R&S®ZN-Z15x
Calibration Units
User Manual

ROHDE&SCHWARZ

Make ideas real

This User Manual describes the following R&S ZN-Z15x models:

- R&S®ZN-Z150, N (f), 2 ports, 5 kHz to 6 GHz (1335.6710.72)
- R&S®ZN-Z151, SMA (f), 2 ports, 100 kHz to 8.5 GHz (1317.9134.32)
- R&S®ZN-Z151, N (f), 2 ports, 100 kHz to 8.5 GHz (1317.9134.72)
- R&S®ZN-Z152, SMA (f), 6 ports, 100 kHz to 8.5 GHz (1319.6003.36)
- R&S®ZN-Z153, SMA (f), 4 ports, 100 kHz to 8.5GHz (1319.6178.34)
- R&S®ZN-Z156, 1.85 mm (f), 2 ports, 5 GHz to 67 GHz (1332.7239.02)
- R&S®ZN-Z156, 1.85 mm (f), 2 ports, 10 MHz to 67 GHz (1332.7239.03)

User manual 1326.5080.02 covers the R&S®ZN-Z154 calibration unit.

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

This calibration unit has been designed to be used with Rohde & Schwarz vector network analyzers of the R&S ZNx and R&S ZVx family. They are intended for the development, production and verification of electronic components and devices in industrial, administrative and laboratory environments. Use the R&S ZN-Z15x 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:

- The multilingual printed "Safety Instructions" are delivered with your Rohde & Schwarz vector network analyzer R&S ZNx or R&S ZVx.

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

1.1 Labels on the product

Labels on the casing inform about:

- Product and environment safety
- Identification of the product

Table 1-1: Labels regarding product and environment safety

⚠	Potential hazard Read the product documentation to avoid product damage.
(ESD symbol)	Take care when handling electrostatic sensitive devices.
(WEEE symbol)	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".

1.2 Warning messages in the documentation

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

NOTICE

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

2 Key features

A calibration unit enables the automatic calibration of several network analyzer ports in one simple procedure. It contains calibration standards that are electronically switched by the analyzer firmware, when a calibration is performed. The characteristic data of these standards is stored in the calibration unit, so that the analyzer can calculate the error terms and apply the calibration without any further input.

Automatic calibration is faster and less error-prone than manual calibration:

- There is no need to connect calibration standards manually, which is particularly time-saving if you want to calibrate multiple ports.
- Invalid calibrations due to operator errors (e.g. wrong standards or improper connections) are almost excluded.
- There is no need to handle calibration kit data.
- The internal standards do not wear out because they are switched electronically.

The R&S ZN-Z15x calibration units differ in the number of calibration ports and the connector types. For an overview, refer to the data sheet.

3   Preparing for use

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

3.1   Unpacking and checking

1. Unpack the product carefully.

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

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

4. Check the equipment for damage.

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

3.2   Choosing the operating site

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

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.

3.3   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 calibration unit, if possible.

Signal input and output levels

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

ⓘ If you use an external power amplifier, make sure that the maximum RF input power of the calibration unit quoted in the data sheet is never exceeded. See Chapter 3.5, "RF connections", on page 8.

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.

3.4   USB connection

The calibration unit is equipped with a USB Type-C connector at the rear. The USB connection is used to power-supply and control the unit from a network analyzer of the R&S ZVx or R&S ZNx family.

A direct USB connection is recommended. You can connect several calibration units to different USB ports of the analyzer and you can connect other USB devices (mouse, keyboard, memory stick etc.) simultaneously.

In general, an unused calibration unit can remain connected to the USB port of the analyzer and you can connect or disconnect it while the network analyzer is operating. However, note the following restrictions.

(i)
- The calibration unit relies on a USB voltage supply of 5V. If you connect it via a USB hub, you have to use an active one.
- During a firmware update of the network analyzer, the calibration unit must be disconnected.
- Do not disconnect the unit while data is being transferred between the analyzer and the unit.

See also "Cable selection and electromagnetic interference (EMI)" on page 6.

3.5   RF connections

The calibration unit provides two RF connectors (numbered 1 to 2), to be connected to the test ports of the analyzer. The connector type is the same for all RF ports of a calibration unit.

The maximum RF input power of the calibration unit is beyond the RF output power range of the analyzer. If the device is directly connected to the test ports of the analyzer, there is no risk of damaging the calibration unit.

See also "Signal input and output levels" on page 7.

4   Working with R&S ZN-Z15x

4.1   Establishing the USB connection

To establish the USB connection between calibration unit and network analyzer, proceed as follows:

1. Switch on and start up your network analyzer.

2. Connect the USB Type-A connector of the USB cable to any of the USB Type-A connectors on the front or rear panel of the analyzer. You can also connect the unit before switching on the analyzer.

   Note: Wear a grounded wrist strap during this step (see "Preventing electro-static discharge (ESD)" on page 7).

3. Wait until the operating system has recognized and initialized the new hardware. After completing the initialization, the status LED will switch to green (see Chapter 4.2, "Function of the status LED", on page 9).

   The unit is ready to use, as outlined below.

4.2   Function of the status LED

The LED on top of the Calibration Unit informs about the actual status of the device. The different states have the following meaning:

OFF	The calibration unit is not connected or defective.
Red	The micro controller is running but there is no USB communication with the network analyzer. With a current network analyzer firmware and error-free operation, this status only appears for a short time after connecting the calibration unit.
Blinking red	During the boot sequence of the network analyzer, the LED possibly shows a fast blinking red until the operating system is started. The LED switches between red and green, until the firmware comes up.
Green	The calibration unit is ready use.

Blinking orange	Data transfer between the calibration unit and the network analyzer. Do not disconnect the USB cable.
Blinking blue	Calibration in progress. Do not disconnect the USB cable.

4.3   Performing an automatic calibration

Once the USB connection between calibration unit and network analyzer has been established, an automatic calibration can be performed as follows:

1. Start the automatic calibration function of your network analyzer.

2. Configure the automatic calibration. In particular:
    a) Select the test ports to calibrate, and the desired calibration type.
    b) Select the appropriate R&S ZN-Z15x model and characterization.
    c) Configure the required RF port assignments between analyzer and calibration unit.

3. For each RF port assignment:
    a) Connect the calibration unit ports to the test ports of the network analyzer, as depicted in the analyzer GUI.
    b) Start the calibration data acquisition.

4. Disconnect the RF ports of the calibration unit.

ⓘ   Wear a grounded wrist strap during steps 3 and 4 (see "Preventing electrostatic discharge (ESD)" on page 7).

Accuracy considerations

To ensure an accurate calibration, please observe the following items:

*   Do not use adaptors between the calibration unit and the test ports.

*   After connecting the unit to the USB port, allow for a sufficient warm-up time (see data sheet) before starting the calibration.

*   To ensure best accuracy, the analyzer automatically reduces the source power to –10 dBm. If the test setup contains a large attenuation, deactivate Automatic Power Reduction for Calibration Unit in the Calibration tab of the System Configuration dialog and ensure an input power of –10 dBm at the ports of the calibration unit (please also refer to the data sheet).

The calibration type depends on the number of ports and of the analyzer type. If a single port is calibrated, the analyzer uses a reflection calibration type (e.g. Full One Port / Refl OSM). For 2 and more ports, you can choose among several calibration types.

4.4 User characterization

The calibration unit offers the possibility to store multiple user characterization data files either on its internal flash memory or on the microSD card (R&S ZN-Z152, R&S ZN-Z153). Use the "Characterize Cal Unit" function of your network analyzer for this purpose. For details, refer to the analyzer's help system.

4.5 microSD card

On the rear of the R&S ZN-Z152 and R&S ZN-Z153 calibration units, there is a microSD card slot. The microSD card can be used to store user characterization data. The factory data is always stored on the internal memory.

(i) • Use the microSD card shipped with the calibration unit, if possible.
   • Before removing or inserting the microSD card, disconnect the USB connection between calibration unit and network analyzer.

4.6 Mounting the calibration unit

To mount the calibration unit e.g. on a wafer prober, remove the elastic buffers on the bottom of the housing. There are either two threads (R&S ZN-Z156) or four threads for use of M2.5 screws.

5 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 5-1: QR code to the Rohde & Schwarz support page