R&S®ZN-Z86/ZN-Z86X
Switch Matrix
User Manual

ROHDE & SCHWARZ

Make ideas real

This manual describes the R&S®ZN-Z86 and R&S®ZN-Z86X switch matrix base units and port extension options.

R&S®ZN-Z86 (50 Ω, 2.92 mm (f) connectors, 100 MHz to 26.5 GHz)

- "Base unit, 2HU, 2x6 configuration", order no. 1351.2216K02
- R&S®ZN-Z86-B22 "Additional test ports 7–12 (2 VNA ports)", order no. 1351.2900.22
- R&S®ZN-Z86-B24 "Additional test ports 7–12 (4 VNA ports)", order no. 1351.2900.24
- R&S®ZN-Z86-B32 "Additional test ports 13–18 (2 VNA ports)", order no. 1351.2900.32
- R&S®ZN-Z86-B34 "Additional test ports 13–18 (4 VNA ports)", order no. 1351.2900.34
- R&S®ZN-Z86-B42 "Additional test ports 19–24 (2 VNA ports)", order no. 1351.2900.42
- R&S®ZN-Z86-B44 "Additional test ports 19–24 (4 VNA ports)", order no. 1351.2900.44

R&S®ZN-Z86X (50 Ω, 2.92 mm (f) connectors, 100 MHz to 26.5 GHz)

- "Base unit, 3HU for extra paths", order no. 1351.2222K02
- R&S®ZNZ86X-B24 "Test ports 1-12 (4 VNA ports)", order no. 1351.2222.24
- R&S®ZNZ86X-B44 "Test ports 1-24 (4 VNA ports)", order no. 1351.2222.44

Throughout this manual: R&S® is abbreviated as R&S.

Contents

1   Safety and regulatory information

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

Intended use

External switch matrices R&S ZN-Z86 have been designed to be used with a vector network analyzer (VNA) of the families R&S ZNA/ZNB/ZNBT/ZND. They are intended for the development, production and verification of electronic components and devices in industrial, administrative and laboratory environments. Use a R&S ZN-Z86 only for its designated purpose. Observe the operating conditions and performance limits stated in the specifications document.

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 specifications document, manuals and the printed "Safety Instructions" document. If you are unsure about the appropriate use, contact Rohde & Schwarz customer support.

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

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

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

Lifting and carrying the product

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

Choosing the operating site

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

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

You can operate the product up to an altitude of 2000 m above sea level. If a higher altitude is permissible, the value is provided in the specifications document. The product is suitable for pollution degree 2 environments where nonconductive contamination can occur. For more information on environmental conditions such as ambient temperature and humidity, see the specifications document.

Setting up the product

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

If the product has foldable feet, always fold the feet completely in or out to ensure stability. The feet can collapse if they are not folded out completely or if the prod-

uct is moved without lifting it. The foldable feet are designed to carry the weight of the product, but not an extra load.

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

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

Connecting the product

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

Connecting to power

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

Take the following measures for your safety:

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

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

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

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

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

Cleaning the product

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

Meaning of safety labels

Safety labels on the product warn against potential hazards.

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

	Electrical hazard
	Indicates live parts. Risk of electric shock, fire, personal injury or even death.

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

	Protective conductor terminal
	Connect this terminal to a grounded external conductor or to protective ground. This connection protects you against electric shock if an electric problem occurs.

1.2   Labels on the product

Labels on the casing inform about:

● Personal safety, see "Meaning of safety labels" on page 8
● Product and environment safety, see Table 1-1
● Identification of the switch matrix model and supporting operating frequency range

Table 1-1: Labels regarding product 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".
⚠	Take care when handling electrostatic sensitive devices.

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.

WARNING

Potentially hazardous situation. Could result in death or serious injury if not avoided.

CAUTION

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

NOTICE

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

1.4   Korea certification class B

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

2 Introduction

External switch matrices R&S ZN-Z8x are designed and optimized for Rohde & Schwarz VNAs of the families R&S ZNA/ZNB/ZNBT/ZND.

With their extended frequency range of 100 MHz to 26.5 GHz, matrices R&S ZN-Z86 and R&S ZN-Z86X are particularly suitable for the 26.5 GHz models R&S ZNA26/ZNB26/ZNBT26.

The switch matrix R&S ZN-Z86 comes in a compact 2HU, 19-inch rack mountable chassis. An optional compatible 19-inch rack mount kit, R&S ZZA-KNP21 (order no. 1177.8803.00), can be added for mounting the switch matrix on a 19-inch rack.

Switch matrix R&S ZN-Z86X comes in a 3HU, 19-inch rack mountable chassis. An optional compatible 19-inch rack mount kit, R&S ZZA-KNP31 (order no. 1177.8810.00), can be added for mounting the switch matrix on a 19-inch rack.

For a R&S ZN-Z8x with **firmware version V2.0.0.0 or higher**, you can use the R&S ZN-Z8X Toolbox software (installed on your Windows PC) to connect to the switch matrix via LAN or USB. The R&S ZN-Z8X Toolbox gives you access to all required settings and monitoring functions of the connected switch matrix, and enables manual switching.

> 💡
> - The latest firmware can be downloaded free of charge from the R&S ZN-Z8x firmware page.
> - The R&S ZN-Z8X Toolbox can be downloaded free of charge from the R&S ZN-Z8x software page.

2.1 Option concept

R&S ZN-Z86

Depending on the installed options, the R&S ZN-Z86 offers support for 2 or 4 matrix VNA ports and up to 24 matrix test ports.

The base unit (order no. 1351.2216K02) implements a 2x6 switch matrix that can connect its two VNA ports to any pair of its test ports. Optional port extensions

increase the number of matrix test ports up to 24, with either 2 or 4 matrix VNA ports. See Table 2-1 and Table 2-2.

Table 2-1: R&S ZN-Z86: Options for 2 matrix VNA ports

Option	Order no.	Additional ports	Resulting matrix
R&S ZN-Z86-B22	1319.2900.22	Test ports 7 to 12	2 x 12
R&S ZN-Z86-B32[*]	1319.2900.32	Test ports 13 to 18	2 x 18
R&S ZN-Z86-B42[**]	1319.2900.42	Test ports 19 to 24	2 x 24
[*] requires R&S ZN-Z86-B22			
[**] requires R&S ZN-Z86-B22 and R&S ZN-Z86-B32			

By connecting two R&S ZN-Z86 with 2 VNA ports to a 4-port VNA, you can increase the number of test ports of the VNA to 48. Use the cable set R&S ZN-ZB26 (order no. 1328.8911.05) to establish the RF connections between an R&S ZNB26/40/43 and two switch matrices stacked on a benchtop.

Table 2-2: R&S ZN-Z86: Options for 4 matrix VNA ports

Option	Order no.	Additional ports	Resulting matrix
R&S ZN-Z86-B24	1319.2900.24	VNA ports 3 and 4 Test ports 7 to 12	4 x 12
R&S ZN-Z86-B34[*]	1319.2900.34	Test ports 13 to 18	4 x 18
R&S ZN-Z86-B44[**]	1319.2900.44	Test ports 19 to 24	4 x 24
[*] requires R&S ZN-Z86-B24			
[*] requires R&S ZN-Z86-B24 and R&S ZN-Z86-B34			

For technical details, see the R&S ZN-Z86 specifications.

R&S ZN-Z86X

The R&S ZN-Z86X base unit (order no. 1351.2222K02) does not include any switch modules. It must be equipped it with one of the available port options, offering 4 matrix VNA ports and 12 or 24 test ports (see Table 2-3).

The selected port option determines the number of matrix test ports. However, the external RF links allow you to connect them two or four VNA ports.

Table 2-3: R&S ZN-Z86X: Options for 2 or 4 matrix VNA ports

Option	Order No.	Extension	Resulting matrix
R&S ZNZ86X-B24	1319.2222.24	VNA ports 1 to 4 Test ports 1 to 12	Switch matrix 2/4 x 12
R&S ZNZ86X-B44	1319.2222.44	VNA ports 1 to 4 Test ports 1 to 24	Switch matrix 2/4 x 24

For both port options, you can configure the R&S ZN-Z86X to operate with two or four matrix VNA ports. The configuration comprises hardware and firmware settings (see Chapter 3.3.3.3, "Operation with 2 or 4 matrix VNA ports", on page 46).

For technical details, refer to the R&S ZN-Z86 specifications.

2.2   Documentation overview

This section provides an overview of the R&S ZN-Z86 user documentation. Unless specified otherwise, you find the documents at:

https://www.rohde-schwarz.com/manual/znz8xswitchmatrix

2.2.1   User manual

The user manual (this document) is shipped with the R&S ZN-Z86 in printed form.

Beyond safety and "getting started" topics, it contains descriptions of all instrument functions and the remote control of the instrument. In addition, it contains notes on preventative maintenance and on troubleshooting based on the warnings and error messages that the instrument emits.

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

2.2.2   Printed safety instructions

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

2.2.3 Instrument security procedures

Deals with security issues when working with the R&S ZN-Z86 in secure areas. It is available for download on the internet.

2.2.4 Release notes and open-source acknowledgment (OSA)

Release notes list new features, improvements and known issues of a particular R&S ZN-Z86 firmware version, and describe its installation.

The firmware uses several valuable open source software packages. The OSA document provides verbatim license texts of the open-source software packages that are used by a particular R&S ZN-Z86 firmware version.

The printed OSA that is shipped with the product corresponds to the pre-installed firmware.

You can download the latest firmware, its release notes and OSA document from the R&S ZN-Z8x firmware page:

https://www.rohde-schwarz.com/firmware/znz8xswitchmatrix

2.2.5 Specifications and brochures

The specifications document, also known as the data sheet, contains the technical specifications of the R&S ZN-Z86. 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 https://www.rohde-schwarz.com/brochure-datasheet/znz8xswitchmatrix.

2.2.6 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 authorized users on the global Rohde & Schwarz information system (GLORIS):

https://gloris.rohde-schwarz.com

2.2.7 R&S ZN-Z8X Toolbox manual

The R&S ZN-Z8X Toolbox software allows you to configure and operate the matrix manually. It can be downloaded free of charge from the R&S ZN-Z8x software page:

https://www.rohde-schwarz.com/software/znz8xswitchmatrix

Some applications of the R&S ZN-Z8X Toolbox are described in this manual. For further information, refer to the *R&S ZN-Z8X Toolbox user manual* that is installed with the software.

3   Getting started

The sections below describes how to put a switch matrix R&S ZN-Z86 into operation, how to establish external connections, and how to integrate it into a network.

The R&S ZN-Z86 description applies to all instrument variants and configurations. Differences are pointed out explicitly where relevant.

3.1   Preparing for use

3.1.1   Lifting and carrying

For safety information, see "Lifting and carrying the product" on page 6.

3.1.2   Unpacking and checking

1. Unpack the product carefully.

2. Retain the original packing material. Use it when transporting or shipping the product later.

3. Using the delivery notes, check the equipment for completeness.

4. Check the equipment for damage.

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

3.1.3   Choosing the operating site

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

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

Electromagnetic compatibility classes

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

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

3.1.4   Setting up the product

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

3.1.4.1   Placing the product on a bench top

To place the product on a bench top

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

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

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

3. **WARNING!** A stack of products can fall over and cause injury. Never stack more than three products on top of each other. Instead, mount them in a rack.

    Stack as follows:
    ● If the products have foldable feet, fold them in completely.

- It is best if all products have the same dimensions (width and length). If the products have different dimensions, stack according to size and place the smallest product on top.
- Do not exceed the permissible total load placed on the product at the bottom of the stack:
  - 50 kg when stacking products of identical dimensions (left figure).
  - 25 kg when stacking smaller products on top (middle figure).
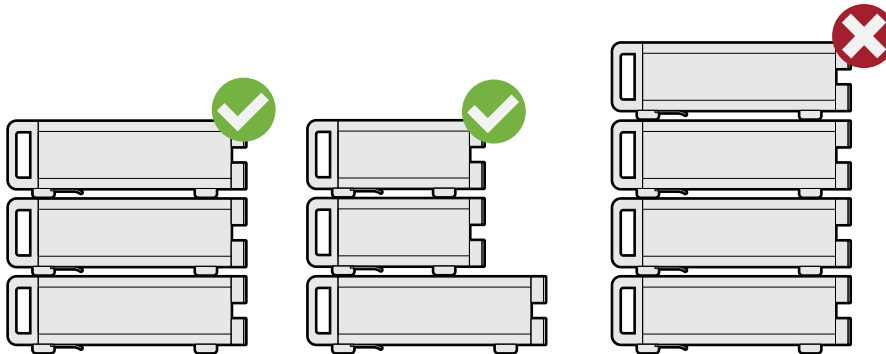
Left   = Stacked correctly, same dimensions
Middle = Stacked correctly, different dimensions
Right   = Stacked incorrectly, too many products

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

   Prevent overheating as follows:

   - Keep a minimum distance of 10 cm between the fan openings of the product and any object in the vicinity to provide sufficient airflow and ventilation.
   - Do not place the product next to heat-generating equipment such as radiators or other products.

ⓘ To use R&S ZNA or R&S ZNBT vector network analyzer with R&S ZN-Z86/R&S ZN-Z86X switch matrix, use the R&S ZN-ZTBE and R&S ZN-ZTBXE base extension boxes to enable a benchtop setup. For more information on how to use the extension boxes, refer to Chapter A, "Base extension boxes", on page 87.

3.1.4.2   Mounting the product 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 product in a rack

1. Use an adapter kit to prepare the product for rack mounting.

    a) Order the 19" rack adapter kit designed for the product. For the order number, see the specifications document.
    b) Mount the adapter kit. Follow the assembly instructions provided with the adapter kit.

2. Grab the product by the handles and push it onto the shelf until the rack brackets fit closely to the rack.

3. Tighten all screws on the rack brackets to secure the product in the rack.

To unmount the product from a rack

1. Loosen the screws at the rack brackets.

2. Remove the product from the rack.

3. If placing the product on a bench top again, unmount the adapter kit from the product. Follow the instructions provided with the adapter kit.

3.1.5   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.
- Use ≤ 3 m for the USB cable length or the USB cable delivered with the switch matrix, if possible.

Signal input and output levels

Information on signal levels is provided in the specifications document. Keep the signal levels within the specified ranges to avoid damage to the product and connected devices.

Preventing electrostatic discharge (ESD)

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

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

Ground yourself to prevent electrostatic discharge damage:

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

3.1.6   Connecting to power

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

1. Plug the AC power cable into the AC power connector on the rear panel of the product. Only use the AC power cable delivered with the product.

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 specifications document.

3. If necessary, also ground the product using the grounding terminal ⏚.

When the instrument is connected to the AC supply, it automatically adjusts to the AC supply voltage (see the labeling for the voltage range). It is not necessary to manually adjust the instrument to a specific voltage or to change the fuse.

3.1.7 Connecting external devices

The instrument is equipped with different interfaces for establishing a remote control connection, typically from a VNA of the R&S ZNA/ZNB/ZNBT/ZND families of vector network analyzers.

3.1.7.1 USB

If necessary, connect the USB connecting cable (order no. 6145.1492.00) to the USB type B (Device) port on the rear panel. With direct connection to a Host device, a connecting cable A-B (plug type A onto plug type B) must be used.

3.1.7.2 LAN

The connection to the LAN is made using a commercially available RJ-45 cable via the LAN interface on the back of the instrument.

► **NOTICE!** Possible disturbance of network operation.

Switch off the instrument before connecting or removing the network cable to ensure reliable detection of the network connection and to avoid faults during operation of the instrument.

The network interface works with a 100 Mbit/s IEEE 802.3u Ethernet. The TCP/IP network protocol and the associated network services are preconfigured. To exchange data in a local area network (LAN), it must be possible to address each connected computer or instrument via a unique IP address or a hostname.

By default, every R&S ZN-Z86/ZN-Z86X is assigned a hostname `ZN-Z86/ZN-Z86X-<serial number>`, for example `ZN-Z86-100001` or `ZN-Z86X-100001`.

Networks with DHCP

The ZN-Z8x switch matrix is preconfigured to use the dynamic host configuration protocol (DHCP). In such networks, the instrument is automatically assigned a free IP address.

Static IP configuration

With static IP configuration, the static IP configuration data are usually provided by the network administrator. They can be activated on the instrument using remote control.

Point-to-Point connections

Establishing a simple network – a LAN connection between the switch matrix and a computer without integration into a larger network – requires assignment of an IP address for the instrument and the computer. Private IP addresses 192.168.xxx.yyy are available for this connection. The values for xxx and yyy range from 1 to 254; the subnet mask length is 24 or higher. The IP address for the gateway must also be specified, but it is not of significance in this case.

3.1.7.3   Direct control

The "direct control" interface allows you to establish a direct connection between the measurement bus of the VNA and the FPGA controlling the routes of the switch matrix. As direct control bypasses the matrice's microcontroller, it significantly reduces the switching times compared to management via USB or LAN.

ⓘ
- For R&S ZNA and R&S ZND, direct control is not available.
- For R&S ZNB and R&S ZNBT, a direct control interface is available on the "device control" extension (options R&S ZNB-B12 and R&S ZNBT-B12, respectively).
  A suitable cable is available as option R&S ZN-B121.

Use cable R&S ZN-B121 to connect the analyzer's "DIRECT CTRL" interface to the matrice's "Direct Control IN" interface. A second switch matrix can be connected via "Direct Control OUT" (see Table 3-2).

3.1.8   Switching on or off

Table 3-1: Overview of power states

Status	LED	Position of power switch
Off	Off	[0]
Standby	🟠 orange	[I]
Ready	🟢 green	[I]

To switch on the product

The product is OFF but connected to power.

1. Move the power supply switch to position [I] to turn the instrument ON.

    The LED of the [standby] key turns Orange. See Table 3-1.

2. Press the [standby] key.

    The LED changes to green.
    When the instrument receives power from the AC supply, it immediately starts
    loading the firmware (mini display: "ZNZ84 FPGA loading...") and performs a
    self-test.
    When the firmware is successfully loaded, the instrument is ready for opera-
    tion and can be remotely controlled via USB or LAN and Direct Control.

To shut down the product

The product is in the ready state.

► Press the [standby] key.

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

To disconnect from power

The product 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].

    The LED of the standby key is switched off.

2. Disconnect the product from the power source.

3.1.9   Function check

The instrument automatically monitors the most important instrument functions when it is turned on.

3.2   Instrument tour

This chapter shows all function keys, control elements and connections on the front and rear panel of the R&S ZN-Z86/Z86X.

3.2.1   Front panel

The front panel of the switch matrix provides:

- The administrative area on the left-hand side
- To its right, the matrix VNA port area and the matrix test port area.

Brief explanations on the controls and connectors can be found in the following subsections.
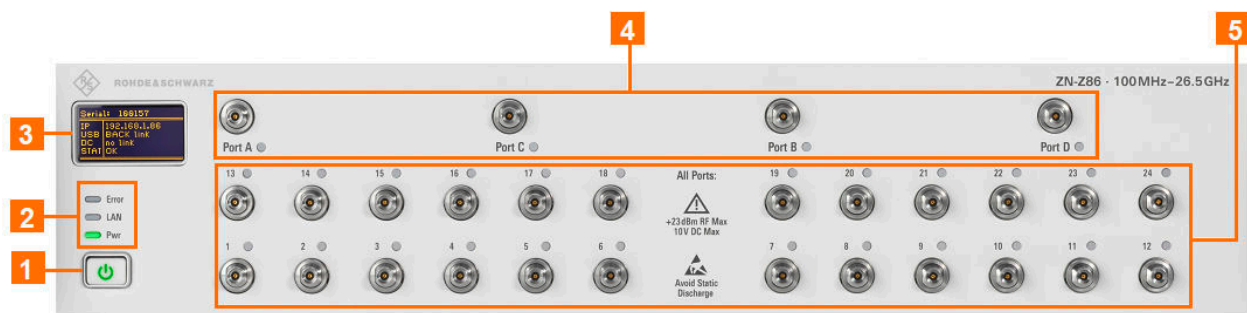
Figure 3-1: Front panel of the R&S ZN-Z86

1 = Standby key
2 = Status LEDs
3 = Mini display
4 = Matrix VNA ports
5 = Matrix test ports
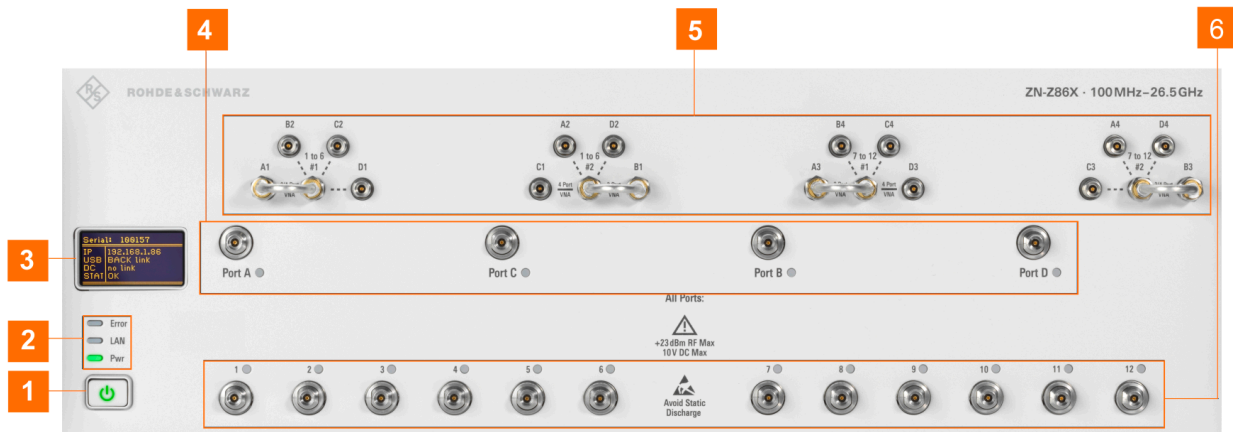
Figure 3-2: Front panel of the R&S ZN-Z86X for 12 ports

1 = Standby key
2 = Status LEDs
3 = Mini display
4 = Matrix VNA ports
5 = External RF links
6 = Matrix test ports
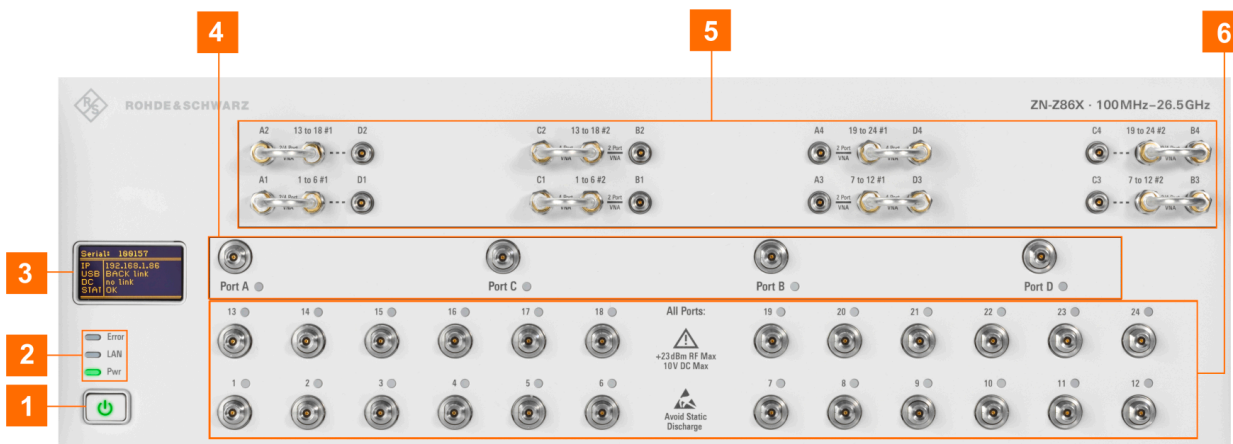
Figure 3-3: Front panel of the R&S ZN-Z86X for 24 ports

1 = Standby key
2 = Status LEDs
3 = Mini display
4 = Matrix VNA ports
5 = External RF links
6 = Matrix test ports

3.2.1.1   Standby key

The key serves two main purposes:

- Toggle between standby and ready state; see "To switch on the product" on page 22.
  When the instrument is powered up, it comes up in ready state.

- Shut down the instrument; see "To shut down the product" on page 22.

3.2.1.2   Status LEDs

Above the standby toggle switch, some LEDs indicate various status information:

- [ERR]: operation state; if an error occurs, the LED lights up red

- [LAN]: LAN error occurred

- [PWR]: power state (ready/standby); see "To switch on the product" on page 22.

3.2.1.3   Mini display

The miniature display in the upper left-hand corner of the instrument provides the following instrument information:

- Serial number `Serial`

- IP address `IP` (see Chapter 3.1.7.2, "LAN", on page 20)

- USB link state `USB: REAR link` or `no link` (see Chapter 3.1.7.1, "USB", on page 20)

- Direct control state `DC: link` or `no link` (see Chapter 3.1.7.3, "Direct control", on page 21)

- Operational status `STAT: OK` or `Error <error code>` (see `SYSTem: ERRor?` on page 70)

3.2.1.4   Matrix VNA ports
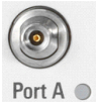
2.92 mm female connectors, 50 Ω, labeled A, C, B, D (from left to right). A colored LED indicates whether the related port is in use.

- With the R&S ZN-Z86 base unit, connectors A and B are available. The R&S ZN-Z86X unit always comes with all 4 connectors (A, B, C and D).
- With the optional 4-VNA-port extension R&S ZN-Z86-B24, -B34 and B44, connectors C and D are added to the R&S ZN-Z86 base unit.

3.2.1.5   External RF links (R&S ZN-Z86X only)
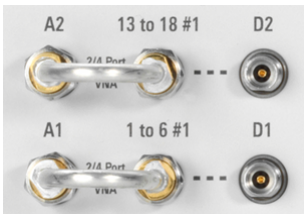
2.92 mm female connectors (50 Ω) that allow you to switch between operation with 2 or 4 matrix VNA ports.

The jumpers can also be ordered as spare parts (order no. 1145.2580.00).

3.2.1.6   Matrix test ports

Numbered female connectors (50 Ω), serving as outputs for the RF stimulus signal and as inputs for the measured RF signals from the DUT (response signals).

- Without port extension, the R&S ZN-Z86 base unit offers ports 1 to 6. Optional extensions R&S ZN-Z86-B22/B24, R&S ZN-Z86-B32/B34 and R&S ZN-Z86-B42/B44 add test ports 7 to 12, 13 to 18 and 19 to 24, respectively, to the R&S ZN-Z86 base unit.
- For the R&S ZN-Z86X base unit, it depends on the selected port option: R&S ZNZ86X-B24 offers 12 test ports, R&S ZNZ86X-B44 offers 24 test ports.

Rohde & Schwarz recommends you to use a suitable torque wrench such as R&S ZN-ZTW torque wrench (order no. 1328.8534.35) when fastening the RF cables on the connectors.

ⓘ The instrument can be damaged if excessive torque is applied to the connectors. The recommended torque value is 90 N-cm for 2.92 mm connectors.

If the related port is in use, the color of the LED indicates the connected VNA port. The LED colors can be set using the R&S ZN-Z8X Toolbox which can be downloaded from the Rohde & Schwarz internet site.

See also "Signal input and output levels" on page 19 for maximum input levels of the instrument.

3.2.2   Rear panel

This section shows all interfaces on the back of the R&S ZN-Z86 and R&S ZN-Z86X.
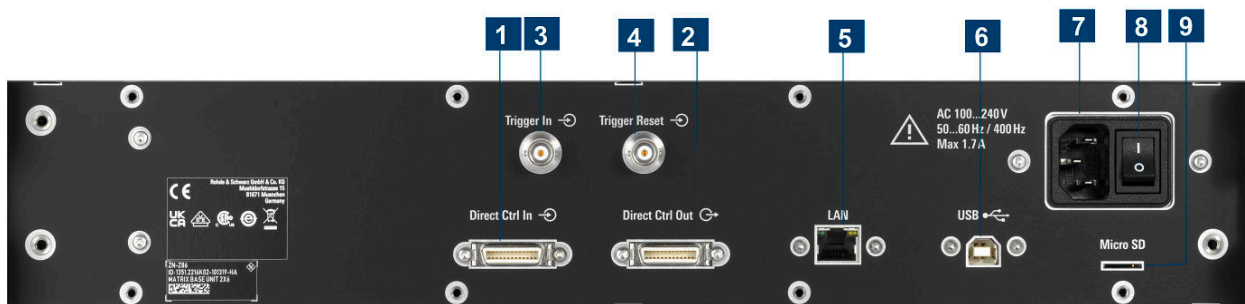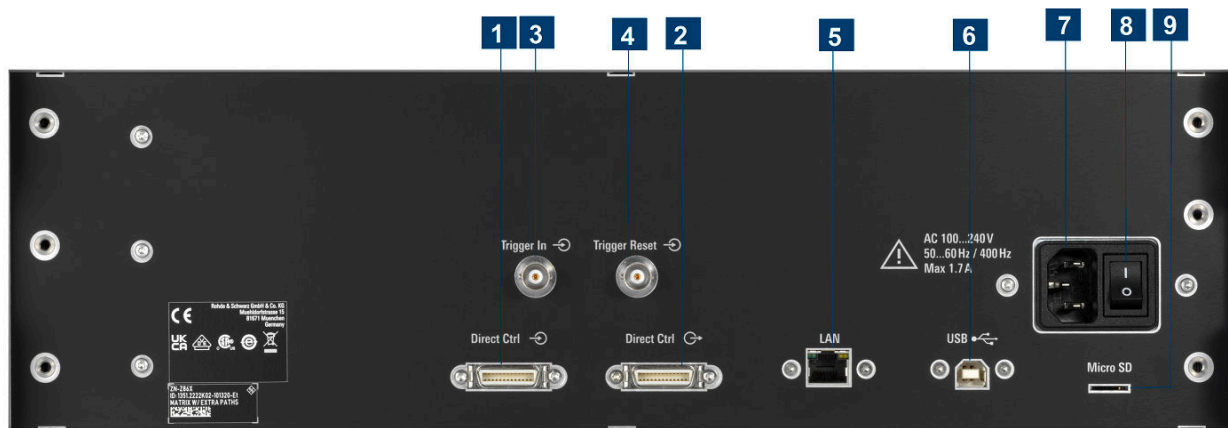

Figure 3-4: R&S ZN-Z86 rear view

Figure 3-5: R&S ZN-Z86X rear view

Table 3-2: Rear panel elements

Index	Label	Description
1	Direct Ctrl ⊕	Direct control interface, incoming and outgoing. Allows a direct connection between the R&S ZNB/ZNBT measurement bus and the FPGA controlling the matrix switches, bypassing the microcontroller. See Chapter 3.1.7.3, "Direct control", on page 21.
2	Direct Ctrl ⊕	
3	Trigger In	BNC connector to trigger the predefined trigger sequences with up to 2048 scenarios.
4	Trigger Reset	BNC connector to switch to the first entry in the trigger sequence list.
5	LAN	RJ-45 connector to integrate the instrument to a Local Area Network, primarily for remote control purposes.
6	USB	Type B (Device) high-speed USB connector to control the instrument from the VNA. The length of passive connecting USB cables must not exceed 1 m. See also "Cable selection and electromagnetic interference (EMI)" on page 18.
7		AC power connector
8	IO	Power switch
9	Micro SD	Not used.

See the R&S ZN-Z86 specifications for details.

3.3   Instrument configurations

The single function of a switch matrix R&S ZN-Z86/Z86X is to establish RF connections between its VNA ports (statically connected to the RF ports of the VNA) and its test ports (statically connected to the DUT or DUTs), applying a passive load match to currently unused ports.

Typically these connections are requested by the connected VNA that ultimately wants to:

- Send a stimulus signal (the *a* wave) to a particular DUT port and to receive the response signal from the stimulated and other DUT ports (the *b* waves).
- Quickly switch over to different stimulus/response ports.

The connection paths of the switch matrix (with or without optional port extension) are shown in simplified form in the circuit diagrams below.

3.3.1   Switch module 2x6

The switching functionality of R&S ZN-Z86/R&S ZN-Z86X is provided by non-blocking 2x6 switch modules.

At the "north", a 2x6 switch module provides two matrix VNA ports, at the "south" it provides 6 matrix test ports. Routes are established using RF semiconductor switches SP<n>T (n=3,4), each of them allowing to set up bidirectional connections between its single "input port" to any of its n "output ports".

The switch module is non-blocking, that is, the two matrix VNA ports can be simultaneously connected to any pair of test ports.
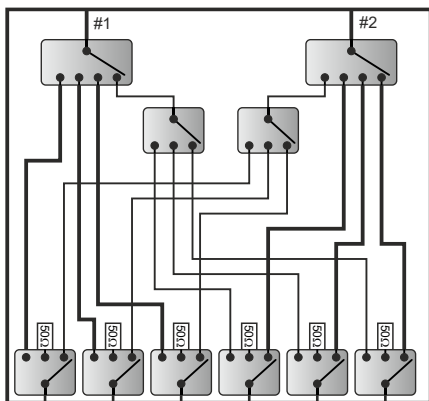

Figure 3-6: Switch module 2x6

To prevent reflections caused by misadjustment, 50 Ω terminating resistors are connected to unused outputs.

3.3.2   R&S ZN-Z86 configurations

3.3.2.1   Base unit 2 x 6

Base unit

For a R&S ZN-Z86 base unit without hardware option, the switching functionality is provided by a single switch module 2x6. This unit is equipped with two physical VNA ports (A and B) and six physical test ports (1 to 6).
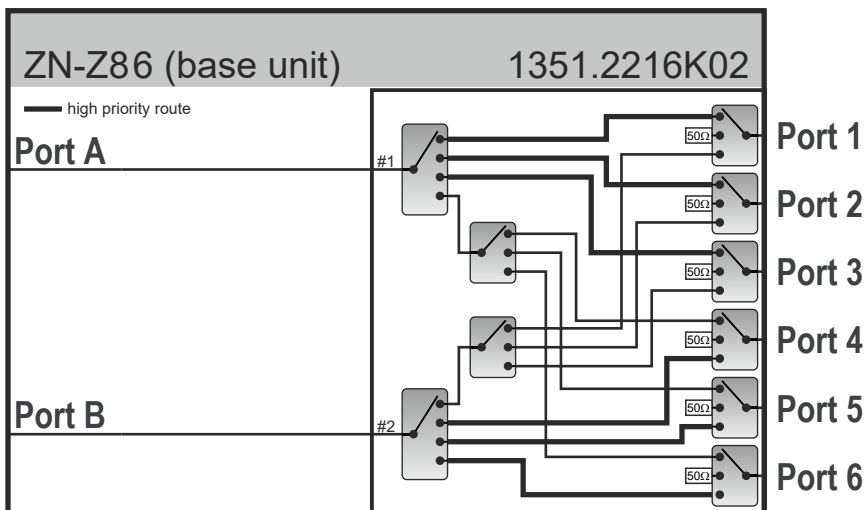

Figure 3-7: R&S ZN-Z86 switch matrix 2 x 6

3.3.2.2   Switch matrix 2 x 12

Base unit with option R&S ZN-Z86-B22

Option R&S ZN-Z86-B22 adds a second switch module 2x6 to the Base unit 2 x 6, providing six additional physical test ports (7 to 12) in the R&S ZN-Z86 instrument.
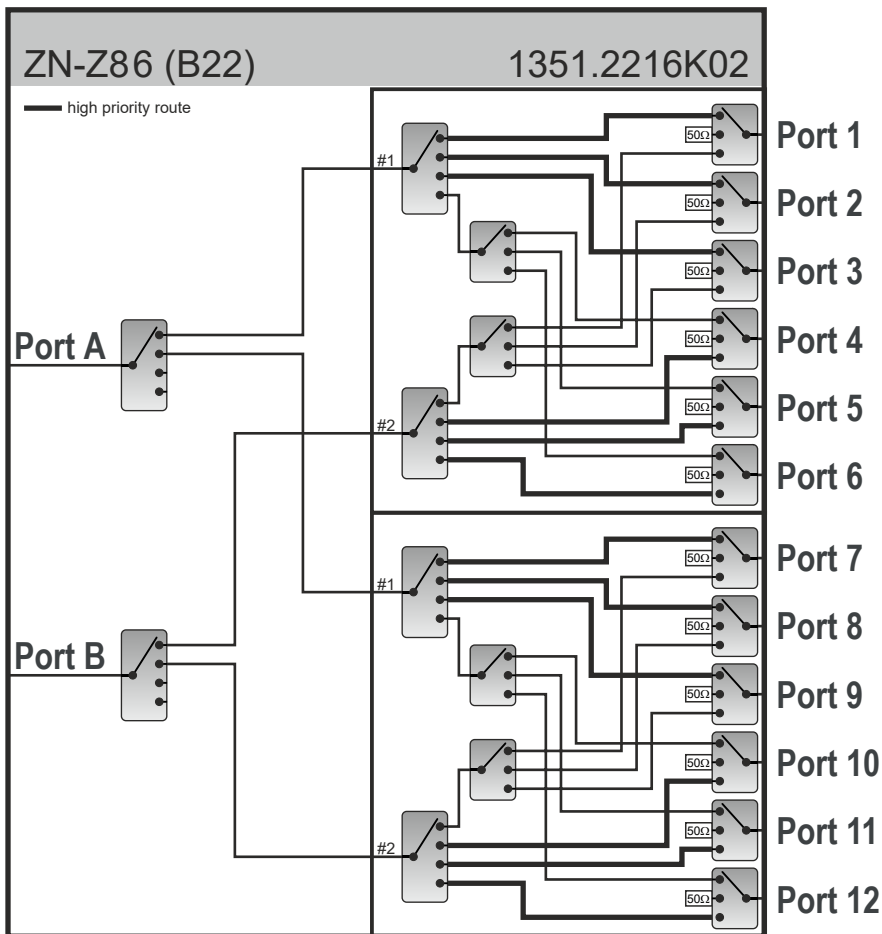

Figure 3-8: R&S ZN-Z86 switch matrix 2x12

3.3.2.3 Switch matrix 4 x 12

Base unit with option R&S ZN-Z86-B24

Option R&S ZN-Z86-B24 adds a second switch module 2x6 to the Base unit 2 x 6, providing two additional physical VNA ports (C and D) and six physical test ports (7 to 12) in the R&S ZN-Z86 instrument.
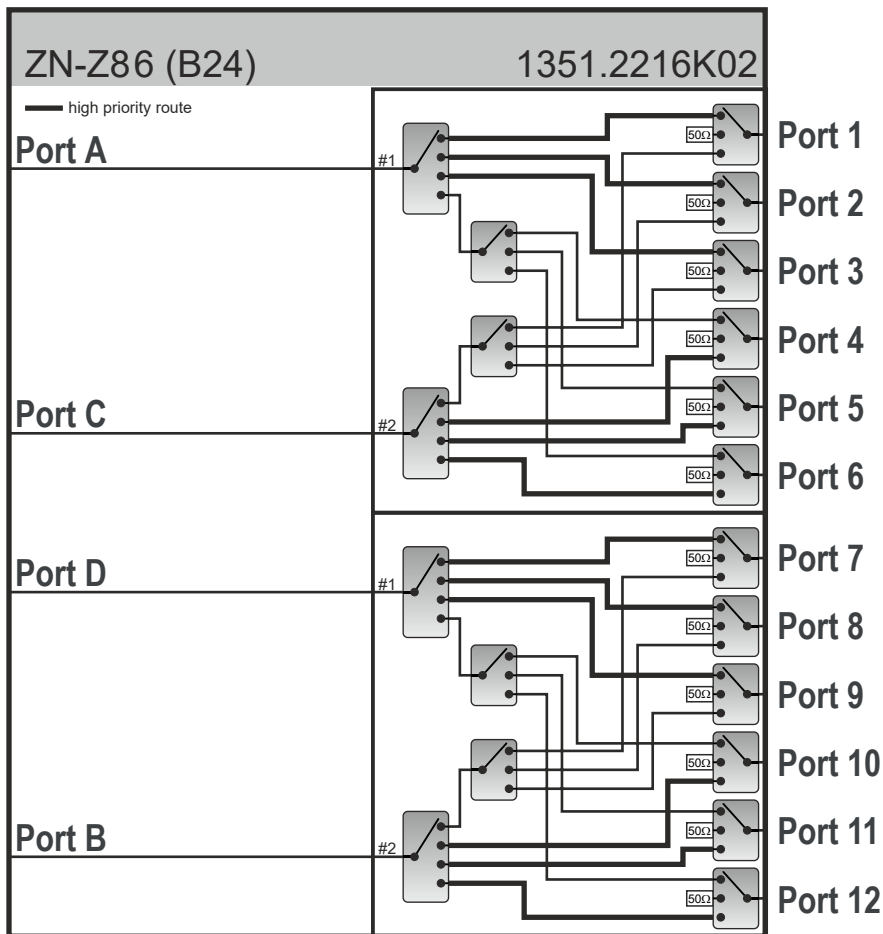

Figure 3-9: R&S ZN-Z86 switch matrix 4 x 12

3.3.2.4 Switch matrix 2 x 18

Base unit with options R&S ZN-Z86-B22 and -B32

Option R&S ZN-Z86-B32 adds another switch module 2x6 to the Switch matrix 2 x 12, providing six additional physical test ports (13 to 18) in the R&S ZN-Z86 instrument.

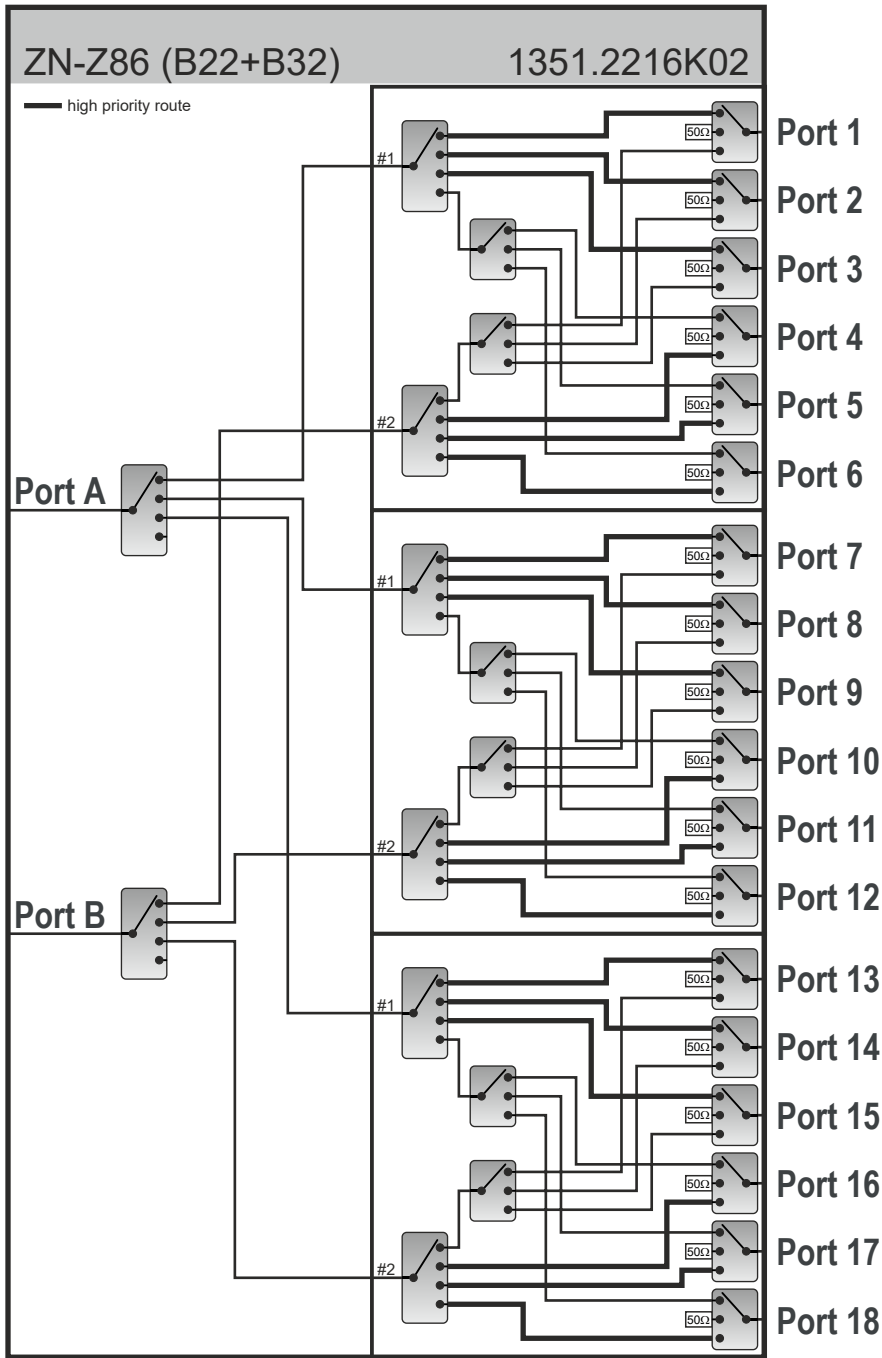*Figure 3-10: R&S ZN-Z86 switch matrix 2 x 18*

3.3.2.5 Switch matrix 4 x 18

Base unit with options R&S ZN-Z86-B24 and -B34

Option R&S ZN-Z86-B34 adds another switch module 2x6 to the Switch matrix 4 x 12, providing six additional physical test ports (13 to 18) in the R&S ZN-Z86 instrument.
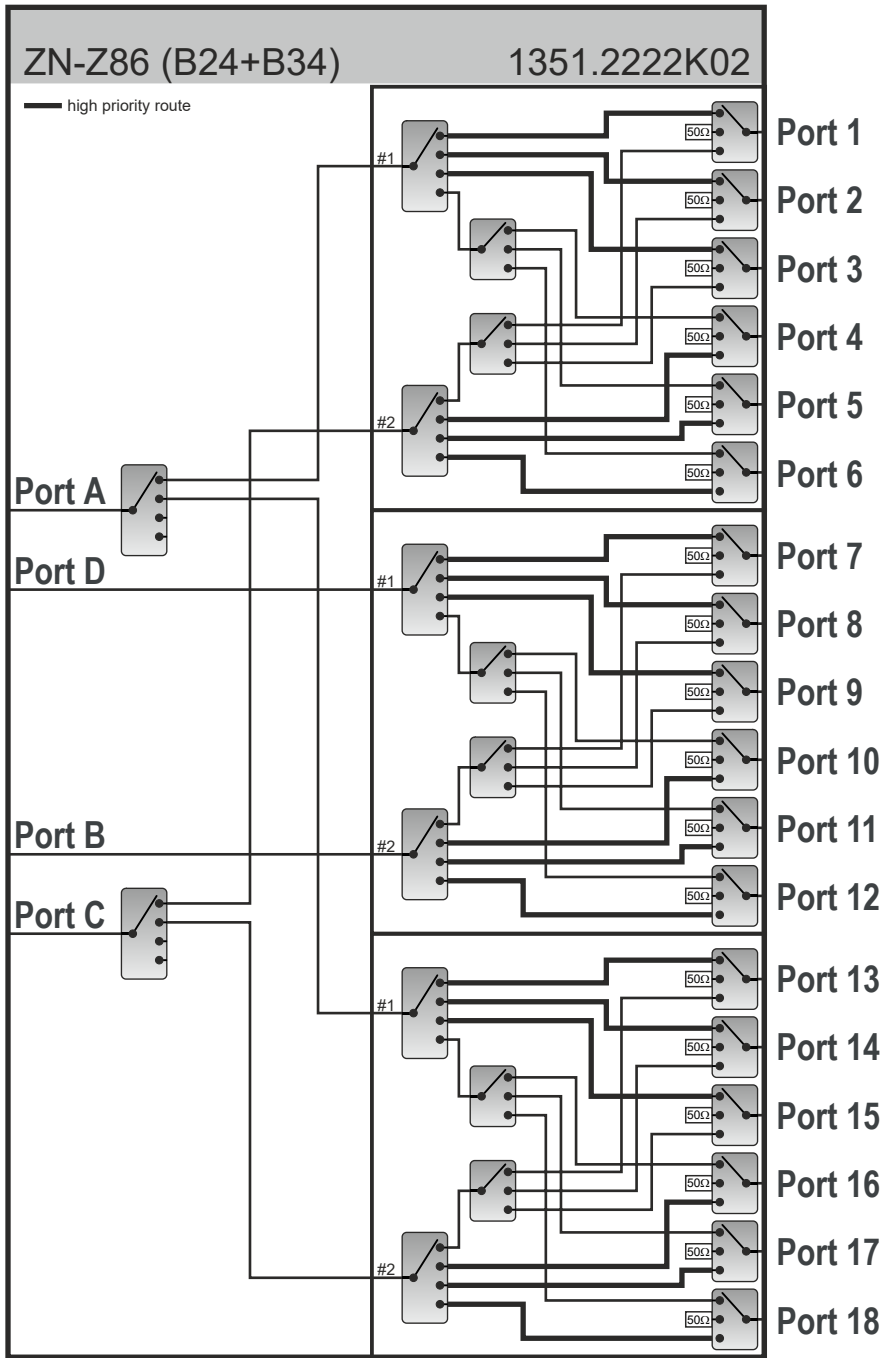
Figure 3-11: R&S ZN-Z86 switch matrix 4 x 18

3.3.2.6 Switch matrix 2 x 24

Base unit with options R&S ZN-Z86-B22, -B32 and -B42

Option R&S ZN-Z86-B42 adds another switch module 2x6 to the Switch matrix 2 x 18, providing six additional physical test ports (19 to 24) in the R&S ZN-Z86 instrument.

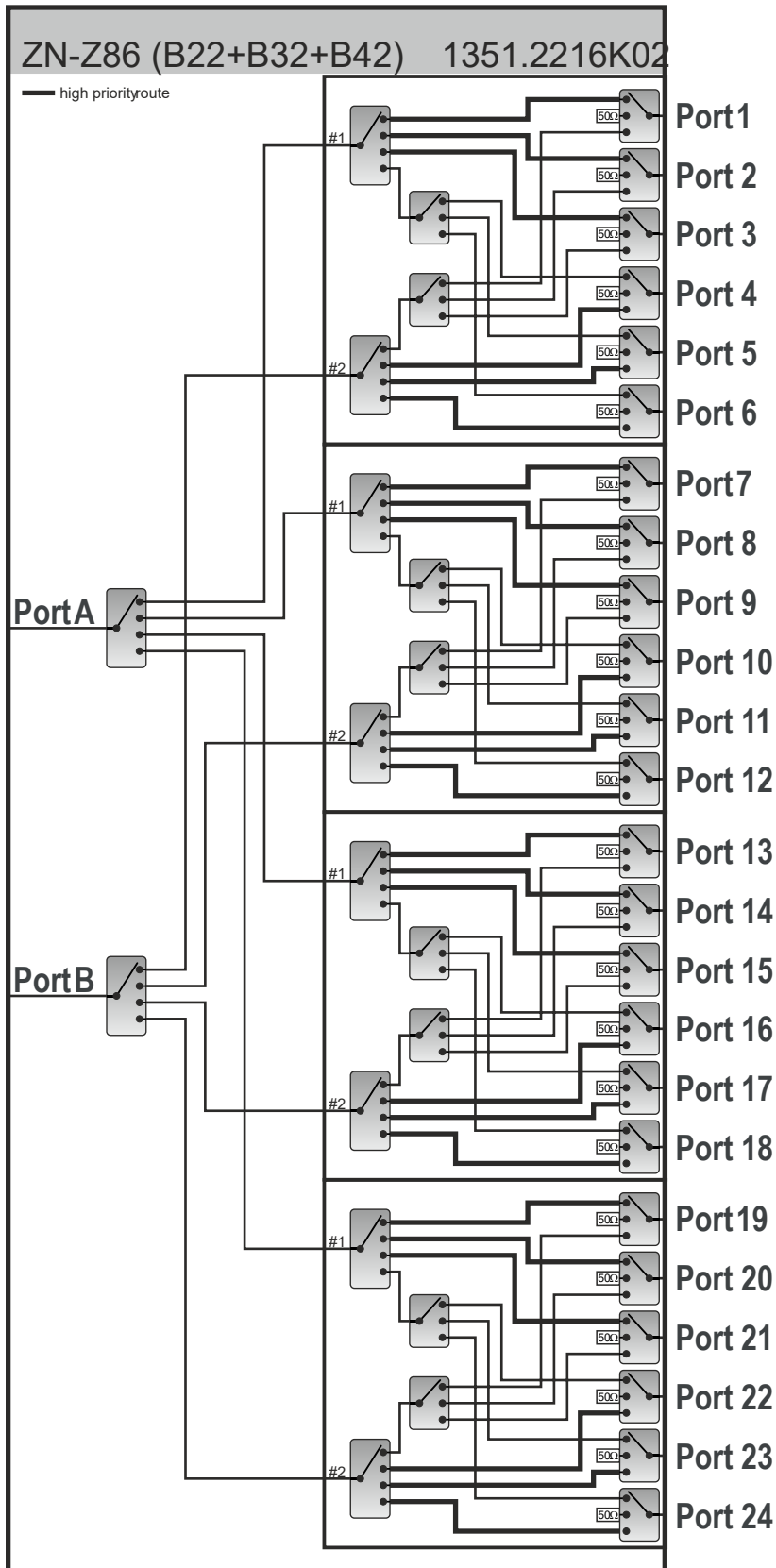*Figure 3-12: R&S ZN-Z86 switch matrix 2 x 24*

3.3.2.7 Switch matrix 4 x 24

Base unit with options R&S ZN-Z86-B24, -B34 and -B44

Option R&S ZN-Z86-B44 adds another switch module 2x6 to the Switch matrix 4 x 18, providing two additional physical VNA ports (C and D) and six additional physical test ports (19 to 24) in the R&S ZN-Z86 instrument.
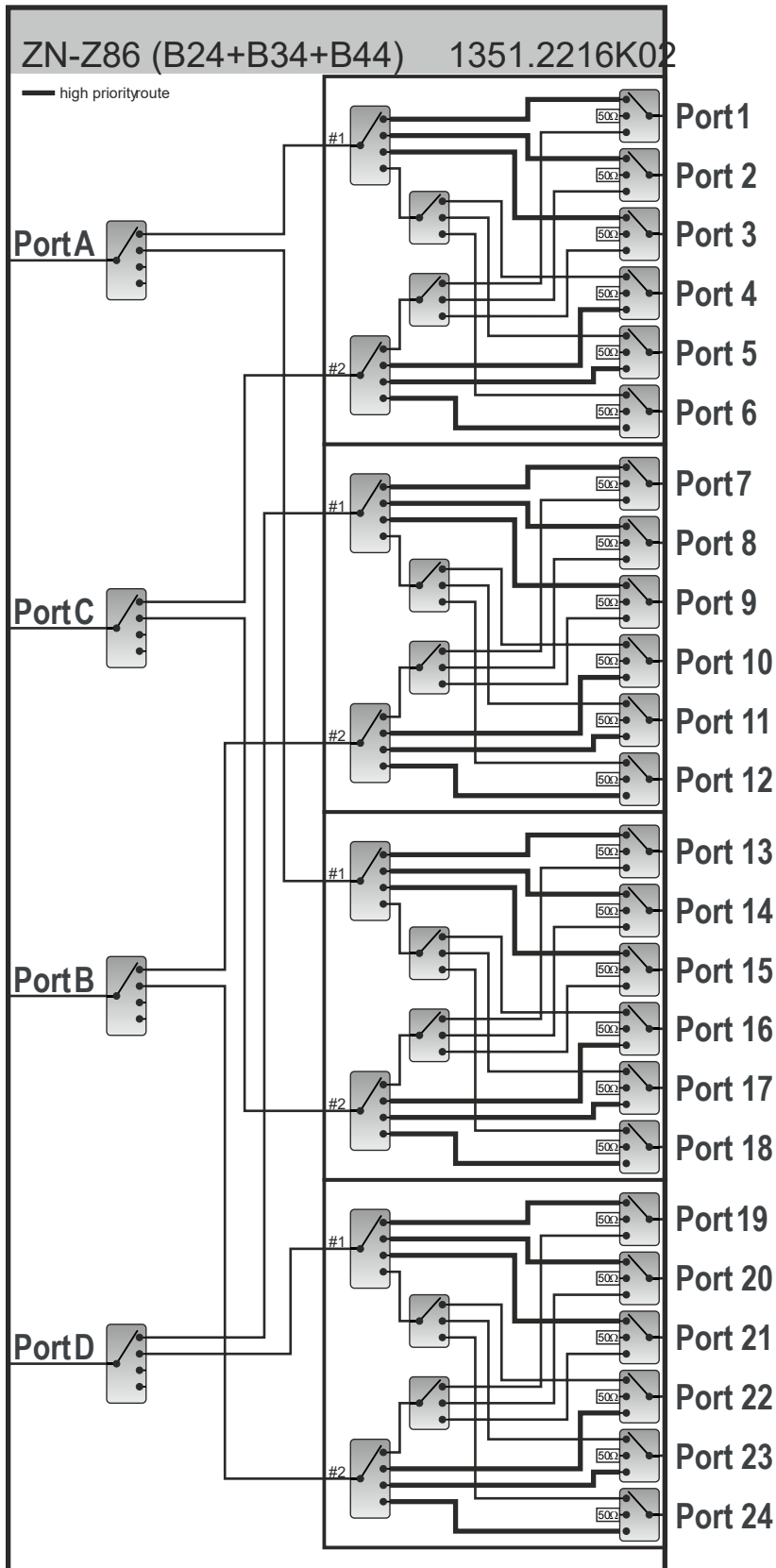
Figure 3-13: R&S ZN-Z86 switch matrix 4 x 24

3.3.3   R&S ZN-Z86X configurations

3.3.3.1   Switch matrix 2/4 x 12

Base unit with option R&S ZNZ86X-B24

Option R&S ZNZ86X-B24 adds two switch module 2x6 to the R&S ZN-Z86X instrument, providing four physical VNA ports (A, B, C and D) and 12 physical test ports (1 to 6 and 7 to 12).

Figure 3-14: R&S ZN-Z86X Switch matrix 2/4 x 12

3.3.3.2 Switch matrix 2/4 x 24

Base unit with option R&S ZNZ86X-B44

Option R&S ZNZ86X-B44 adds four switch modules 2x6 to the R&S ZN-Z86X instrument, providing four physical VNA ports (A, B C and D) and 24 physical test ports (1 to 6, 7 to 12, 13 to 18 and 19 to 24).
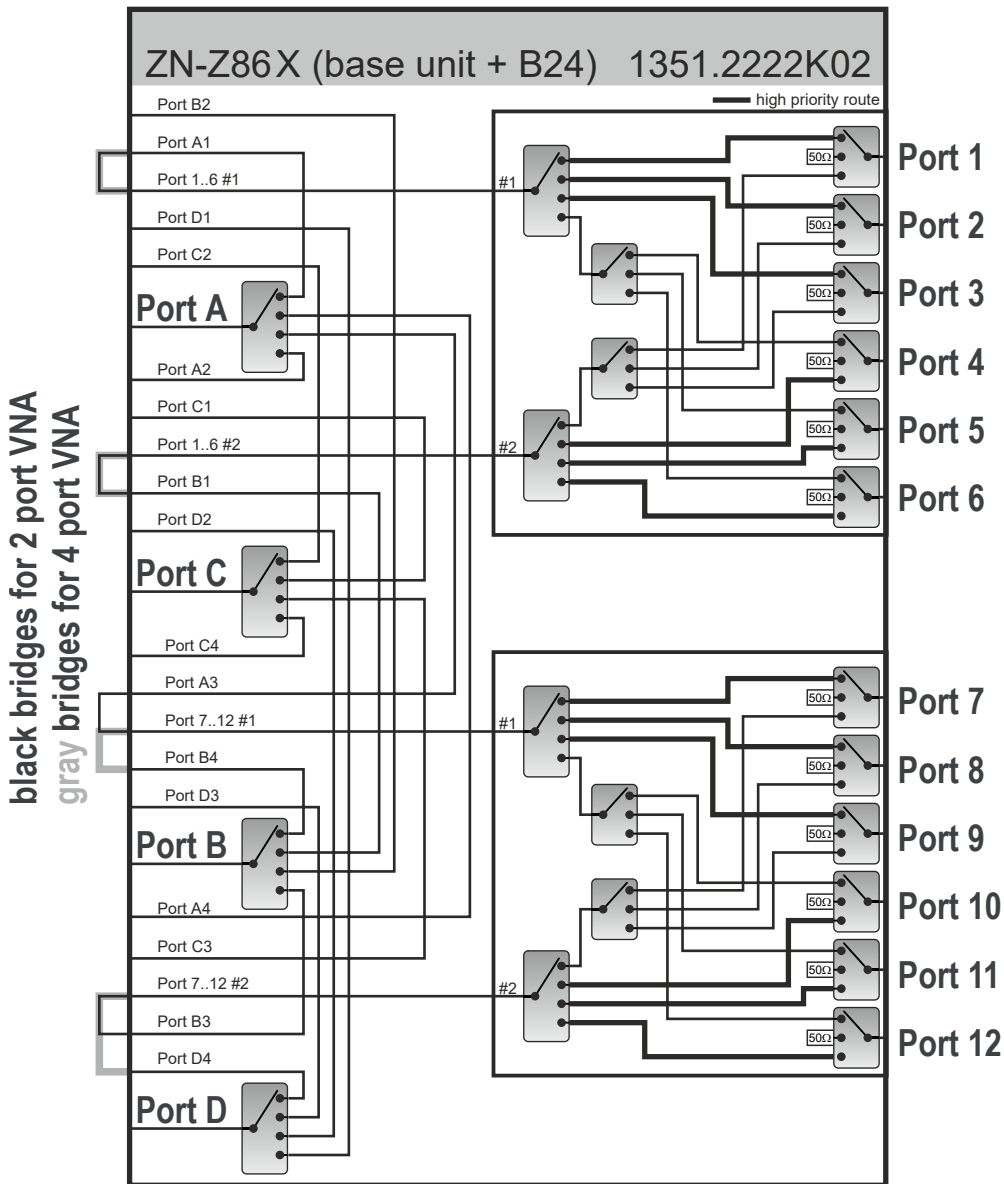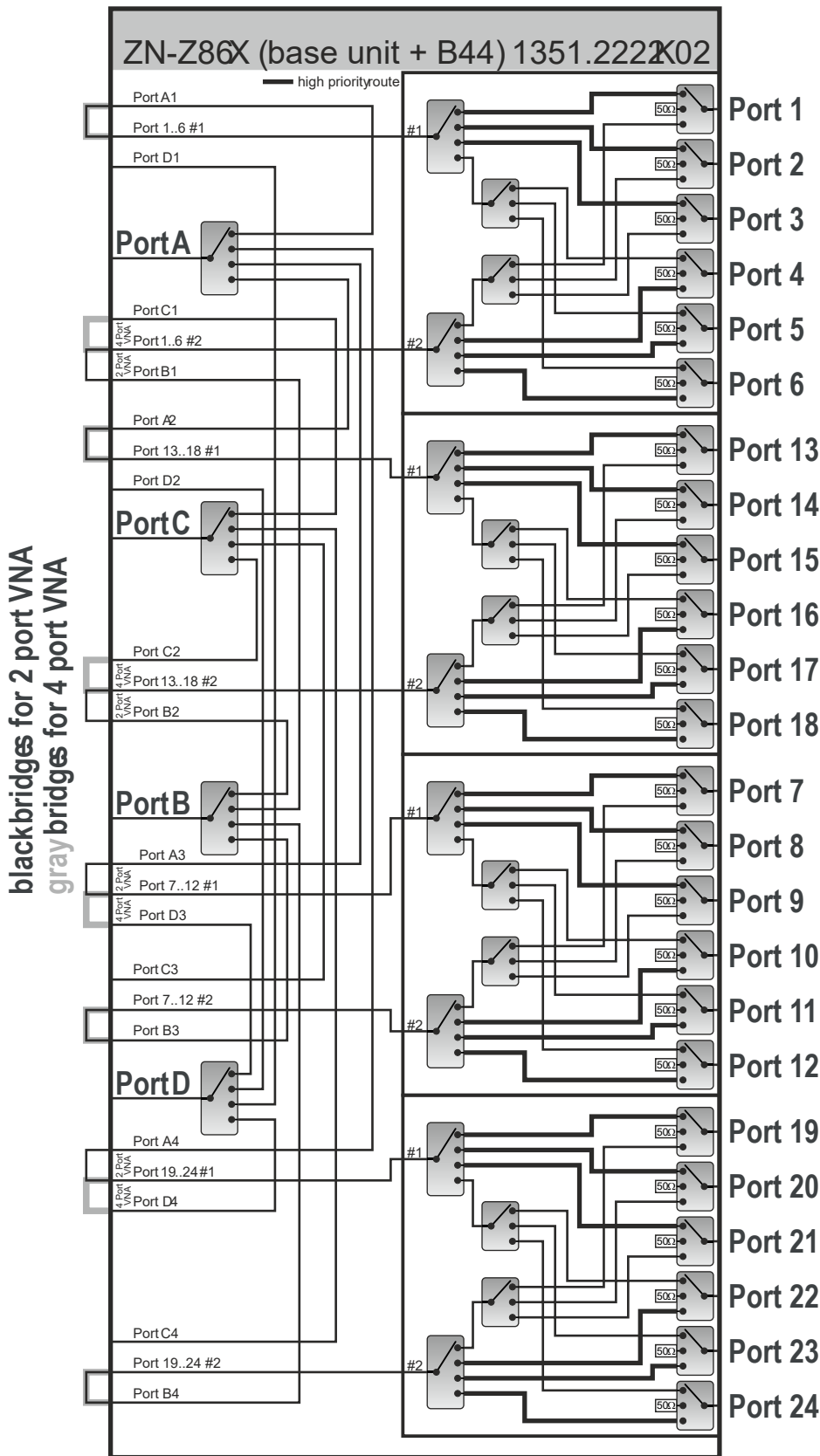
Figure 3-15: R&S ZN-Z86X Switch matrix 2/4 x 24

3.3.3.3   Operation with 2 or 4 matrix VNA ports

The R&S ZN-Z86X can operate as a 2 x N or 4 x N switch matrix.

To select between operation with 2 and 4 matrix VNA ports, you have to:

- Adjust the jumper cable position of the external RF links.
  See "Adjusting the jumper cable position of the external RF links" on page 46.

- Tell the matrix firmware to use 2 or 4 matrix VNA ports for routing.
  See "Selecting the VNA port mode" on page 47.

(i)   Mechanical and firmware settings must be consistent. Otherwise the R&S ZN-Z86X does not function properly.

Adjusting the jumper cable position of the external RF links

The labels "2/4 Port VNA", "2 Port VNA" and "2/4 Port VNA" indicate the correct adjustment for the 4 RF link groups. The adjustment of the outer groups is identical for both modes.

To operate the R&S ZN-Z86X switch matrix in 2-port VNA mode, adjust the external RF links as shown in Table 3-3. Once the external RF links are placed in the correct position, select the suitable VNA port mode as described in "Selecting the VNA port mode" on page 47.

Table 3-3: External RF links for 2-port mode

outer left	inner left	inner right	outer right

To operate the R&S ZN-Z86X switch matrix in 4-port VNA mode, adjust the external RF links as shown in Table 3-4. Once the external RF links are placed in the correct position, select the suitable VNA port mode as described in "Selecting the VNA port mode" on page 47.

Table 3-4: External RF links for 4-port mode

outer left	inner left	inner right	outer right

Selecting the VNA port mode

Select the suitable VNA port mode in the R&S ZN-Z8X Toolbox ("Routes" > "2 Port VNA"|"4 Port VNA") or via SCPI command (`CONFig:VNAport:MODE 2|4`). The setting is stored persistently on the matrix.
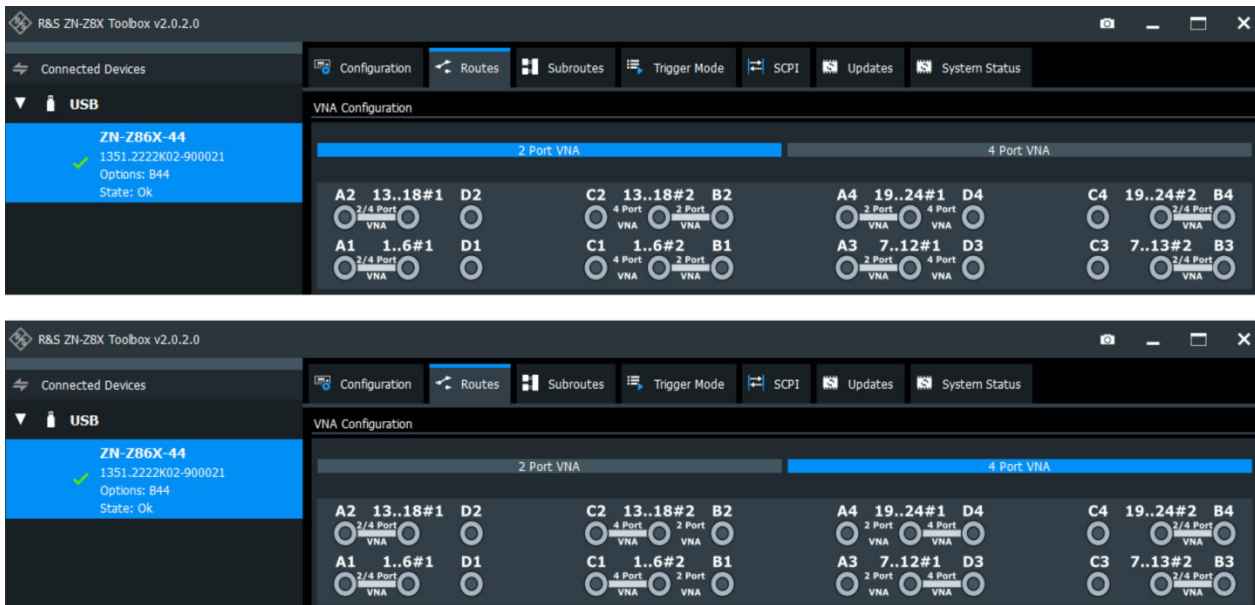
Figure 3-16: 2-port vs. 4-port mode

3.4   Application

As a VNA extension, the purpose of a switch matrix is to increase the number of test ports. The connected switch matrices convert an N-port network analyzer into an N'-port network analyzer (N'>N) without modifying the VNA itself. The increased number of test ports can reduce or even eliminate the manual reconnections of the DUT, resulting in a higher measurement speed, reliability and repeatability.

The firmware of the R&S ZNA/ZNB/ZNBT/ZND VNAs is able to control switch matrices R&S ZN-Z8x directly. It is fast and easy to set up and operate one or more switch matrices via the graphical user interface. For example, a 4-port R&S ZNB in combination with two R&S ZN-Z86 can work as a multi-port VNA with up to 48 ports.

Note however, that an N-port VNA only has N measurement receivers. Although you can connect more than N DUT ports, you can only measure N DUT outputs (b waves) simultaneously. For example, consider a DUT with 6 unbalanced ports, connected to a 2-port analyzer via a switch matrix. For each stimulus port, 5 sweeps are required to measure the resulting b waves, $6 \cdot 5 = 30$ sweeps in total. For "real" 6-port analyzers like the R&S ZNBT, a single sweep per driving port is sufficient.

Furthermore, in the example above, at least 6*5/2 successive matrix switching procedures are required (one for each port pair). Each of these switching procedures involves command processing and physical switching, and hence takes some time to complete. For speed optimizations, the characteristics of the available switch matrices must be considered (see Chapter 3.4.5, "Multiple paths: precision versus speed", on page 59).

(i)
- Matrix support is **not** available for R&S ZNL/LE.
- R&S ZN-Z86X has not been tested with R&S ZND.
- Direct control eliminates the protocol and command processing overhead of the standard remote control interfaces and hence significantly reduces the total switching time.
- While it is possible to connect multiple matrices to a single analyzer of the R&S ZNA/ZNB/ZNBT family, matrix cascading at RF layer is **not** supported.

3.4.1 Matrix setup and operation at the VNA

Setting up a switch matrix at a R&S ZNA/ZNB/ZNBT/ZND typically involves the following steps:

1. Establish a control connection via the appropriate interface (USB, LAN, direct control)

2. Register the matrix (as managed object)

3. Define the RF configuration:
   a) Configure the matrix-VNA-connections according to the existing (or planned) physical connections between VNA test ports and matrix VNA ports
   b) Configure the usable test ports, i.e. the matrix test ports and the VNA ports not connected to a matrix.

After this initial setup, the analyzer takes control of the attached matrices: it configures the test ports and dynamically establishes the required matrix through-connections according to the current measurement task.

ⓘ   For the R&S ZN-Z86X, adjust the jumper cable position of the external RF links and configure the VNA port mode before you set up the matrix in the VNA firmware.

Configuring VNA ports

To configure VNA ports for use with the R&S ZN-Z86/R&S ZN-Z86X switch matrix:

1. Press the [Setup] key to open the "Setup" softtool

2. For R&S ZNA, activate the "Switch Matrix" tab.
   For R&S ZNB/BT/D, activate the "External Ports" tab.

3. Select "Switch Matrix..." to open the "External Matrices" dialog.
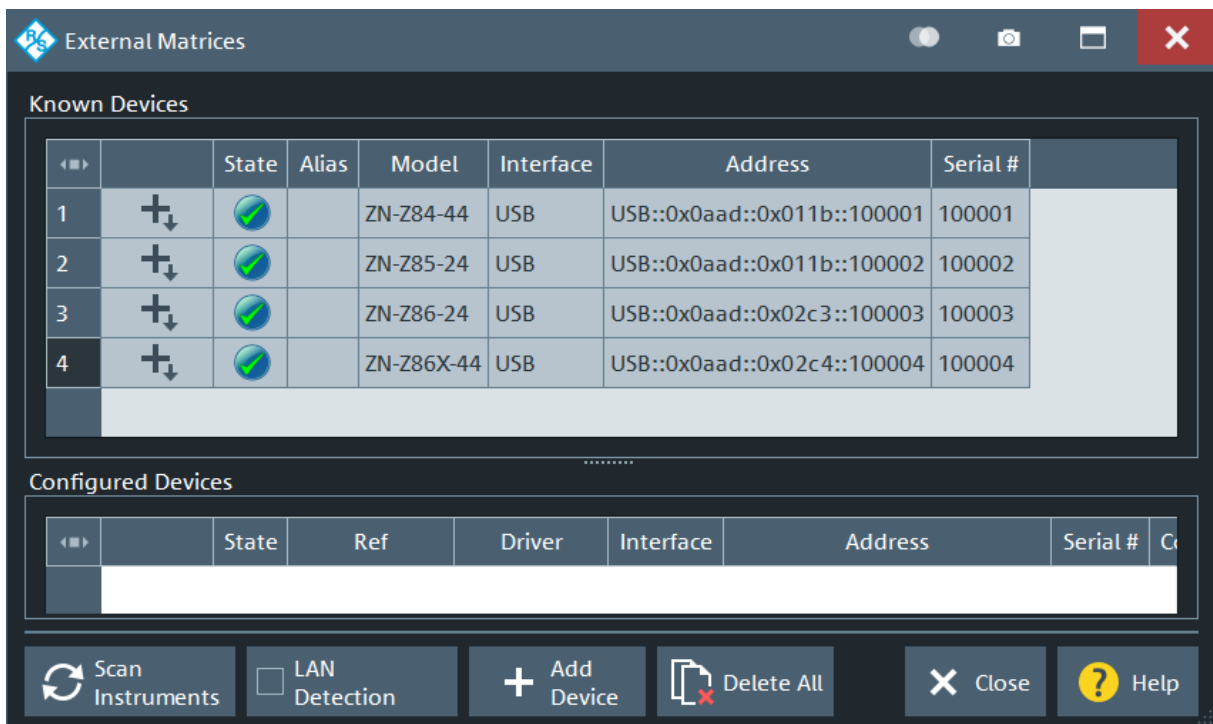
Switch matrices connected via USB or direct control are autodetected and listed under "Known Devices".
Activate "LAN Detection" to include the LAN interface in the autodetection sequence. **Note** that autodetection does not work if the matrix is not on the same LAN segment as the VNA.
Use "Scan Instruments", if your matrix does not appear under "Known Devices".

4. If your switch matrix appears under "Known Devices", select ⊞ to add it to the "Configured Devices".
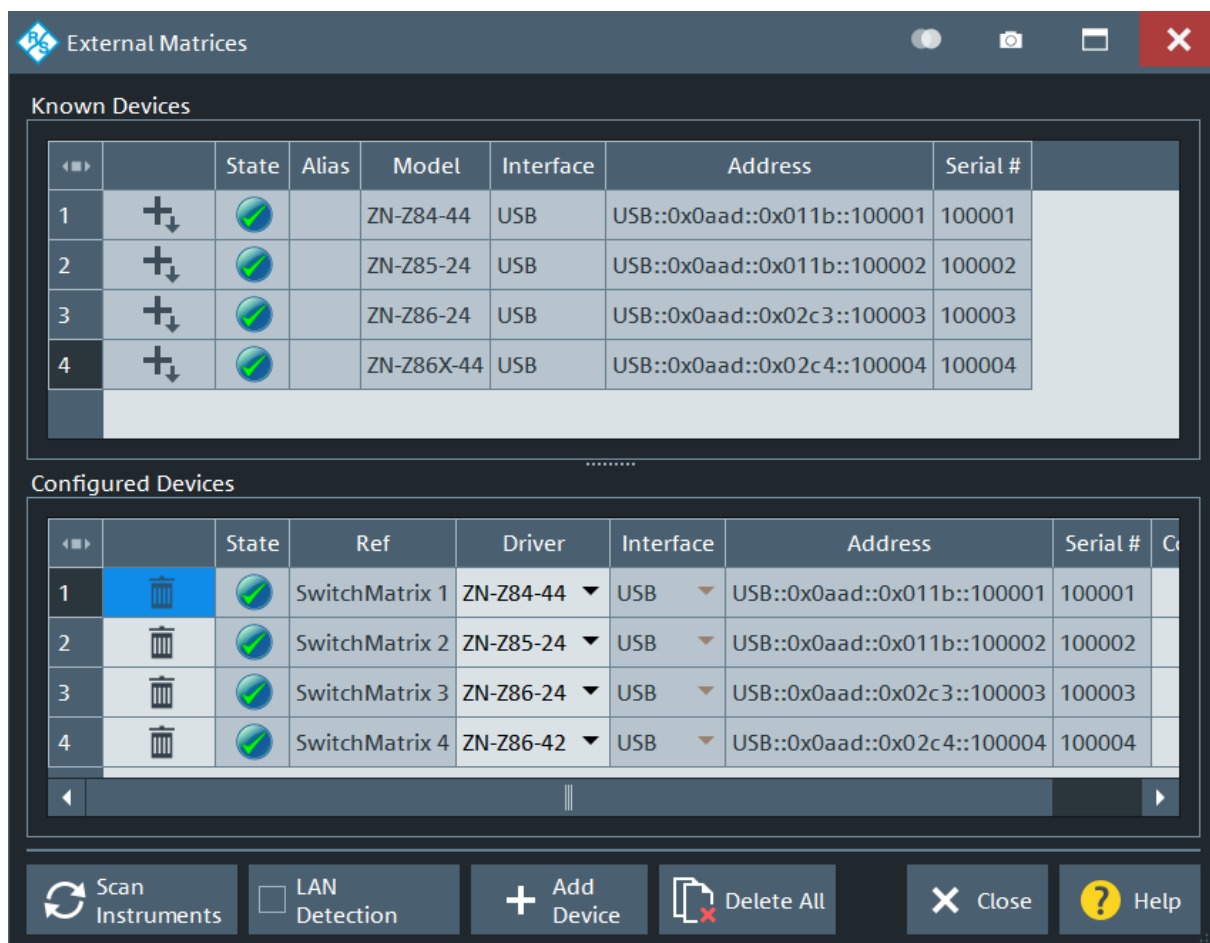
5. If autodetection fails, click "Add Device" to open the "Add External Switchma-
    trix" dialog that allows you to configure the switch matrix manually.
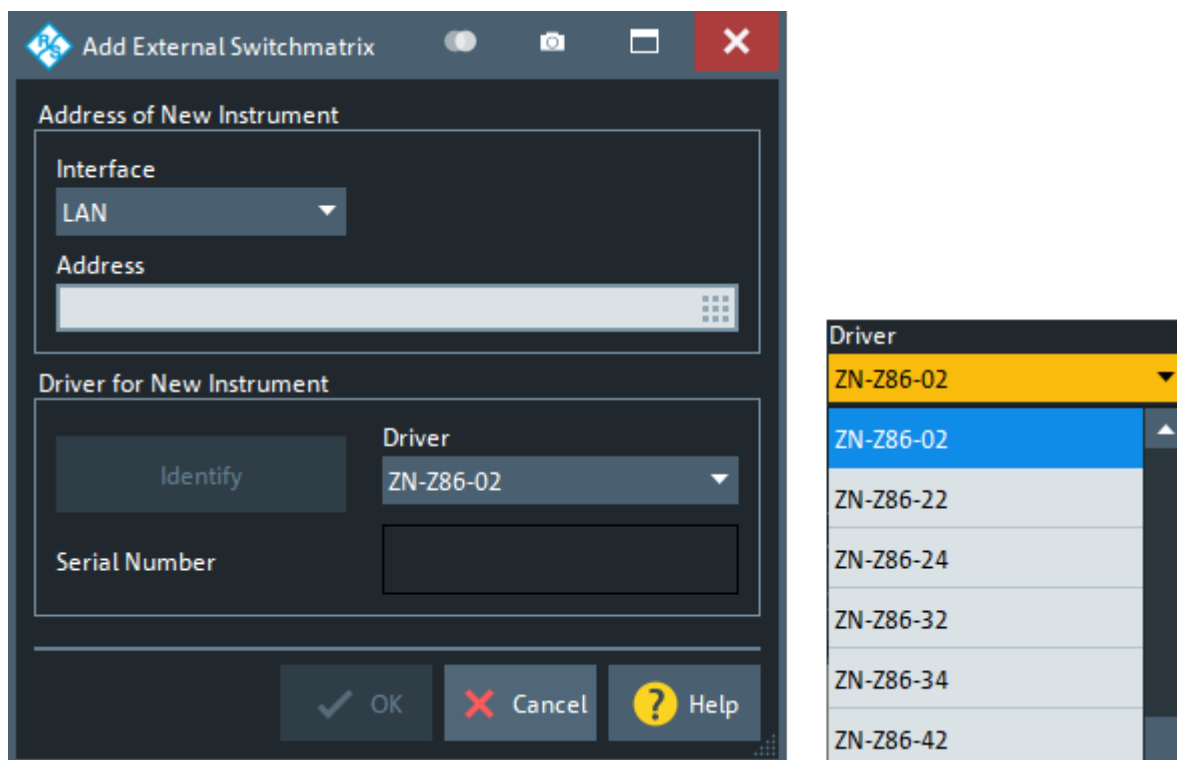
In the "Add External Switchmatrix" dialog:

a) Specify the LAN "Address" of your switch matrix.
b) Select "Identify" to connect to the switch matrix and query its properties
   (`*IDN?`, `CONFig:VNAport:MODE?`).

c) "Driver":
     If identification was successful, the VNA firmware chooses the suitable
     driver. Otherwise – or if you did not set the correct VNA port mode, you
     have to select it from the "Driver" dropdown.
     For R&S ZN-Z86, the driver name is composed of the matrix type and the
     highest option available on the matrix. For the R&S ZN-Z86X, the 2 x N
     and 4 x N switch matrices (N = 12, 24) have the same routing properties
     as their R&S ZN-Z86 counterparts. For this reason, the VNA firmware
     offers common drivers for R&S ZN-Z86 and R&S ZN-Z86X. Select the suit-
     able one according to the following table.

Table 3-5: VNA switch matrix drivers for R&S ZN-Z86 and R&S ZN-Z86X

Matrix	Driver	R&S ZN-Z86 highest option	R&S ZN-Z86X highest option and VNA ports
2 x 6	ZN-Z86-02	None (Base unit 2 x 6 only)	n.a.
2 x 12	ZN-Z86-22	R&S ZN-Z86-B22	R&S ZNZ86X-B24 **2** VNA ports
4 x 12	ZN-Z86-24	R&S ZN-Z86-B24	R&S ZNZ86X-B24 **4** VNA ports
2 x 18	ZN-Z86-32	R&S ZN-Z86-B32	n.a.
4 x 18	ZN-Z86-34	R&S ZN-Z86-B34	n.a.
2 x 24	ZN-Z86-42	R&S ZN-Z86-B42	R&S ZNZ86X-B44 **2** VNA ports
4 x 24	ZN-Z86-44	R&S ZN-Z86-B44	R&S ZNZ86X-B44 **4** VNA ports

d) Tap or click "OK" to apply the configuration and close the dialog.
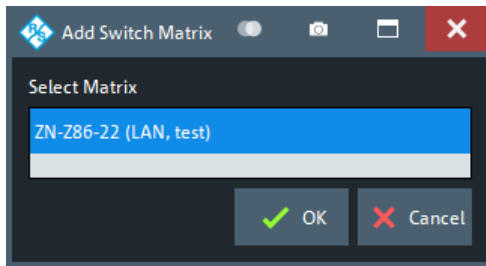   The manually configured switch matrix appears under "Configured Devices".

6. Tap or click "Close" to close the "External Matrices" dialog.

7. For R&S ZNA, select "Switch Matrix" > "Matrix RF Connections".
     For R&S ZNB/BT/D: select "External Ports" > "Switch Matrix" > "Matrix RF
     Connections".
     If no previous connection configuration exists, the "Add Switch Matrix" dialog
     appears.

In this case:

a) Select the switch matrices that you want to add to the RF configuration
b) Select "OK"

The "Switch Matrix RF Connections" dialog opens.
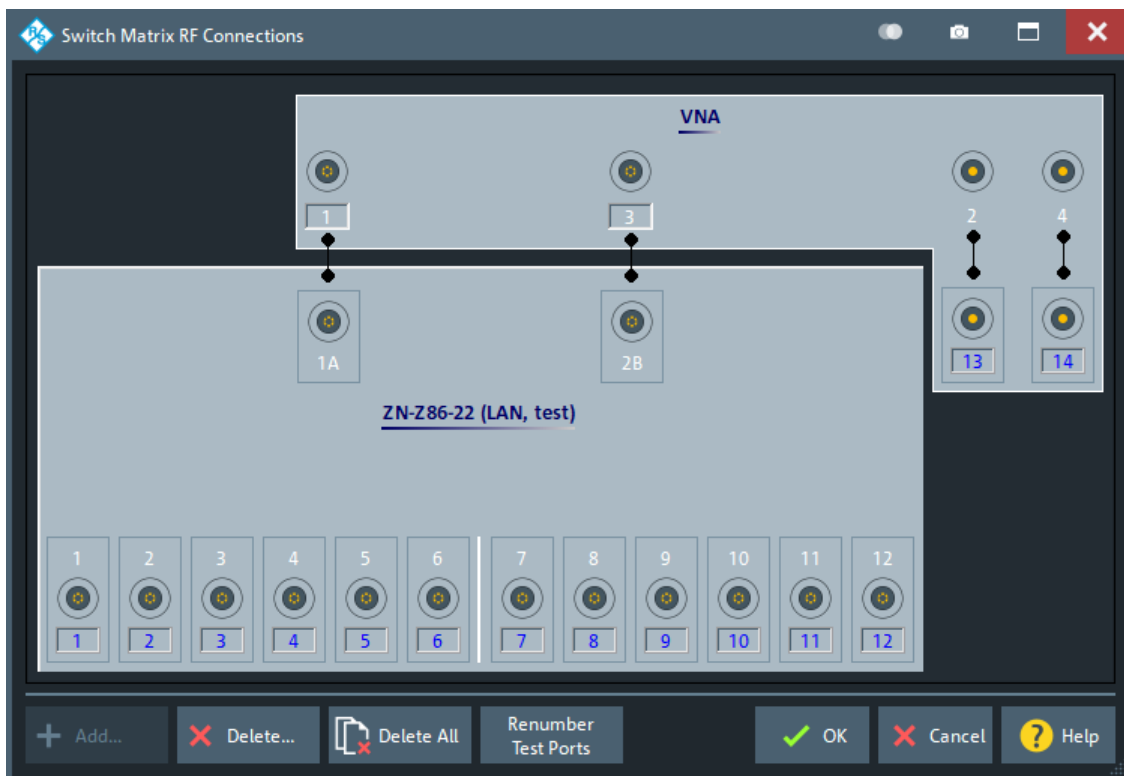
8. In the "Switch Matrix RF Connections" dialog:

   a) Configure the matrix VNA port assignments according to your setup
   b) Deactivate unused test ports
   c) Renumber the usable test ports as needed

3.4.2   RF connections and matrix connectivity

Depending on the expansion stage of the R&S ZN-Z86 and the RF connections between VNA and matrix:

- Certain matrix test ports can be unusable
- Certain transmission measurements can be impossible

Example:

Consider a fully equipped R&S ZN-Z86, where the matrix VNA ports of the left submatrix cannot be connected to the test ports of the right submatrix and vice versa.

If none of the two VNA ports of the right submatrix is connected, there is no path from the VNA to the test ports of this submatrix.
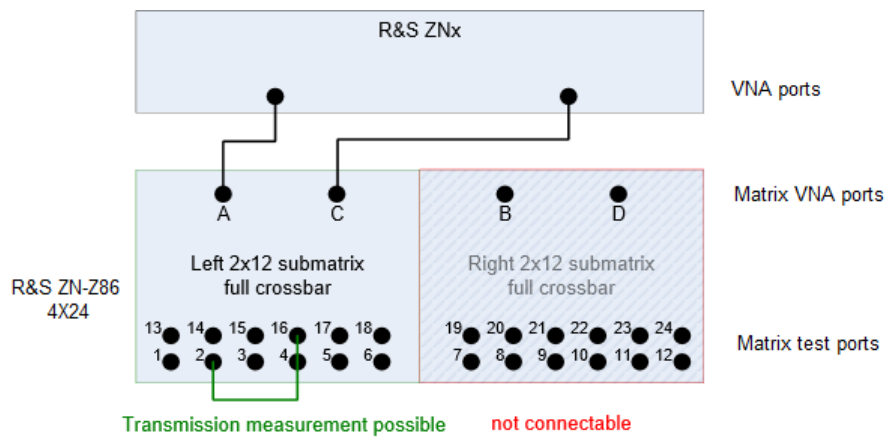

Figure 3-17: Unconnected right submatrix

Example:

Connecting one of two submatrix VNA ports enables reflection measurements for the corresponding matrix test ports. However, as long as a second connection between the VNA and this submatrix is missing, "intra-submatrix" transmission measurements are still impossible.
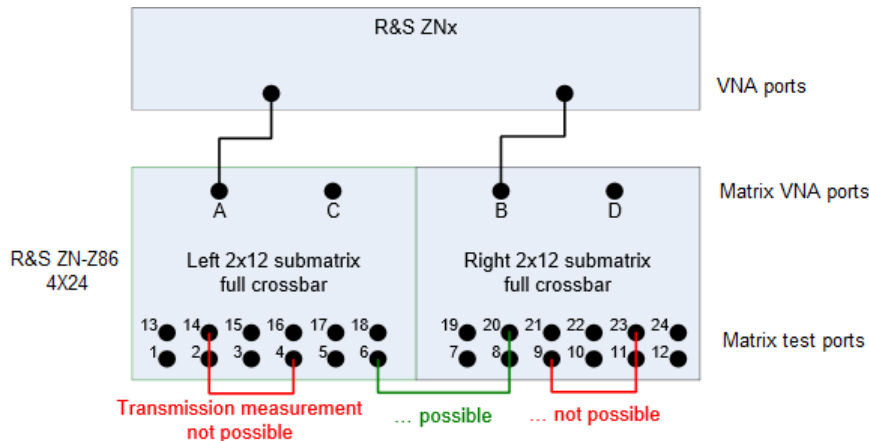

Figure 3-18: Partially connected submatrices

3.4.3   Routes

R&S ZNx firmware allows you to create RF routes from matrix VNA ports (A, B, C or D) to matrix test ports (1 to 24) using the R&S ZN-Z8X Toolbox or SCPI commands. It also allows you to query the existing routes using the `ROUTe?` SCPI command. For example, `ROUTe A3,B4` connects matrix VNA Port A with matrix test port 3 and matrix VNA Port B with matrix test port 4. For further information, refer to `ROUTe` SCPI command.

3.4.4   Subroutes

Switch matrices R&S ZN-Z86/Z86X comprise two types of switch modules: 1 to 4 and 2 to 6. For R&S ZN-Z86, the instrument firmware decides how to switch these modules for a specific route. For R&S ZN-Z86X, however, these switch modules are configurable and can be used separately.
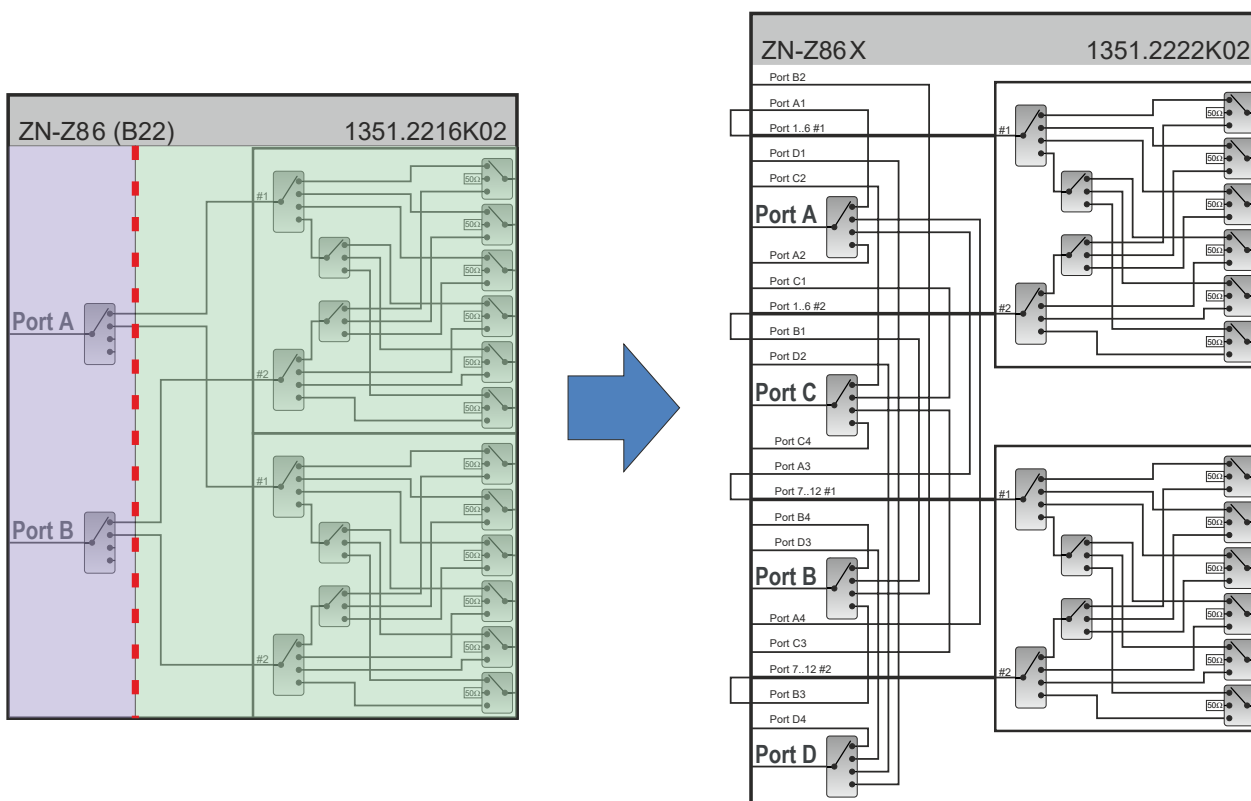
Figure 3-19: Subroutes in ZN-Z86X

To switch the 1 to 4 switch module, `SUBRoute PA1,PB2,PC3,PD4` SCPI command can be used to create subroutes from matrix VNA Port A to matrix port A1, matrix VNA Port B to matrix port B2, matrix VNA Port C to matrix port C3 and matrix VNA Port D to matrix port D4 respectively. Similarly, to switch the 2 to 6 switch module, `SUBRoute P0106201,P0712108,P1318114,P1924120` can be used to create subroutes where P0106201 means in the module with ports 01 to 06, the input #2 is routed to test port 1, P0712108 means in the module with ports 07 to 12, the input #1 is routed to test port 8, P1318114 means in the module with ports 13 to 18, the input #1 is routed to test port 14 and P1924120 means in the module with ports 19 to 24, the input #1 is routed to test port 20 (refer to the diagram below). For further information, refer to `SUBRoute` SCPI command.
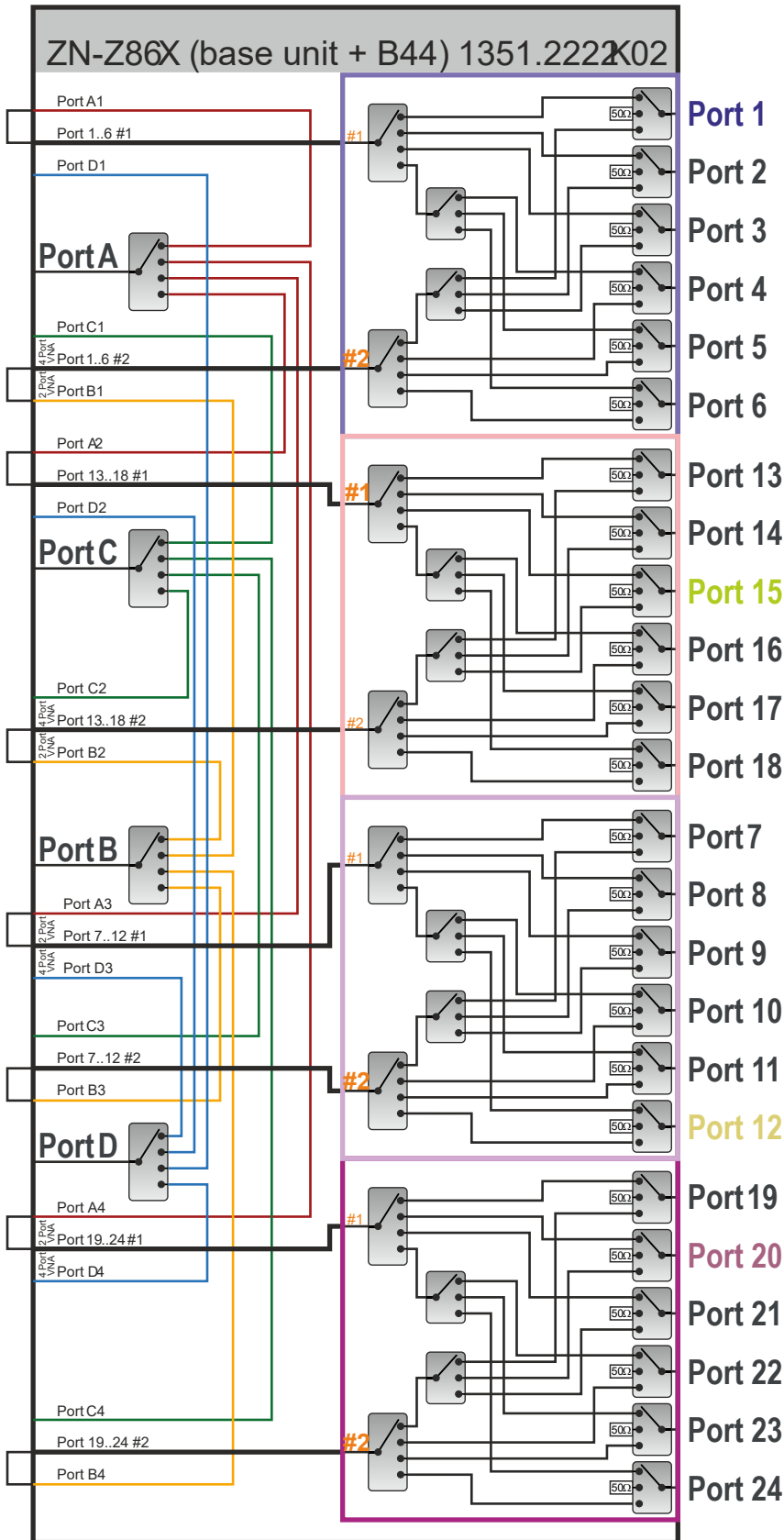
Figure 3-20: SUBRoute P0106201,P0712108,P1318114,P1924120

3.4.5   Multiple paths: precision versus speed

The switch matrix offers multiple routes to a given matrix test port and hence measurements can be performed using different physical paths (where a *path* consists of the traversed VNA connections and matrix routes).

These paths have different characteristics – in particular if the corresponding matrix routes differ in the number of switches being traversed.
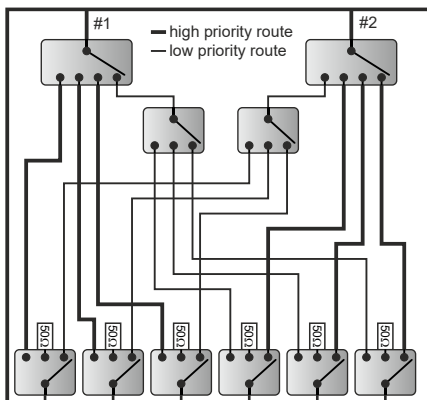

Figure 3-21: Routes and priorities

R&S ZNx firmware prioritizes the available routes according to the number of switches that they traverse:

- To obtain the highest measurement *precision*, the driving VNA port must use the "best possible" (highest priority) route. This can cause additional matrix switching procedures and hence can result in a reduced measurement speed.

- If the focus is on measurement *speed*, the number of matrix switching procedures should be minimized, disregarding a possible loss in measurement precision.

As for "slow" management connections the trade-off between precision and speed cannot be resolved, the R&S ZNx VNA firmware allows to select which optimization should be performed.

To see the difference between the two optimizations, again consider a DUT with 6 unbalanced ports, connected to a 2-port analyzer via the R&S ZN-Z86 base unit without extension. If all S-parameters shall be measured, at least 6*5/2 successive matrix switching procedures are required (one for each pair of test ports) and the *speed* optimization would choose one of these minimum solutions. In contrast, the *precision* optimization always selects the priority 1 route for the driving port, which results in 6*5 successive matrix switches (one per *directed* port pair).

💡 Always choose the *precision* optimization if the switch matrix is connected using Direct control. The switching speed of the matrix, in this case, is in the same range as the source switch of the VNA.

3.4.6 Trigger functionality

R&S ZN-Z86/Z86X allows triggering of the sequenced trigger mode by various events, such as a certain signal on the rear panel going high. This switch matrix supports software triggers and hardware triggers to control the operation of sequenced triggering mode.

R&S ZN-Z86/Z86X supports the following trigger sources:

* Software Triggers: Software triggers allow activation of the sequenced trigger mode under software control (using the R&S ZN-Z8X Toolbox or SCPI commands).

* Hardware Triggers: Hardware triggers are external inputs to the switch matrix and have two basic sources:

    – BNC connectors: The two BNC connectors on the rear panel can act as hardware triggers for the sequenced trigger mode.
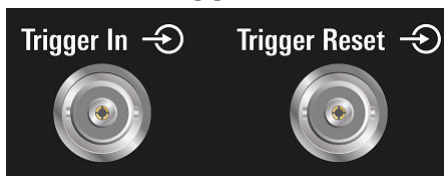
Figure 3-22: BNC connectors for triggering

    – Direct Control connector: Dedicated PINs on Direct Control connector can also be used for the sequenced trigger mode. Figure 3-23 shows the respective pin numbers on the Direct Control connector that can be used for ZN-Z86/ZN-Z86X triggering.
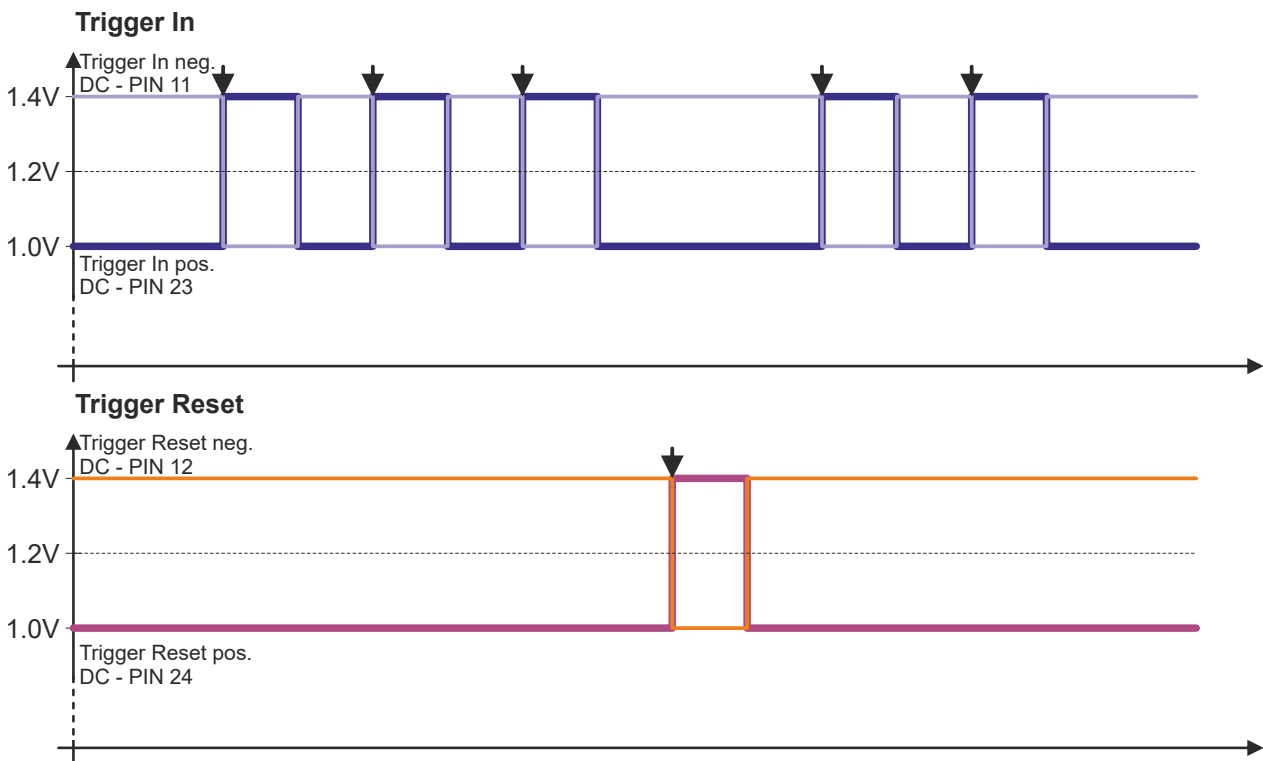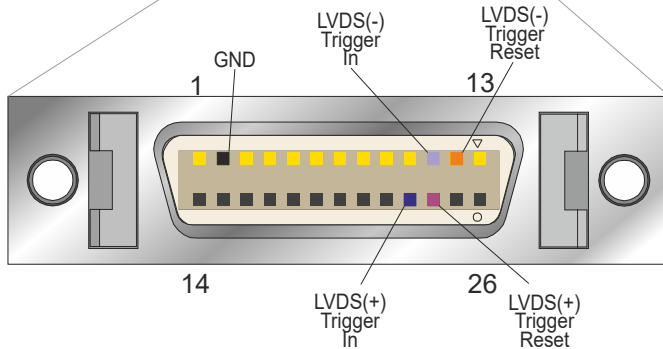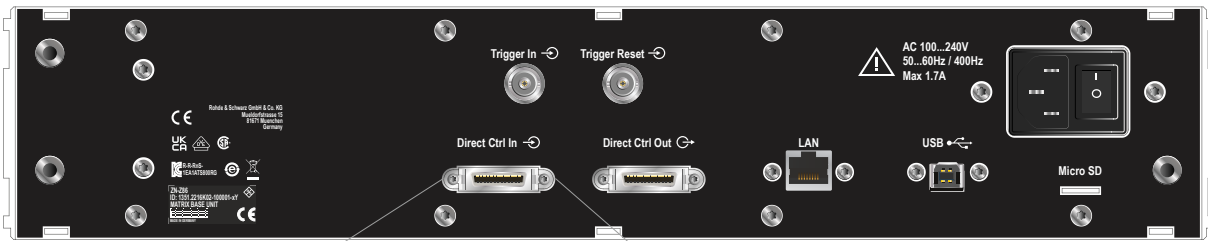
Figure 3-23: Direct Control connector for triggering

R&S ZN-Z86/ZN-Z86X contains a trigger table with a capacity of up to 2048 entries that can be filled via R&S ZN-Z8X Toolbox or SCPI commands. Once filled, you can activate the trigger mode and initiate a trigger through this predefined list of table entries in real time.

Figure 3-24 shows a snapshot of a predefined list of entries created to initiate the sequenced trigger mode. Each row in the list can be activated by a trigger signal in a sequence. The arrow highlighted in the red box shows the current active row.
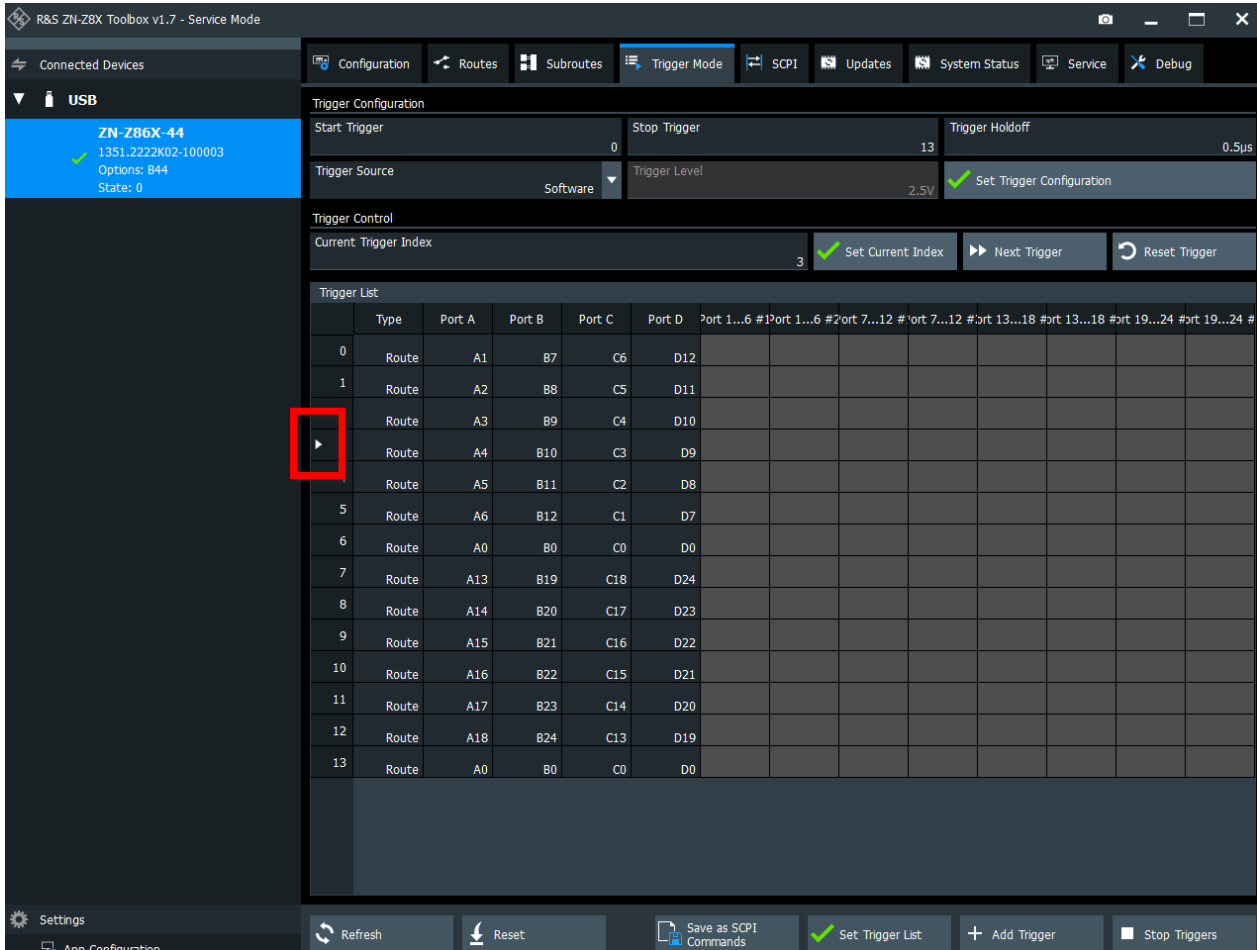
Figure 3-24: Software triggering via R&S ZN-Z8X Toolbox

Table 3-6 also shows an example of a predefined list of entries created to initiate the sequenced trigger mode.

Table 3-6: Table Entries for Triggering

Index	Port A	Port B	Port C	Port D
0	A1	B7	C2	D8
1	A2	B8	C3	D9
2	A3	B9	C4	D10
3	A6	B12	C5	D11
....				
2047	A0	B0	C0	D0

4   Remote operation

The switch matrix is remote-controlled from the VNA and R&S ZN-Z8X Toolbox; local operation on the device itself is not possible. For information on how to control the switch matrix from the VNA, refer to Chapter 3.4.1, "Matrix setup and operation at the VNA", on page 49.

The RF port LEDs of the R&S ZN-Z86/ZN-Z86X indicate the currently switched routes between matrix VNA ports and matrix test ports. The PWR LED on the front panel indicates the standby state of the instrument. The front panel USB is equipped with an LED that is lit while a connection is active.

This instrument is equipped with a 128x64 monochrome OLED-Display that displays the following information:

● Serial number of the instrument (for identification purposes)

● IP address

● USB and Direct Control link states

● Operational state of the instrument. This can be either

   – `OK` if the instrument is error-free or

   – `ERROR <error code>` with the error code of the last occurred error.

The following sections describe the steps and commands required for remote control of the ZN-Z8x switch matrix.

In Chapter 4.1, "Basic information on remote control", on page 64, you find information on setting up the switch matrix for remote control and on the available interfaces and protocols. You also find a brief description of the status register. The remote control commands are explained in detail in Chapter 4.2, "Remote control – commands", on page 68.

4.1   Basic information on remote control

This chapter contains basic information on remote control of the ZN-Z8x switch matrix. It contains instructions for setting up the instrument for remote control and a brief description of the status register.

4.1.1 Interfaces and protocols

The instrument has different interfaces for remote control. The following table provides an overview:

Table 4-1: Remote control interfaces and protocols

Interface	Comments
USB	On the back of the instrument, there is a type B USB interface (Device) for communication with the Host device. For details see Chapter 4.1.1.2, "USB interface", on page 66.
Local Area Network (LAN)	The LAN port is located at the backplane of the instrument. The LAN interface supports a RAW TCP/IP protocol at port 2101. All LAN parameters can be set using SCPI commands or via USB using the R&S ZN-Z8X Toolbox which can be downloaded from the R&S website. For detailed information about the operation of the ZN-Z8x switch matrix using the R&S ZN-Z8X Toolbox, refer to the *R&S ZN-Z8X Toolbox user manual*. For details see Chapter 4.1.1.3, "LAN interface", on page 67

Standard commands for programmable instruments (SCPI)

For remote control of the instrument, commands in line with the SCPI standard are used. The syntax of commands that are not included in that standard still follows the SCPI rules. The instrument supports SCPI version 1999 (Standard Commands for Programmable Instruments). The SCPI standard is built on the foundation of the IEEE 488.2 standard, and it aims to standardize instrument-specific commands, error handling and status register. For further information on SCPI concepts and definitions, please refer to the book "Automatic Measurement Control – A tutorial on SCPI and IEEE 488.2" by John M. Pieper, R&S order number 0002.3536.00.

ⓘ The description of the remote control functionality assumes that you are familiar with programming and understand how to operate the controller. You find detailed information on syntax and on the interface commands in the SCPI descriptions mentioned above.

4.1.1.1 Commands and responses

Commands are messages that the controller sends to the instrument. They operate the instrument functions and request information. The commands are divided into types based on two criteria:

- Based on the effect that they have on the instrument
  - **Setting commands** control instrument settings, such as resetting the instrument, or entering setting values.
  - **Query commands** make output data for the remote control, for example for identifying the instrument or for querying a setting's value. Queries have a question mark ? at the end of the setting command.
- Based on how they are defined in the IEEE 488.2 and SCPI standards:
  - **Common commands** are precisely defined regarding their function and syntax in the IEEE 488.2 standard. These commands are identical for all instruments, and they refer to functions such as the management of the standardized status register, resetting and self-testing.
  - **Instrument-dependent commands** are for functions that depend on the characteristics of the specific instrument, such as frequency setting. Many of these commands have also been standardized by the SCPI Consortium. Such commands are labeled "SCPI compliant" in the command reference. Commands without the SCPI label are instrument-dependent, however, their syntax follows the SCPI rules, as allowed by the standard.

Responses are messages that the instrument transmits to the controller after a query command. Responses contain measurement results, instrument settings or status information on the instrument.

You find detailed descriptions of the commands for controlling the R&S ZN-Z86/ZN-Z86X in Chapter 4.2, "Remote control – commands", on page 68.

4.1.1.2   USB interface

For remote control via the USB bus, connect the controller (Host) to the R&S ZN-Z86's type B USB interface.

Instrument control requires the generic `USBBULK.dll` and the instrument-specific `znz8x_dll.dll`. These libraries are part of the R&S ZNX firmware and are also installed with the R&S ZN-Z8X Toolbox that can be downloaded from the R&S website.

USB address

To establish a USB connection, you need:

- The **vendor ID** `0x0AAD` (for Rohde & Schwarz)
- The R&S ZN-Z86's **product ID** `0x02C3`

- The R&S ZN-Z86X's **product ID** `0x02C4` and

- The instrument's 6-digit serial number (see mini display or label on the back of the instrument)

4.1.1.3   LAN interface

The instrument is equipped with a LAN interface to enable integration into a local area network (LAN). This interface consists of a connector, a network card, and protocols.

For remote control via the network, the controller and the instrument must be connected via the LAN interface to a common network that uses the TCP/IP network protocol. They are connected using commercially available RJ-45 cables. The TCP/IP network protocol and the network services associated with it are preconfigured on the instrument.

To establish the connection, you need the instrument's IP address or computer name.

Socket communication

An alternative way for remote control of the software is to establish simple network communication using sockets (also referred as "Raw Socket communication").

The simplest way to establish a socket communication to the switch matrix is to connect to the built-in Telnet server. A Telnet client is part of every operating system and supports communication with the server on a command-by-command basis. For better utilization and to enable automation by additional programs, user-defined sockets can be programmed.

Socket connections are established on a specially defined port. The socket address is a combination of the IP address or the instrument's host name and the number of the port configured for remote control. All switch matrices use port number 2101 for this purpose. The port is configured for communication on a command-to-command basis and for remote control by a program.

4.1.2   Status reporting system

The status reporting system stores all information on the instrument's current status and on the errors that have arisen. This information is stored in the status reg-

ister and in an error output queue that can be queried using the `SYSTem:ERRor?` command.

4.2   Remote control – commands

This chapter describes all the commands that are relevant for remote control of the ZN-Z8x switch matrix. The "List of Commands" at the end of the manual contains all commands in an alphabetical order.

The following conventions are used in the remote command descriptions:

- **Command usage**
  If not specified otherwise, commands can be used both for setting and for querying parameters.
  If a command can be used for setting or querying only, or if it initiates an event, the usage is stated explicitly.

- **Parameter usage**
  If not specified otherwise, a parameter can be used to set a value, and it is the result of a query.
  Parameters required only for setting are indicated as **Setting parameters**.
  Parameters required only to refine a query are indicated as **Query parameters**.
  Parameters that are only returned as the result of a query are indicated as **Return values**.

💡   **Tips and tricks for operation ...**

- **The use of upper and lower case letters** designates the long and short forms of a command: `SET:LAN:SNMask = SET:LAN:SNM`

- **Text parameters** are separated from the header by a space. They follow the strict syntax rules for keywords.

- All Commands have to be sent without termination or with <CR> (carriage return 0x0D) termination only.

- Results are returned as ASCII strings terminated with `<CR><LF>` (ASCII 13 followed by ASCII 10)

- Optional Handshake (enabled by default)

4.2.1 Handshake

If Handshake is active, on successful execution of a command that otherwise does not return a result, a confirmation `0,"OK"<CR><LF>` is returned.

HANDshake?

Queries whether Handshake is ON (default) or OFF.

Return values:

<Boolean>	Either `0` (OFF) or `1` (ON)
	*RST: 1 (ON)
Usage:	Query only

HANDshake:ON
HANDshake:OFF

Enables/disables the Handshake logic.

A successful command execution is answered by the handshake confirmation `0,"OK"<CR><LF>`.

Usage:	Event

4.2.2 General functions

*RST

Sets the instrument to a defined default state:

- Handshake is turned ON
- All existing Routes are disconnected
- All trigger entries are deleted and `TRIGger:STATe` is set to OFF.

Usage: Event

SYSTem:CLEar

Clears the error memory.

Usage: Event

SYSTem:ERRor?

Queries the instrument for a list of errors.

Return values:

\<ErrCodes\>   A list of error numbers (see table below).

Usage: Query only

Table 4-2: ZN-Z8x error codes

Error code	Error string	Description
0	ZNZ86_STATUS_OK	
1	ZNZ86_STA-TUS_UNKNOWN_OPT	unknown extension module
2	ZNZ86_STA-TUS_OPT_ERROR	extension module does not match available option codes
3	ZNZ86_STA-TUS_FPGA_ERROR	cannot read from FPGA registers
5	ZNZ86_STA-TUS_NOR_FLASH_ERROR	NOR flashes corrupted (self-test failed)
6	ZNZ86_STATUS_CON-FIG_FILE_ERROR	config.ini corrupted (inconsistent config.ini file)
7	ZNZ86_STA-TUS_FPGA_FALL-BACK_LOADED	productive FPGA corrupted, fallback loaded
8	ZNZ86STA-TUS_FPGA_IRQ_ACTIVE	FPGA triggered a system monitor IRQ
9	ZNZ86_STA-TUS_FPGA_TIME-OUT_LOADING	FPGA loading timeout, e.g. old FPGA not triggering PROG-BUS_FPGA_LOADED_GPIO
10	ZNZ86_STA-TUS_FPGA_INCOMPATI-BLE_VERSION	FPGA version is not compatible with µC version

Error code	Error string	Description
11	ZNZ86_STATUS_MATRIX_FILE_ERROR	matrix.ini corrupted (inconsistent matrix.ini file)
20	ZNZ86_STATUS_FPGA_TEMPALARM	temperature alarm FPGA
21	ZNZ86_STATUS_VCC_AUX9_OUTRANGE	Voltage difference between -12 V and +6 V is out of range
22	ZNZ86_STATUS_VCC_AUX10_OUTRANGE	Voltage difference between -12 V and +5 V (2x6 Modules 1 and 2) is out of range
23	ZNZ86_STATUS_VCC_AUX11_OUTRANGE	Voltage difference between -12 V and +5 V (2x6 Modules 3 and 4) is out of range
24	ZNZ86_STATUS_VCC_AUX14_OUTRANGE	Voltage difference between -9V7 and +3V3 (2x6 Modules 1 and 2) is out of range
25	ZNZ86_STATUS_VCC_AUX15_OUTRANGE	Voltage difference between -9V7 and +2V5 (2x6 Modules 3 and 4) is out of range
26	ZNZ86_STATUS_VCC_AUX6_OUTRANGE	Voltage difference between +1V0 and Ground is out of range
27	ZNZ86_STATUS_VCC_INT_OUTRANGE	Internal FPGA voltage of +1.2 V is out of range
28	ZNZ86_STATUS_VCC_AUX_OUTRANGE	AUX. FPGA voltage of +2.5 V is out of range

4.2.3 Identification

*IDN?

IDENTIFICATION QUERY queries the instrument identification string.

Return values:

<ID_Str>   ROHDE&SCHWARZ,<prodtype>-<opt>,<serial>,<fw version>, where

`<prodtype>` is either `ZN-Z86` or `ZN-Z86X`.

`<opt>` is the option characterizing the expansion stage, i.e. the highest available option.

R&S ZN-Z86X: `24` for the 2/4x12 expansion (highest order no. 1351.2222.**24**), `44` for the 2/4x24 expansion (highest order no. 1351.2222.**44**)

Examples for R&S ZN-Z86: `02` if only the base unit (order no. 1351.2216K**02**) is available; `34` for the 4x18 expansion (highest order no. 1351.2900.**34**).

`<serial>` is the 6-digit serial number (see Mini display or SAP label on the rear panel).

<fw version> is the installed firmware version in "xx.yy" dotted decimal notation (xx: major version; yy: minor version).

Usage:	Query only

---

*OPT?

OPTION IDENTIFICATION QUERY queries the options contained in the instrument and returns a list of the installed options.

Return values:

<options>	"/"-separated list of options, e.g. `Installed Options: Basic/B22/B32` for the 2x18 extension.
Usage:	Query only

---

*SERial?

Returns the serial number of the instrument.

Return values:

<Value>	6-digit serial number, see mini display and SAP label on the back panel
Usage:	Query only

4.2.4   LAN interface

The following commands get/set the properties of the LAN interface.

ⓘ Modified LAN settings are not applied until `SET:LAN:INIT` is executed.
To make the changes permanent, use `WRITE:MXINI`.

SET:LAN:HOST:NAMe <HostName>
SHOW:LAN:HOST:NAMe?

Queries/sets the hostname of the instrument.

If the switch matrix uses DHCP and the DHCP server supports DHCP Option 12, the switch matrix can also be reached via this hostname.

Parameters:

<HostName>   The LAN hostname string (max. 20 characters).
                    The default hostname is `ZNZ86X<serial>`.

SHOW:LAN:MAC:ADDRess?

Queries the LAN MAC address of the instrument.

Return values:

<MACAddress>   The LAN MAC address in the format
                    `xx-xx-xx-xx-xx-xx`, e.g. `00-90-b8-1c-95-b9`.

Usage: Query only

SHOW:LAN:DHCP?

Queries whether DHCP is enabled.

Return values:

<DHCP>	1: DHCP enabled
	0: DHCP disabled (static IP configuration)
Usage:	Query only

SET:LAN:DHCP:ON
SET:LAN:DHCP:OFF

Enables/disables dynamic host configuration.

Usage:	Event

SET:LAN:GW <GWIP>
SHOW:LAN:GW?

Sets/queries the LAN default gateway.

Setting is only possible with static IP configuration (SET:LAN:DHCP:OFF). Otherwise the instrument answers with a "Deactivate DHCP first!"

Note that modified LAN settings are not applied until SET:LAN:INIT on page 75 is executed.

Parameters:

<GWIP>	The IP address of the default gateway in dotted decimal format, e.g. 192.168.1.2.

SET:LAN:IP <IpAddr>
SHOW:LAN:IP?

Sets/queries the LAN IP address.

Setting is only possible with static IP configuration (SET:LAN:DHCP:OFF). Otherwise the instrument answers with a "Deactivate DHCP first!"

Note that modified LAN settings are not applied until SET:LAN:INIT on page 75 is executed.

Parameters:

<IpAddr>   The LAN IP address in dotted decimal format, e.g. `192.168.0.254`.

SET:LAN:SNMask <SnMask>
SHOW:LAN:SNMask?

Sets/queries the LAN subnet mask.

Setting is only possible with static IP configuration (`SET:LAN:DHCP:OFF`). Otherwise the instrument answers with a `"Deactivate DHCP first!"`

Note: Modified LAN settings are not applied until `SET:LAN:INIT` on page 75 is executed.

Parameters:

<SnMask>   The LAN subnet mask in dotted decimal format, e.g. `255.255.255.0`.

SET:LAN:INIT

Activates the previously configured LAN settings (DHCP, IP address, subnet mask, default gateway).

Use the `WRITE:MXINI` command to persist the LAN settings.

Usage: Event

4.2.5 Routes

ROUTe

Creates a set of RF routes (connections from matrix VNA ports to matrix test ports) or queries the existing routes. The query command returns the current set routes.

Note: During route creation,

- Existing routes are deleted
- Unconnected matrix test ports are terminated with a 50 Ω match

If the new route set was successfully created, the SET command returns the created routes exactly as the query would do.

If the new route set is invalid, either because it is empty, involves non-existing ports or contains multiple routes for the same ports, an `1,"ROUTE ERROR"` is returned and the existing routes are preserved.

Parameters:

<Routes>	Non-empty, comma-separated list of routes [A-D][0-48], where each route is determined by a matrix VNA port [A-D] and its connected matrix test port [0-48], for example `ROUTe A1,B2` connects matrix VNA Port A with matrix test port 1 and matrix VNA Port B with matrix test port 2. Matrix test port 0 means that the related matrix VNA port is "not connected"; in queries, both unequipped and unconnected matrix VNA ports are indicated as being connected to matrix test port 0.
Example:	In a 2xN switch matrix, the below SCPI command creates a single route between matrix VNA port A and matrix test port 1: `ROUTe A1` `ROUTe A0` deletes all routes.

SHOW:ROUTes?

Returns the list of all possible routes.

Return values:

Routes	Comma-separated list of all possible routes. For example, in the 2x6 base matrix, the return value is `A1,A2,A3,A4,A5,A6,B1,B2,B3,B4,B5,B6`.
Usage:	Query only

SUBRoute

Creates a set of RF subroutes (1 to 4 or 2 to 6 switch board setting) or queries the existing subroutes. The query command returns the current set subroutes.

Note: During subroute creation,

- Existing routes or subroutes are deleted
- Unconnected matrix test ports are terminated with a 50 Ω match

If the new subroute set was successfully created, the SET command returns the created subroutes exactly as the query would do.

If the new subroute set is invalid, either because it is empty, involves non-existing ports or contains multiple subroutes for the same ports, an `1,"ROUTE ERROR"` is returned and the existing subroutes are preserved.

Parameters:

<Subroutes>

Non-empty, comma-separated list of subroutes P[A-D] [0-4], where each port switch 1 to 4 can be set. For example `SUBRoute PA1,PB2` connects 1 to 4 port switch on Port A from common to 1 and 1 to 4 port switch from common to 2 respectively.
Additionally, 2 to 6 port switches can be set by subroutes P[0106,0712,1318,1924][1-2][00-24]. For example `SUBRoute P0106102,P1318214`connects 2 to 6 port switch used for Port 01-06 from internal port 1 to external port 02 and 2 to 6 port switch 13-18 from internal port 2 to external port 14 respectively.

Example:

In a 2xN switch matrix, the below SCPI command creates a single route between matrix VNA port A and matrix test port 1:
`SUBRoute PA2,PB2,PC2,PD2,`
`P0106103,P0106204,P0712109,P0712210,`
`P1318115,P1318216,P1924121,P1924222`
`SUBRoute`
`P0106100,P0106200,P0712100,P0712200,`
`P1318100,P1318200,P1924100,P1924200` deletes all subroutes.

SHOW:SUBRoutes?

Returns the list of all possible subroutes.

Return values:

Subroutes

Comma-separated list of all possible subroutes.
For example, in the base matrix, the return value is
`PA1,PA2,PA3,PA4,PB1,PB2,PB3,PB4,PC1,PC2,`
`PC3,PC4,PD1,PD2,PD3,PD4,P0106101,P0106102,`
`P0106103,P0106104,P0106105,P0106106,`
`P0106201,P0106202,P0106203,P0106204,`
`P0106205,P0106206,P0712107,P0712108,`
`P0712109,P0712110,P0712111,P0712112,`
`P0712207,P0712208,P0712209,P0712210,`
`P0712211,P0712212,P1318113,P1318114,`
`P1318115,P1318116,P1318117,P1318118,`
`P1318213,P1318214,P1318215,P1318216,`
`P1318217,P1318218,P1924119,P1924120,`
`P1924121,P1924122,P1924123,P1924124,`
`P1924219,P1924220,P1924221,P1924222,`
`P1924223,P1924224..`

Usage: Query only

4.2.6   Trigger

The below section lists all the Trigger commands.

TRIGger:STATe

Turns the trigger state on or off.

Parameters:

<State>   ON,OFF

Example: TRIGger:STATe ON

TRIGger:SEQuence[:ADD]

Sets the start address index of the table. Default value is 0.

Parameters:

<index>   0,1,2,3,...

<routes/sub-routes>   A1, A2, A3,...

Example: TRIGger:SEQuence[:ADD] 0,'A1,B7,C6,D12'

Example: TRIGger:SEQuence[:ADD] 1,'A2,B8,C7,D13'

TRIGger:SEQuence:DELete

Deletes the whole trigger table with default state A0,B0,C0,D0. Start and Stop Index is set to 0.

Usage: Event

TRIGger:SEQuence:START

Sets the start address index of the table. Default value is 0.

Parameters:

<index>   0,1,2,3,...

Example: TRIGger:SEQuence:START 5

TRIGger:SEQuence:STOP

Sets the end index of the trigger table. Default is the last written trigger sequence entry. While setting start and stop index addresses, it is possible to cycle through a segment of the list.

Note: Stop index needs to be greater or equal to the start index.

Parameters:

<index>   0,1,2,3,...

Example: `TRIGger:SEQuence:STOP 15`

TRIGger:SEQuence:IDX

Sets the address index of the active table entry.

Parameters:

<index>   0,1,2,3,...

Example: `TRIGger:SEQuence:IDX 10`

TRIGger:SOURce

Selects the trigger source.

Parameters:

<Source>   SW, DC, BNC

                                 `SW`: Software via SCPI
                                 `DC`: Direct Control Connector
                                 `BNC`: BNC Sockets

Example: `TRIGger:SOURce BNC`

TRIGger:LEVel

Sets the threshold level in volts at which the trigger transitions states.

Parameters:

<Voltage>   0.5 - 4.5V

Example: `TRIGger:LEVel 2.5V`

TRIGger:HOLDoff

Sets the wait time before a retrigger can take place.

Parameters:

<Time>   0.0 - 10us

Example: `TRIGger:HOLDoff 1.5`

TRIGger:NEXT

Creates a software trigger.

Usage: Event

TRIGger:RESET

Initiates a software trigger reset.

Usage: Event

4.2.7 Other

CONFig:VNAport:MODE

Sets or queries the VNA port mode of a R&S ZN-Z86X.

Make sure to keep the port mode in sync with the external RF links.

Parameters:

<VnaPorts>
            2
            2-port mode
            4
            4-port mode

Example: `CONFig:VNAport:MODE 4`

SHOW:DIRectcon:STATus?

Queries the status of the Direct Control interface.

Return values:

<StatusCode>
            Either `0,"D.C. not linked"` or `1,"D.C. linked"`

Usage: Query only

WRITE:MXINI

Writes the current user settings (LAN), to the matrix flash. These settings are loaded during instrument startup.

Usage: Event

5   Maintenance, storage and disposal

The R&S ZN-Z86/ZN-Z86X switch matrix does not require maintenance at regular intervals.

5.1   Cleaning

How to clean the product is described in "Cleaning the product" on page 8.

Do not use any liquids for cleaning. Cleaning agents, solvents, acids and bases can damage the front panel labeling, plastic parts and display.

5.2   Service work

Replacing modules and ordering spare parts is described in the service manual. There you will also find all the ID numbers required for ordering spare parts.

In addition, the service manual contains information on troubleshooting, repairs and replacing modules.

5.3   Storage

Protect the product against dust. Ensure that the environmental conditions, e.g. temperature range and climatic load, meet the values specified in the specifications document.

5.4   Disposal

Rohde & Schwarz is committed to making careful, ecologically sound use of natural resources and minimizing the environmental footprint of our products. Help us by disposing of waste in a way that causes minimum environmental impact.

Disposing of electrical and electronic equipment

A product that is labeled as follows cannot be disposed of in normal household waste after it has come to the end of its life. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Figure 5-1: Labeling in line with EU directive WEEE

Rohde & Schwarz has developed a disposal concept for the eco-friendly disposal or recycling of waste material. As a manufacturer, Rohde & Schwarz completely fulfills its obligation to take back and dispose of electrical and electronic waste. Contact your local service representative to dispose of the product.

6 Transporting

Lifting and carrying

See:

- "Lifting and carrying the product" on page 6

Packing

Use the original packaging material. It consists of antistatic wrap for electrostatic protection and packing material designed for the product.

If you do not have the original packaging, use similar materials that provide the same level of protection. You can also contact your local Rohde & Schwarz service center for advice.

Securing

When moving the product in a vehicle or using transporting equipment, make sure that the product is properly secured. Only use items intended for securing objects.

Transport altitude

Unless otherwise specified in the specifications document, the maximum transport altitude without pressure compensation is 4500 m above sea level.

7   Contacting customer support

Technical support – where and when you need it

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

Contact information

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

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

Annex

A   Base extension boxes

This chapter describes the base extension boxes required to use R&S ZNA or R&S ZNBT vector network analyzer in conjunction with one or more switch matrices R&S ZN-Z86/Z86X.

R&S ZN-ZTBE and R&S ZN-ZTBXE base extension boxes are all-metal customized chassis used to extend the body length of the R&S ZN-Z86 and R&S ZN-Z86X switch matrices respectively. These base extension boxes enable a vector network analyzer such as R&S ZNA or R&S ZNBT to be stacked on top of the switch matrices, thus enabling a benchtop setup without toppling. This is simply done by securing the metal chassis to the rear end of the switch matrices to extend their body length.

A.1   R&S ZN-ZTBE base extension box for R&S ZN-Z86

A R&S ZNA or R&S ZNBT vector network analyzer can be placed on top of the R&S ZN-Z86 switch matrix using the R&S ZN-ZTBE base extension box.
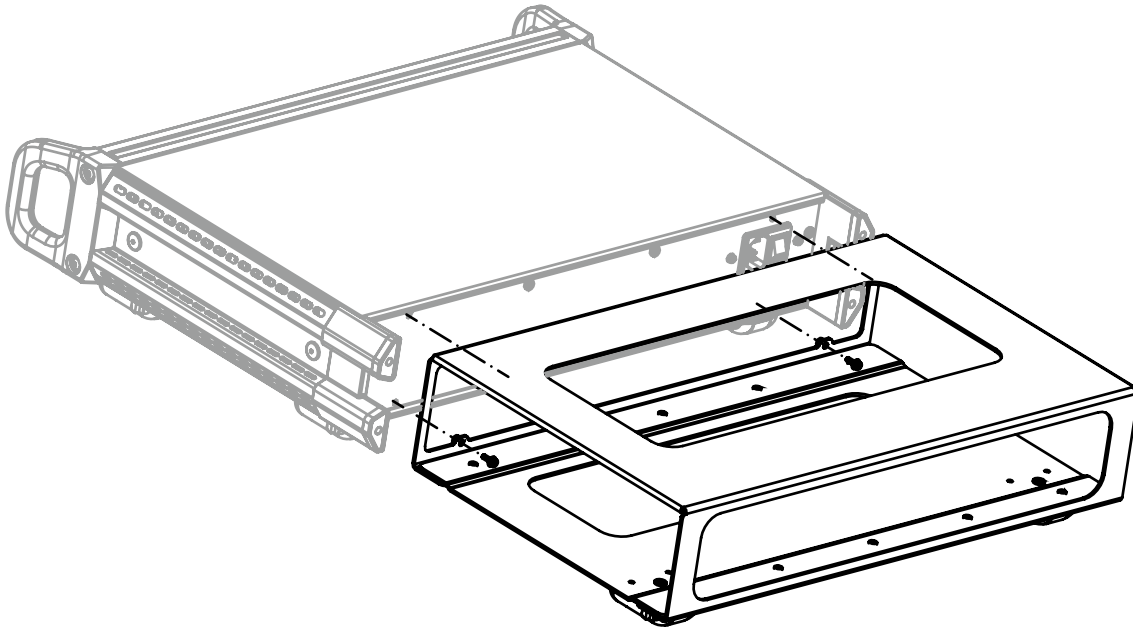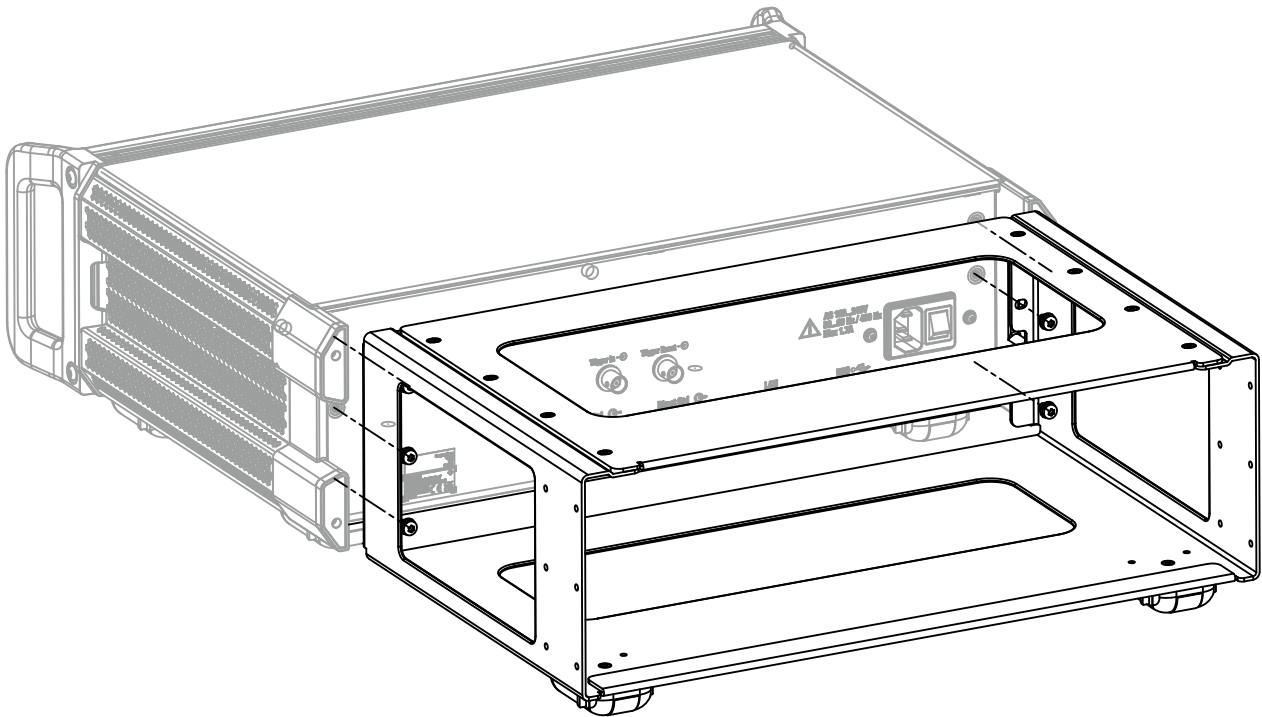
Figure A-1: R&S ZN-ZTBE base extension box

The table below lists the physical dimensions and weight of the R&S ZN-ZTBE base extension box for R&S ZN-Z86.

Table A-1: R&S ZN-ZTBE specifications

Specifications	Description
Maximum Load (for fully equiped R&S ZNBT)	45 kg
Physical Dimensions (width x height x depth)	410 mm × 103 mm × 255 mm = 16.1 in × 4.1 in × 10.0 in
Weight	400 g = 0.9 lb

A.2   R&S ZN-ZTXBE base extension box for R&S ZN-Z86X

A R&S ZNA or R&S ZNBT vector network analyzer can be placed on top of the R&S ZN-Z86X switch matrix using the R&S ZN-ZTXBE base extension box.

Figure A-2: R&S ZN-ZTXBE base extension box

The table below lists the physical dimensions and weight of the R&S ZN-ZTXBE base extension box for R&S ZN-Z86X.

Table A-2: R&S ZN-ZTXBE specifications

Specifications	Description
Maximum Load (for fully equiped R&S ZNBT)	45 kg
Physical Dimensions (width x height x depth)	410 mm × 150 mm × 257 mm = 16.1 in × 5.9 in × 10.1 in
Weight	600 g = 1.3 lb

B   Semi-rigid RF cable sets

The semi-rigid cable sets offered by Rohde & Schwarz establish high-quality RF connections between a VNA and one or two switch matrices, stacked on a bench top.

Cable sets R&S ZN-ZA26, R&S ZN-ZB26 and R&S ZNZT26 are designed for R&S ZNA, R&S ZNB and R&S ZNBT respectively.

Figure B-1: Cable sets R&S ZN-ZA26 for R&S ZNA

Figure B-2: Cable sets R&S ZN-ZB26 for R&S ZNB
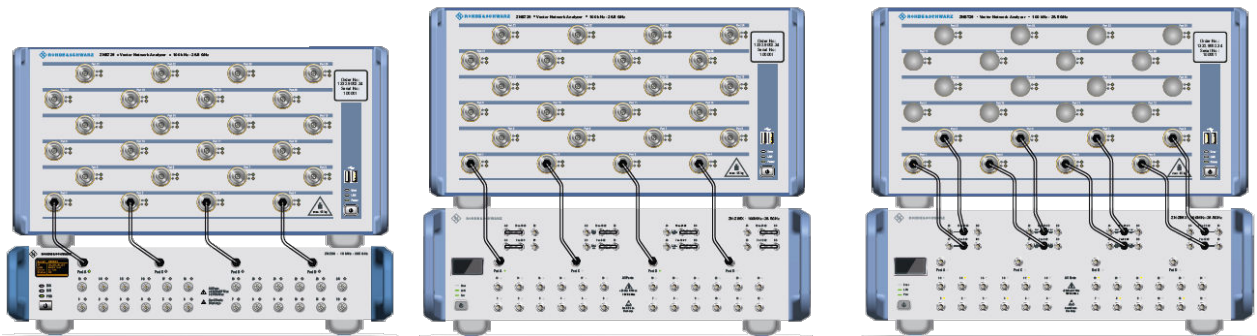
Figure B-3: Cable sets R&S ZN-ZT26 for R&S ZNBT

All contained semi-rigid cables support frequencies up to 26 GHz and are equipped with 2.92 mm (f/m) connectors (female at the VNA, male at the matrix side).

Table B-1: R&S ZN-Z86/ZN-Z86X optional RF cable sets for benchtop operation

VNA	Switch matrix	Cables	Type	Order no.
R&S ZNA26/40/43	R&S ZN-Z86	4	R&S ZN-ZA26	1328.8905.02
R&S ZNA26/40/43	R&S ZN-Z86X	4	R&S ZN-ZA26	1328.8905.03
R&S ZNB26/40/43	R&S ZN-Z86	4	R&S ZN-ZB26	1328.8911.02
R&S ZNB26/40/43	R&S ZN-Z86X	4	R&S ZN-ZB26	1328.8911.03
R&S ZNB26/40/43 4 ports	2 x R&S ZN-Z86,	2 x 2	R&S ZN-ZB26	1328.8911.05
R&S ZNBT26/40	R&S ZN-Z86	4	R&S ZN-ZT26	1328.8928.02
R&S ZNBT26/40	R&S ZN-Z86X *	4	R&S ZN-ZT26	1328.8928.03
R&S ZNBT26/40 ≥ 8 ports	R&S ZN-Z86X *	8	R&S ZN-ZT26	1328.8928.04
* Configured for 4 VNA ports (see Chapter 3.3.3.3, "Operation with 2 or 4 matrix VNA ports", on page 46)				

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