

R&S® HA-Z24E External Preamplifier Manual



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This manual describes the following R&S®HA-Z24E model:

- 1331.6539.85

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1 About the R&S HA-Z24E

The R&S HA-Z24E is an RF preamplifier with a specified frequency range from 1 GHz to 85 GHz with a nominal gain of 20 dB. It can be used up to 90 GHz (overrange).

The R&S HA-Z24E allows you to measure signals from devices under test with low output power, using measurement devices which feature a low sensitivity and do not have a built-in RF preamplifier.

The R&S HA-Z24E is a stand-alone product which can be used with any kind of test setup that provides two USB 2.0 host interfaces. The interfaces are used to provide both the DC supply voltage and the control interface for the preamplifier via a Y-shaped cable.

Each R&S HA-Z24E is characterized in the factory regarding both magnitude and phase. The S-parameters measured in the factory up to 90 GHz are stored in the internal EEPROM of the preamplifier. The S-parameters can be used to compensate the magnitude and phase characteristics of the preamplifier in the test setup. The S-parameters can be read out of the preamplifier via USB into an S2P file, which can then be used for the compensation algorithms. As soon as you connect the R&S HA-Z24E to a power supply, the preamplifier is permanently on.

2 For Your Safety

The R&S HA-Z24E is designated for use in industrial, administrative, and laboratory environments. Use the R&S HA-Z24E only for its designated purpose. Observe the safety and usage instructions in this manual and the supplied safety brochure, as well as operating conditions and performance limits stated in the data sheet. The "Basic Safety Instructions" are delivered with the R&S HA-Z24E in different languages in print. The product documentation helps you use the R&S HA-Z24E safely and efficiently. Keep the product documentation in a safe place and pass it on to subsequent users.

3 Product Description

The R&S HA-Z24E is delivered in a transport case, together with the following accessories:



Figure 3-1: R&S HA-Z24E in delivery case

1 = 1.00-mm adapter cable female to male

2 = Screwdriver to adjust the preamplifier's feet

3 = Y-shaped cable with one Lemosa 5-pole USB connector and two standard USB connectors

4 = Preamplifier unit

The preamplifier unit consists of the following main parts:

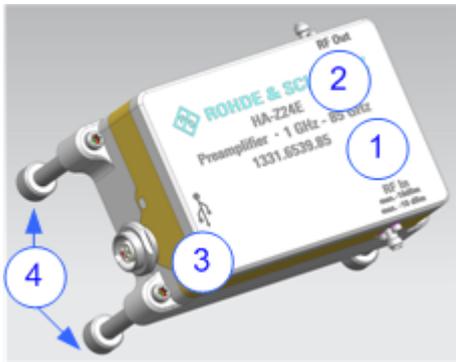


Figure 3-2: Main parts of the preamplifier unit

- 1 = RF input connector
- 2 = RF output connector
- 3 = Lemos 5-pole USB connector and status LED for power supply
- 4 = Adjustable feet

RF input connector

1.00-mm female connector to connect the device under test to the preamplifier.

The R&S HA-Z24E preamplifies frequencies from 1 GHz to 85 GHz with a nominal gain of 20 dB.

Beyond 85 GHz, the R&S HA-Z24E can still be used if you allow for a degradation in the small signal gain - a common effect in amplifiers being operated beyond their dedicated frequency range.

Maximum input power of the R&S HA-Z24E: -10 dBm

Maximum DC voltage: 25 V DC

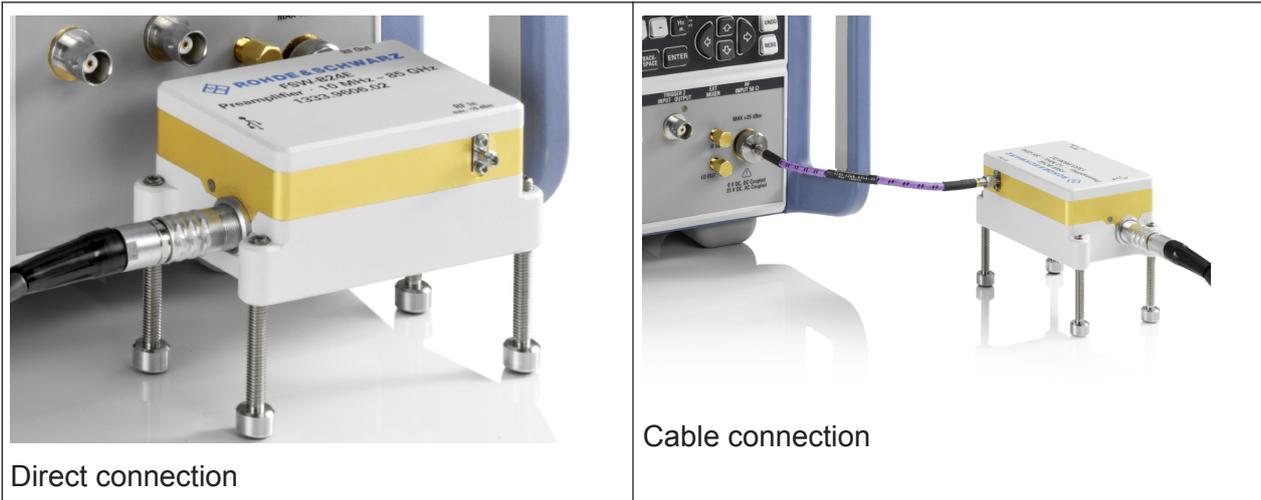
RF output connector

1.00-mm female connector to connect the preamplifier to the measurement device, e.g. a spectrum analyzer.

Depending on the connector type of the measurement device, the R&S HA-Z24E can be connected directly to the measurement device, or using the provided male-to-female adapter cable.

NOTICE**Possible damage to measurement device due to excess power**

To avoid damage to your measurement device, ensure that it supports the maximum output power of the R&S HA-Z24E of +18 dBm.

**Lemosa 5-pole USB connector**

Female Lemosa 5-pole USB connector to connect the preamplifier to a PC or measurement device.

A y-shaped USB cable is provided with the R&S HA-Z24E to connect the preamplifier to two standard USB connectors for power supply (max. 500 mA each).

Via the USB connection, the PC or measurement device provides power to the R&S HA-Z24E, and data from the preamplifier can be transferred to the PC or measurement device.

A green LED indicates the correct connection to the USB ports. If the LED is not on, check the connection.

Adjustable feet

Four screwable feet to adjust the height of the preamplifier and ensure a stable position on the surface.

4 Retrieving the S-Parameters

The R&S HA-Z24E stores the S-parameters as a touchstone (.S2P) file on the device. You can read out those values from a connected PC.

4.1 Prerequisites

To read out values from the R&S HA-Z24E, the PC must meet the following prerequisites:

- Windows7 or Windows10 operating system in the 64-bit version
- Two free USB output connectors for power supply and communication with the preamplifier
Note that the R&S HA-Z24E must always be connected to both USB ports to obtain sufficient supply current. If connected to only one USB port, the R&S HA-Z24E does not work.
- Installed R&S HA-Z24E driver and software



Reading out parameters from a measurement device

Some measurement devices support reading out the parameters for a connected R&S HA-Z24E directly on the device. For details, see the device's documentation.

4.2 Installing the Driver



Install the driver on the PC *before* connecting the R&S HA-Z24E.

1. Download the HA-Z24E_V1.00.zip file from the Rohde & Schwarz product page on the Internet (<https://www.rohde-schwarz.com/product/ha-z24e>).
2. Unzip the file. It contains the HA_Z24E-1.06.msi driver and the HA-Z24E-Tool.exe software.

3. On the PC, start the `HA_Z24E-1.06.msi` file to install the driver.
In case the Windows user account does not have sufficient rights:
 - a) Search for the command-line tool `CMD`.
 - b) Right-click the tool and select the "Run as Administrator" option.
 - c) Start the `HA_Z24E-1.06.msi` file from there.

4.3 Connecting the R&S HA-Z24E to a PC



Do not connect multiple R&S HA-Z24E preamplifiers to the same PC at the same time.

- ▶ Connect the USB connector of the R&S HA-Z24E to the two USB ports of the PC using the provided y-shaped USB cable. If you connect the R&S HA-Z24E to only one USB port, it does not work.

A green LED indicates the correct connection to the USB ports. If the LED is not on, check the connection.

Via the USB connection, the PC provides power to the R&S HA-Z24E, and transfers data from the preamplifier to the PC.

As soon as you connect the R&S HA-Z24E to a power supply, the preamplifier is permanently on. It is ready to use after its warmup time, see the data sheet for details.

4.4 Starting the Software

Ensure the prerequisites and the connection described above are carried out before starting the software.

- ▶ On the PC, run the `HA-Z24E-Tool.exe` included with the driver from any directory.

The software uses the installed driver and reads out the touchdown (.S2P) file from the EEPROM of the R&S HA-Z24E. The file is stored on the PC, in the same directory the software was started from. The name of the file is HA-Z24E.S2P.

If the software recognizes and can read out the touchdown file, the DOS `ERRORLEVEL` returns the value 0.

If any error occurs, for example, the R&S HA-Z24E is not connected or the driver is not installed, the DOS `ERRORLEVEL` returns the value 1. The file HA-Z24E.S2P contains an error message.

5 Measurement Setup with R&S HA-Z24E

The R&S HA-Z24E is inserted into the signal path between the DUT and a measurement device. The measurement device can use the stored values to compensate the effects of preamplification on the measurement results. The following sections describe the necessary steps to insert the R&S HA-Z24E in your measurement setup.



Prerequisites

The measurement device requires two free USB output connectors for power supply. The R&S HA-Z24E must be connected to *both* USB ports using the provided y-shaped USB cable. If you connect the R&S HA-Z24E to only one USB port, it does not work.



Precautions to avoid damage to the RF connectors

When setting up a measurement with the R&S HA-Z24E, consider the following to avoid damage to the RF connectors:

- Use the cables provided with the R&S HA-Z24E to connect the preamplifier to your device under test and the measurement device.
- Use an appropriate torque wrench to fasten the RF connectors of the R&S HA-Z24E. An appropriate torque wrench can be ordered from Rohde & Schwarz (R&S ZN-ZTW).
- Adjust the height of the preamplifier's feet so the device is on the same height as the measurement device and stands firmly on the surface. Never let the preamplifier hang in mid-air, held only by the connector.

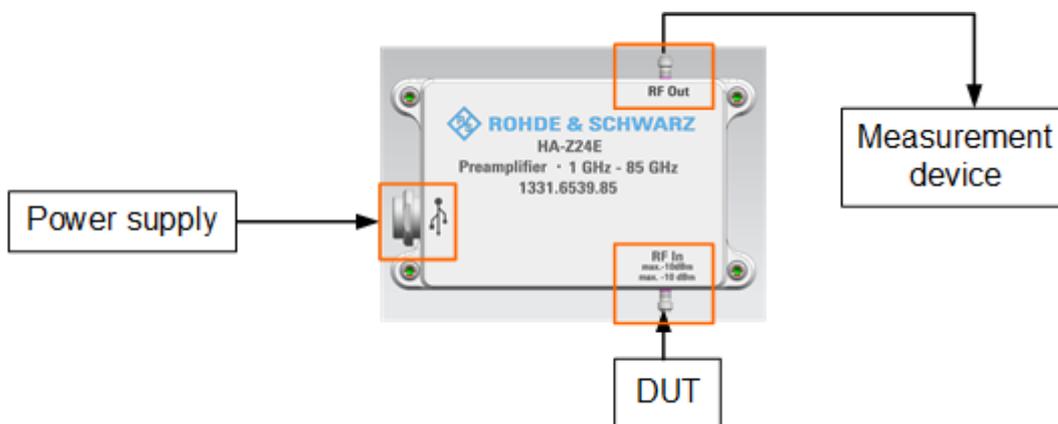


Figure 5-1: Measurement setup with the R&S HA-Z24E

To set up a measurement with the R&S HA-Z24E

1. Connect the DUT to the RF IN connector of the R&S HA-Z24E using the provided 1-mm cable, or directly.
2. Connect the R&S HA-Z24E to the measurement device. If the measurement device has the same connector type as the R&S HA-Z24E, you can connect the two devices directly.
 - a) Adjust the feet of the preamplifier to the height of the connector on the measurement device.
 - b) Connect the RF OUT connector of the R&S HA-Z24E to the RF input connector of the measurement device.
3. If the measurement device does not have the same connector type as the R&S HA-Z24E, use an adapter cable to connect the two devices.

- a) Connect one end of the 1-mm cable to the RF OUT connector of the R&S HA-Z24E.
 - b) Connect the other end of the 1-mm cable to the RF input connector of the measurement device.
4. Connect the USB power supply connector of the R&S HA-Z24E to the two USB ports of the measurement device or a PC using the provided cable. A green LED indicates the correct connection to the USB ports. If the LED is not on, check the connection.

As soon as you connect the R&S HA-Z24E to a power supply, the preamplifier is permanently on. It is ready to use after its warmup time, see the data sheet for details.

6 Performance Test

The following test describes how to check the performance of your device compared to the specifications in the R&S HA-Z24E data sheet.

Test equipment

Network analyzer with a frequency range of 1 GHz to 85 GHz

Test setup

1. [**STIMULUS** : START FREQUENCY : **1 GHz**]
2. [**STIMULUS** : STOP FREQUENCY : **90 GHz**]
3. [**STIMULUS** : POWER : **-15 dBm**]
4. Connect the two USB cables provided with the R&S HA-Z24E to a PC.
5. Connect port 1 of the network analyzer to the RF IN connector of the preamplifier.
6. Connect port 2 of the network analyzer to the RF OUT connector of the preamplifier.

Evaluation

The measured S-parameter S21 should comply with the datasheet specification for small signal gain.