a Cartesian diagram. The marker info field shows the frequency and group delay at the marker position.

Refer to the information on trace formats in the help system or in the user manual to learn more about the diagram properties.

## 5.1.2    Reflection S-parameter measurement
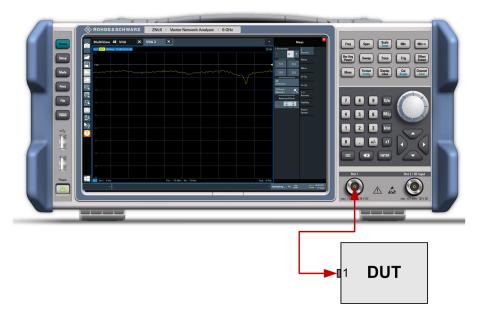
In a reflection measurement, the analyzer transmits a stimulus signal to the input port of the device under test (DUT) and measures the reflected wave. Different trace formats allow you to express and display the results, depending on what you want to learn from the data. Only one analyzer test port is required for reflection measurements.

In principle, a reflection measurement involves the same steps as a transmission measurement. Note the following differences:

- The basic test setup for reflection measurements involves a single DUT and analyzer port. For instance, you can connect the input of your DUT to port 1 of the analyzer as shown below.
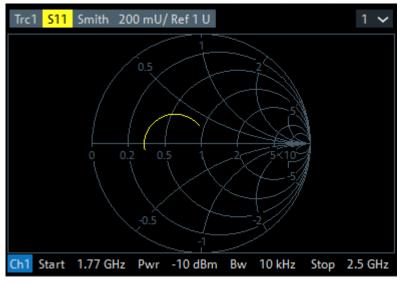
You can also use the basic transmission test setup, e.g. if you want to measure reflection and transmission parameters in parallel.

- The analyzer provides special calibration types for reflection measurements. Use the calibration wizard and select an appropriate type.
  The full 2-port calibration TOSM corrects the system errors for all transmission and reflection S-parameters.

- Some of the trace formats are particularly suited for reflection measurements. For instance, you can display the measured reflection coefficient $S_{11}$ in a Smith chart to obtain the complex input impedance at port 1.

## 5.2　Zooming into the display

To analyze the areas around the peak levels in more detail, we will zoom into a peak.

1. Tap the "Multiple Zoom" icon in the toolbar.

   

   The icon is highlighted to indicate that zoom mode is active.

2. Tap the diagram near the peak and drag your finger to the opposite corner of the zoom area. A white rectangle is displayed from the point where you tapped to the current position.
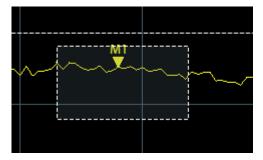
   

   *Figure 5-1: Defining the zoom area*

   When you remove your finger, the zoom area is enlarged in a second (sub-)window.

*Figure 5-2: Zoomed display around a peak*

# 5.3    Saving settings

To restore the results of our measurements later, we will store the instrument settings to a file.

**To save the instrument settings to a file**

1.  Tap the "Save" icon in the toolbar.

    

2.  Press the keyboard key on the front panel to display the online keyboard, as you will have to enter text in the next step.

    

3.  In the "Save" dialog box, tap the "File name" field and enter *MyMultiView-Setup* using the keyboard.

Keep the default "File Type" setting "Instrument with all Channel Setups" to store the configuration of all channel setups.



*Figure 5-3: Saving the instrument settings to a file*

4. Tap the "Save" button.

   The file `MyMultiViewSetup.dfl` is stored in the default directory `C:\ProgramData\Rohde-Schwarz\ZNL-FPL\Save`.

**To load stored instrument settings**

You can restore the settings to the instrument at any time using the settings file.

1. Press the [Preset] button to restore the default instrument settings so you can check that the stored user settings are actually restored afterwards.

2. Tap the "Load" icon in the toolbar.



3. In the "Load" dialog box, select the `MyMultiViewSetup.dfl` file in the default directory `C:\ProgramData\Rohde-Schwarz\ZNL-FPL\Save`.

4. Tap the "Load" button.

   All instrument settings are restored and the display should resemble the instrument display right before the settings were stored.

## 5.4　　Printing and saving results

Finally, after a successful measurement, we will document our results. First we will export the numeric trace data, then we will create a screenshot of the graphical display.

**To export the trace data**

1. Press the [Trace] key on the front panel.

2. Tap the Trace softkey.

3. Tap the "Trace / Data Export" tab.

4. Tap the "Export Trace to ASCII File" button.

5. Enter the file name *MyMultiViewResults*.

   The trace data is stored to `MyMultiViewResults.DAT`

**To create a screenshot of the display**

1. Tap the "Print immediately" icon in the toolbar.



   A screenshot of the current display is created. Note that the colors on the screen are inverted in the screenshot to improve printout results.

2. In the "Save Hardcopy as " > "Portable Network Graphics (PNG)" dialog box, enter a file name, e.g. *MyMultiViewDisplay*.

The screenshot is stored to `MyMultiViewDisplay.png`.



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# 6 Operating the instrument

This chapter provides an overview on how to work with the R&S ZNLE.

(i) **Remote control**

In addition to working with the R&S ZNLE interactively, located directly at the instrument, it is also possible to operate and control it from a remote PC. Various methods for remote control are supported:

* Connecting the instrument to a (LAN) network
* Using the web browser interface in a LAN network
* Using the Windows Remote Desktop application in a LAN network
* Connecting a PC via the GPIB interface

How to configure the remote control interfaces is described in the R&S ZNLE user manual.
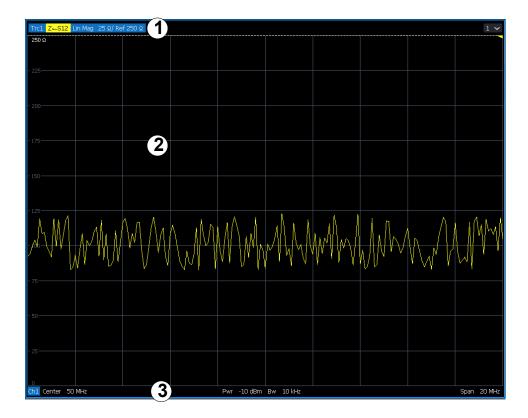
## 6.1 Understanding the Display Information

The following figure shows a measurement diagram. All different information areas are labeled. They are explained in more detail in the following sections.

1 = Window title bar with measurement-specific (trace) information
2 = Diagram area with marker information
3 = Diagram footer with diagram-specific information

**Window title bar**

For each parameter diagram, a window is displayed with the following information in the title bar:



1 = Trace name
2 = Measured parameter
3 = Trace format
4 = Scale per division
5 = Reference value

**Diagram footer**

For each parameter diagram, a window is displayed with the following information in the footer:

Ch1 Center 50 MHz    Pwr  -10 dBm  Bw  10 kHz          Span  20 MHz
 ①        ②              ③          ④                    ⑤

1 = Channel
2 = Center frequency
3 = Power level
4 = Measurement bandwidth
5 = Span

# 6.2    Accessing the functionality

All tasks necessary to operate the instrument can be performed using this user interface. Apart from instrument specific keys, all other keys that correspond to an external keyboard (e.g. arrow keys, ENTER key) operate as specified by Microsoft.

For most tasks, there are at least 2 alternative methods to perform them:

● Using the touchscreen
● Using other elements provided by the front panel, e.g. the keypad, rotary knob, or arrow and position keys.

The measurement and instrument functions and settings can be accessed by selecting one of the following elements:

● System and function keys on the front panel of the instrument
● Softkeys on the touchscreen
● Context menus for specific elements on the touchscreen
● Icons on the tool bar in the touchscreen
● Displayed setting on the touchscreen

## 6.2.1    Toolbar functions

Standard functions can be performed via the icons in the toolbar at the top of the screen.

💡 You can hide the toolbar display, e.g. when using remote control, to enlarge the display area for the measurement results ("Setup" > "Display" > "Displayed Items" ).

See the R&S ZNLE User Manual.

**Print immediately**
Prints the current display (screenshot) as configured.

**Open**
Opens a file from the instrument ("Save/Recall" menu).

**Save**
Stores data on the instrument ("Save/Recall" menu).

**Undo**
Reverts last operation, i.e. the status before the previous action is retrieved.

The undo function is useful, for example, if you are performing a zero span measurement with several markers and a limit line defined and accidentally select a different measurement. In this case, many settings would be lost. However, if you press [UNDO] immediately afterwards, the previous status is retrieved, i.e. the zero span measurement and all settings.

**Note:** The [UNDO] function is not available after a [PRESET] or "Recall" operation. When these functions are used, the history of previous actions is deleted.

**Redo**
Repeats previously reverted operation

**Zoom mode**
Displays a dotted rectangle in the diagram that can be expanded to define the zoom area.

**Multiple zoom mode**
Multiple zoom areas can be defined for the same diagram.

**Zoom off**
Displays the diagram in its original size.

**SmartGrid**
Activates "SmartGrid" mode to configure the screen layout.

**Sequencer**
Opens the "Sequencer" menu to perform consecutive measurements.

**Help (+ Select)**
Allows you to select an object for which context-specific help is displayed
See Chapter 6.5, "Getting help", on page 67

**Help**
Displays context-sensitive help topic for the most recently selected element

See Chapter 6.5, "Getting help", on page 67

**Windows**
Displays the Windows "Start" menu and task bar.

See "To access the "Start" menu" on page 25.

## 6.2.2    Softtools

Softtools display groups of related settings as a tabbed panel. They can be opened via function keys on the (virtual) front panel, or via context menu items.



*Figure 6-1: Scale softtool*

The softtools are displayed in the softkey bar of the instrument. The title area of the softkey bar displays the name of the currently opened softtool.
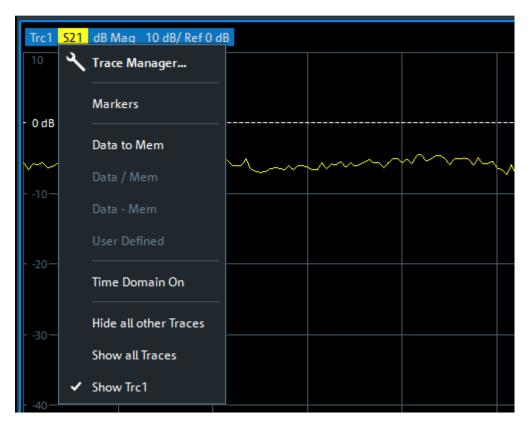
If you close the softkey bar using its close icon, it is automatically reopened the next time a function key is pressed. You can change this behavior in the "User Interface" tab of the "VNA Setup" dialog.

Some controls on the softtool tabs allow you to read and modify settings (e.g. "Ref Value" in the screenshot above), some perform actions (e.g. "Auto Scale Trace"), while others open additional dialogs (button label ends with "...").

## 6.2.3    Context menus

Several items in the diagram area have context menus (for example markers, traces or the channel bar). If you right-click on one of these items (or tap it for about 1 second), a menu is displayed which contains the same functions as the corresponding softkey. This is useful, for example, when the softkey display is hidden.



## 6.2.4    On-screen keyboard

The on-screen keyboard is an additional means of interacting with the instrument without having to connect an external keyboard.

The on-screen keyboard display can be switched on and off as desired using the "On-Screen Keyboard" function key beneath the screen.



When you press this key, the display switches between the following options:

- Keyboard displayed at the top of the screen
- Keyboard displayed at the bottom of the screen
- No keyboard displayed

You can use the TAB key on the on-screen keyboard to move the focus from one field to another in dialog boxes.

# 6.3    Entering data

Data can be entered in dialog boxes using one of the following methods:
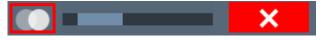
- Using the touchscreen, via the online keyboard
- Using other elements provided by the front panel, e.g. the keypad, rotary knob, or navigation keys
  The rotary knob acts like the [ENTER] key when it is pressed.
- Using a connected external keyboard

**Transparent dialog boxes**

You can change the transparency of the dialog boxes to see the results in the windows behind the dialog box. Thus, you can see the effects that the changes you make to the settings have on the results immediately.

To change the transparency, select the transparency icon at the top of the dialog box. A slider is displayed. To hide the slider, select the transparency icon again.

(The title bar of the dialog box is always slightly transparent and is not affected by the slider.)

**Particularities in windows dialog boxes**

In some cases, e.g. if you want to install a printer, original Windows dialog boxes are used. In these dialog boxes, the rotary knob and function keys do not work. Use the touchscreen instead.

**Entering numeric parameters**

If a field requires numeric input, the keypad provides only numbers.

1. Enter the parameter value using the keypad, or change the currently used parameter value by using the rotary knob (small steps) or the [UP] or [DOWN] keys (large steps).

2. After entering the numeric value via keypad, press the corresponding unit key. The unit is added to the entry.

3. If the parameter does not require a unit, confirm the entered value by pressing the [ENTER] key or any of the unit keys.
   The editing line is highlighted to confirm the entry.

**Entering Alphanumeric Parameters**

If a field requires alphanumeric input, you can use the on-screen keyboard to enter numbers and (special) characters (see Chapter 6.2.4, "On-screen keyboard", on page 61).

**Correcting an entry**

1. Using the arrow keys, move the cursor to the right of the entry you want to delete.

2. Press the [Backspace] key.

   The entry to the left of the cursor is deleted.

3. Enter your correction.

**Completing the entry**

► Press the [ENTER] key or the rotary knob.

**Aborting the entry**

► Press the [ESC] key.
   The dialog box is closed without changing the settings.

# 6.4    Touchscreen gestures

A touchscreen allows you to interact with the software using various finger gestures on the screen. The basic gestures supported by the software and most applications are described here. Further actions using the same gestures may be possible.

**Tapping**

Touch the screen quickly, usually on a specific element.

You can tap most elements on the screen; in particular, any elements you can also click on with a mouse pointer.



*Figure 6-2: Tapping*
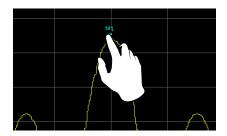
**Double-tapping**

Tap the screen twice, in quick succession.

Double-tap a diagram or the window title bar to maximize a window in the display, or to restore the original size.

**Dragging**

Move your finger from one position to another on the display, keeping your finger on the display the whole time.

By dragging your finger over a table or diagram you can pan the displayed area of the table or diagram to show results that were previously out of view.
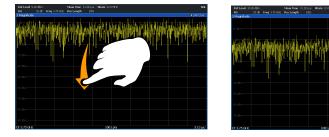


*Figure 6-3: Dragging*

**Pinching and spreading two fingers**

Move two fingers together on the display (pinch) or move two fingers apart on the display (spread).
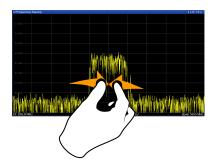
When you pinch two fingers in the display, you decrease the size of the currently displayed area, showing the surrounding areas previously out of view.

When you spread two fingers in the display, you increase the size of the currently displayed area, showing more details.

You can pinch or spread your fingers vertically, horizontally, or diagonally. The direction in which you move your fingers determines which dimension of the display is changed.
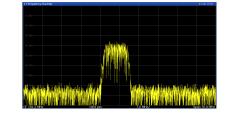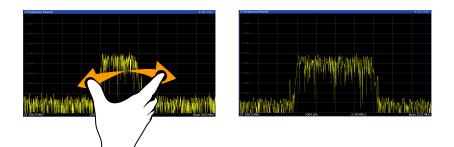
*Figure 6-4: Pinching*



*Figure 6-5: Spreading*

ⓘ **Touch gestures in diagrams change measurement settings**

When you change the display using touch gestures, the corresponding measurement settings are adapted. This is different to selecting an area on the screen in zoom mode, where merely the resolution of the displayed trace points is changed temporarily (graphical zoom).

**Mouse vs. touch actions**

Any user interface elements that react to actions by a mouse pointer also react to finger gestures on the screen, and vice versa. The following touch actions correspond to mouse actions:

*Table 6-1: Correlation of mouse and touch actions*

| Mouse operation | Touch operation |
|---|---|
| Click | Tap |
| Double-click | Double-tap |
| Click and hold | Touch and hold |
| Right-click | Touch, hold for 1 second and release |

| Mouse operation | Touch operation |
|---|---|
| Drag-&-drop (= click and hold, then drag and release) | Touch, then drag and release |
| Mouse wheel to scroll up or down | Swipe |
| Dragging scrollbars to scroll up or down, left or right | Swipe |

| | |
|---|---|
| In (graphical) Zoom mode only: dragging the borders of the displayed rectangle to change its size | Touch, then drag and release |

**Example:**

You can scroll through a long table in conventional mouse operation by clicking in the table's scrollbar repeatedly. In touch operation, you would scroll through the table by dragging the table up and down with your finger.

## 6.5 Getting help

If any questions or problems concerning the R&S ZNLE arise, an extensive online help system is provided on the instrument and can be consulted at any time. The help system is context-sensitive and provides information specifically for the current operation or setting to be performed. In addition, general topics provide an overview on complete tasks or function groups as well as background information.

The online help can be opened at any time by selecting one of the "Help" icons on the toolbar or by pressing the [F1] key on an external or the on-screen keyboard.

**To call context-sensitive help**

► To display the "Help" dialog box for the currently focused screen element, e.g. a softkey or a setting in an opened dialog box, select the "Help" icon on the toolbar.



The "Help" dialog box "View" tab is displayed. A topic containing information about the focused screen element is displayed.

If no context-specific help topic is available, a more general topic or the "Content" tab is displayed.

ⓘ    For standard Windows dialog boxes (e.g. File Properties, Print dialog etc.), no context-sensitive help is available.

**to display a help topic for a screen element not currently focused**

1.  Select the "Help pointer" icon on the toolbar.



The pointer changes its shape to a "?" and an arrow.

2.  Select the screen element to change the focus.

A topic containing information about the selected (now focused) screen element is displayed.

# 7      Customer support

## 7.1      Collecting information for support

If problems occur, the instrument generates error messages which in most cases will be sufficient for you to detect the cause of an error and find a remedy.

Error messages are described in the "Troubleshooting" section of the user manuals.

In addition, our customer support centers are there to assist you in solving any problems that you may encounter with your R&S ZNLE. We will find solutions more quickly and efficiently if you provide us with the information listed below.

- **Windows Event Log Files**
  Windows records important actions of applications and the operating system in event logs. You can create event log files to summarize and save the existing event logs (see "To create windows event log files" on page 70).

- **System Configuration:** The "System Configuration" dialog box (in the "Setup" menu) provides information on:

  - **Hardware Info:** hardware assemblies

  - **Versions and Options:** the status of all software and hardware options installed on your instrument

  - **System Messages:** messages on any errors that may have occurred

  An .xml file with information on the system configuration ( "Device Footprint" ) can be created automatically (using the `DIAGnostic:SERVice:SINFo` command or as described in "To collect the support information" on page 70).

- **Error Log:** The `RSError.log` file (in the
  `C:\Program Files\Rohde-Schwarz\Vector Network Analyzer\ZNL\log` directory) contains a chronological record of errors.

- **Support file:** a *.zip file with important support information can be created automatically (in the
  `C:\Program Files\Rohde-Schwarz\Vector Network Analyzer\ZNL\user` directory). The *.zip file contains the system configuration information ( "Device Footprint" ), the current eeprom data and a screenshot of the screen display.

**To collect the support information**

1. Press the [Setup] key.

2. Select "Service" > "R&S Support" and then "Create R&S Support Information" .

   The file is stored as
   ```
   C:\Program Files\Rohde-Schwarz\Vector Network Analyzer\ZNL\
   user\<inst_model>_<serial-no>_<date_and_time>.zip
   ```
   For example
   ```
   C:\Program Files\Rohde-Schwarz\Vector Network Analyzer\ZNL\
   user\ZNLE3__20160803_145113.zip
   ```

**To create windows event log files**

1. Select the "Windows Start Button"  in the bottom left corner.

2. Enter *Event Viewer* and select "Enter".

3. Select and expand "Windows Logs" in the "Console Tree".

4. Right-click on each subsection and select "Save All Events As...".

*Figure 7-1: Event Viewer*

5. Enter a file name and select "Save"

Collect the error information and attach it to an email in which you describe the problem. Send the email to the customer support address for your region as listed in

# 7.2    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 7-2: QR code to the Rohde & Schwarz support page*

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