

R&S® RT-ZM

Modular Probe System

User Manual



1419312802

Version 05

ROHDE & SCHWARZ

Make ideas real



This manual describes the following R&S®RT-ZM models:

- R&S®RT-ZM15 (1800.4700K02)
- R&S®RT-ZM30 (1419.3005K02)
- R&S®RT-ZM60 (1419.3105K02)
- R&S®RT-ZM90 (1419.3205K02)
- R&S®RT-ZM130 (1800.4500K02)
- R&S®RT-ZM160 (1800.4600K02)

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Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol and without product type numbers, e.g. R&S®RT-ZM15/30/60/90/130/160 is indicated as R&S RT-ZM, and the R&S®ProbeMeter is indicated as R&S ProbeMeter.

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1 Safety and regulatory information

The product documentation helps you to use the product safely and efficiently. Follow the instructions provided here and throughout the manual.

Intended use

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

The R&S RT-ZM modular probe is designed for measurements on circuits that are only indirectly connected to the mains or not connected at all. It is not rated for any measurement category.

The probe is designed for usage with oscilloscopes that have a Rohde & Schwarz probe interface. Supported Rohde & Schwarz oscilloscopes are listed in the probe's data sheet.

Where do I find safety information?

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

- In [Chapter 1.1, "Safety instructions"](#), on page 5. The same information is provided in many languages as printed "Safety Instructions". The printed "Safety Instructions" are delivered with the product.
- Throughout the documentation, safety instructions are provided when you need to take care during setup or operation.

1.1 Safety instructions

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

Use the product only for its intended use and within its performance limits. Intended use and limits are described in the product documentation such as the data

sheet, manuals and the printed "Safety Instructions for Oscilloscopes and Accessories" document. If you are unsure about the appropriate use, contact Rohde & Schwarz customer service.

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

Reconfigure or adjust the product only as described in the product documentation or the data sheet. 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 service at <https://www.rohde-schwarz.com/support>.

In these safety instructions, the term "product" covers instruments (oscilloscopes), probes and their accessories.

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.

Unless otherwise specified in the data sheet, you can operate the product up to an altitude of 2000 m above sea level.

The product is suitable for pollution degree 2 environments where nonconductive contamination can occur. For more information on environmental conditions such as ambient temperature and humidity, see the data sheet.

Performing measurements

Take the following measures for your safety:

- To ascertain voltage-free state, use an appropriate voltage tester. Any measurement setup including an oscilloscope is not suitable for this purpose.
- The maximum input voltage on channel inputs and the external trigger input must not exceed the value specified in the data sheet.
- Observe all voltage and current ratings of the instrument, the probes, and the accessories. Exceeding the allowed voltages can lead to an electric shock. Limits and ratings are marked on the products and listed in the data sheets.

Labels on the product

Consider that the rated voltage depends on the frequency. The voltage limitation curves or values are provided in the data sheet.


- Never cause any short circuits when measuring sources with high output currents.
- Use only probes and accessories that comply with the measurement category (CAT) of your measurement task. If the product is rated for any measurement category, the permitted category is indicated on the product and in the data sheet. If you use other than Rohde & Schwarz accessories, make sure that they are suitable for the instrument and the measurement task.
- Set the correct attenuation factor on the instrument according to the probe being used. Otherwise, the measurement results do not reflect the actual voltage level, and you might misjudge the actual risk.
- The probe pins are extremely pointed and can easily penetrate clothes and the skin. Handle the probe pins with great care. To exchange a probe pin, use tweezers or pliers to avoid injuries. When transporting the accessories, always use the box supplied with the probe.
- Prevent the probe from receiving mechanical shock. Avoid putting excessive strain on the probe cable or exposing it to sharp bends. Touching a broken cable during measurements can cause injuries.
- Set up all probe connections to the instrument before applying power.

1.2 Labels on the product

Labels on the casing inform about:

- Personal safety
- Product and environment safety
- Identification of the product

Table 1-1: Meaning of safety labels

	<p>Potential hazard Read the product documentation to avoid personal injury or product damage.</p>
-------------------------------------------------------------------------------------	--------------------------------------------------------------------------------------------------------

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.

2 Product description

The R&S RT-ZM is a modular probe consisting of a probe amplifier and various probe tip modules for different applications.

The R&S RT-ZM probe family features the MultiMode function which allows you to switch between single-ended, differential and common mode measurements without reconnecting or resoldering the probe.

With different tip modules and tip cables, the R&S RT-ZM probe can be connected to a wide variety of devices under test (DUT) and is suitable for various measurement tasks.

Provided with special features such as the R&S ProbeMeter and the micro button, the R&S RT-ZM is designed to meet tomorrow's challenges in probing.

The probe is equipped with the Rohde & Schwarz probe interface. It can be connected to any Rohde & Schwarz instrument that is compatible with this interface. When connected to the front panel, the probe is controlled by the oscilloscope's software. Supported oscilloscopes are listed in the data sheet.

2.1 Key characteristics and key features

2.1.1 Key characteristics

The key characteristics of the probe are the following:

MultiMode feature for differential, common mode and single-ended measurements	
Two different probe gain settings with 10:1 and 2:1 attenuation to achieve low system noise	
Bandwidth	DC to 1.5 GHz (R&S RT-ZM15) DC to 3 GHz (R&S RT-ZM30) DC to 6 GHz (R&S RT-ZM60) DC to 9 GHz (R&S RT-ZM90) DC to 13 GHz (R&S RT-ZM130) DC to 16 GHz (R&S RT-ZM160)
Dynamic range	±2.5 V (10:1 attenuation) ±0.5 V (2:1 attenuation)

Key characteristics and key features

Operating voltage window (each pin to GND)	± 7.0 V with ± 16 V offset capability, DC to 100 kHz ± 5.0 V with ± 16 V offset capability, > 100 kHz
Maximum non-destructive input voltage	± 30 V DC
Input resistance	Differential: 400 k Ω Single-ended: 200 k Ω
R&S ProbeMeter, measurement error	<0.2 %
R&S ProbeMeter, dynamic range	± 7 V
Offset capability	± 16 V for compensating single-ended, differential and common mode DC offsets
Low zero and gain errors throughout the entire temperature range for all measurement modes	
Micro button	
Rohde & Schwarz probe interface	

2.1.2 Key features

Micro button

The micro button remotely controls important functions of the Rohde & Schwarz oscilloscope. The function is assigned at the oscilloscope.

For details, see [Chapter 4.4, "Micro button"](#), on page 41.

R&S ProbeMeter

The R&S ProbeMeter measures the DC voltage of the input signal directly at the probe tip. It provides a continuous high-precision DC voltage measurement that is independent of the settings of the oscilloscope and runs in parallel to the time domain measurement. If activated on the base unit, the measured value is displayed on the screen of the Rohde & Schwarz oscilloscope.

The R&S ProbeMeter simultaneously measures both differential and common mode DC voltages.

For details, see [Chapter 4.5, "R&S ProbeMeter"](#), on page 41.

Probe DC correction

The probe amplifier includes an integrated data memory with individually determined DC correction parameters (e.g. gain, offset). These correction parameters are read out and processed by the Rohde & Schwarz oscilloscope. As a result,

Unpacking and checking

the probe offers a very high degree of DC accuracy so that additional calibration procedures are not required.

Probe frequency correction

The R&S RT-ZM probe amplifier includes an integrated data memory with individually measured S-parameters. These correction parameters are read out and processed by the Rohde & Schwarz oscilloscope. This leads to a more accurate probe frequency response and an enhanced measurement accuracy.

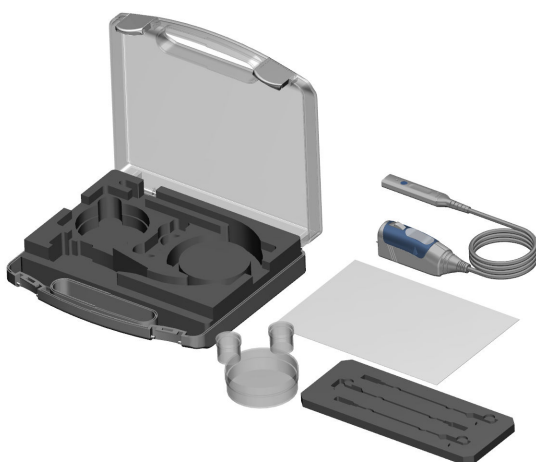
2.2 Unpacking and checking

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.

Delivery notes

The delivery contains the following items:



- R&S RT-ZM modular probe
- Carrying case
- Accessory boxes
- Foam inlay for tip cables
- User manual
- Data sheet
- Calibration certificate
- Documentation of calibration values (if ordered)
- Safety instructions for oscilloscopes and accessories (multilingual)

Description of the probe

If R&S RT-ZMA tip modules were ordered, they come in a separate packaging and can be inserted into the foam inlay.

Accessories supplied with the probe are listed in [Chapter 2.4, "Accessories and items"](#), on page 14.

2.3 Description of the probe

The probe consists of the active probe amplifier, the probe box for connection to the oscilloscope, the probe cable and various probe tip modules.



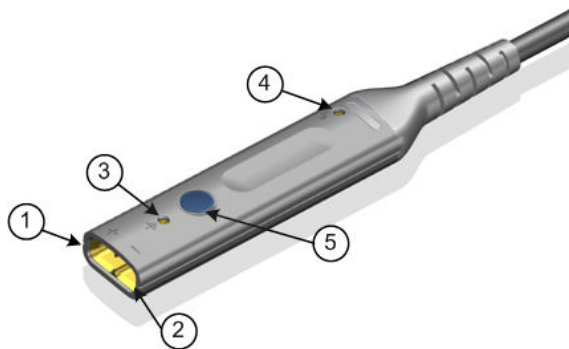
Figure 2-1: R&S RT-ZM probe consisting of probe amplifier and probe box

2.3.1 Probe amplifier

The probe amplifier is designed for easy handling and high-performance measurements. The R&S RT-ZM probe amplifier is designed for use with the R&S RT-ZMA probe tip modules.

See also: [Chapter 3.4, "Connecting the probe to the DUT"](#), on page 21.

Description of the probe



- (1) Positive coaxial input
- (2) Negative coaxial input
- (3) Ground socket
- (4) Termination voltage socket
- (5) Micro button

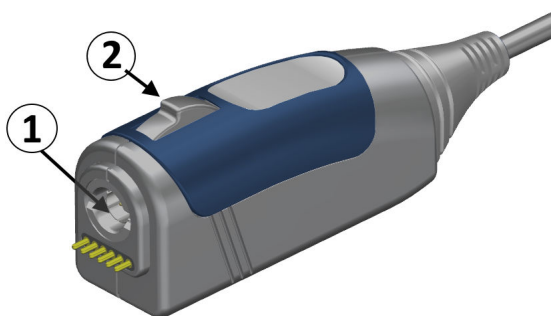
Signal and termination voltage sockets are compatible with 0.64 mm (25 mil) square pins and 0.6 mm to 0.8 mm (24 mil to 35mil) round pins.

2.3.2 Probe box

The probe box connects the probe and the oscilloscope via the Rohde & Schwarz probe interface. The Rohde & Schwarz probe interface contains a male precision 7 mm (276 mil) BNC connector and six pogo pin connectors. This interface provides the required supply voltage and is also used to transmit analog signals and digital data simultaneously. All the analog voltages required by the probe are generated in the probe box.

The BNC connector is a precision component designed to reach a much higher frequency limit when connected to an instrument with Rohde & Schwarz probe interface.

Connect the probe only to an instrument with Rohde & Schwarz probe interface. Never connect it to a usual BNC jack, because this can damage the probe interface.



- (1) Rohde & Schwarz probe interface with 7 mm (276 mil) coaxial connector and 6 pogo pins
- (2) Release knob

2.3.3 Probe tip modules

To use the probe for measurements, select the appropriate probe tip module and connect it to the probe amplifier.

Figure 2-2 shows all probe tip modules that are available for the R&S RT-ZM probe. The usage of probe tip modules is described in Chapter 3.4, "Connecting the probe to the DUT", on page 21.

If you need more probe tip modules, you can order them at Rohde & Schwarz. The order numbers are provided in the data sheet.

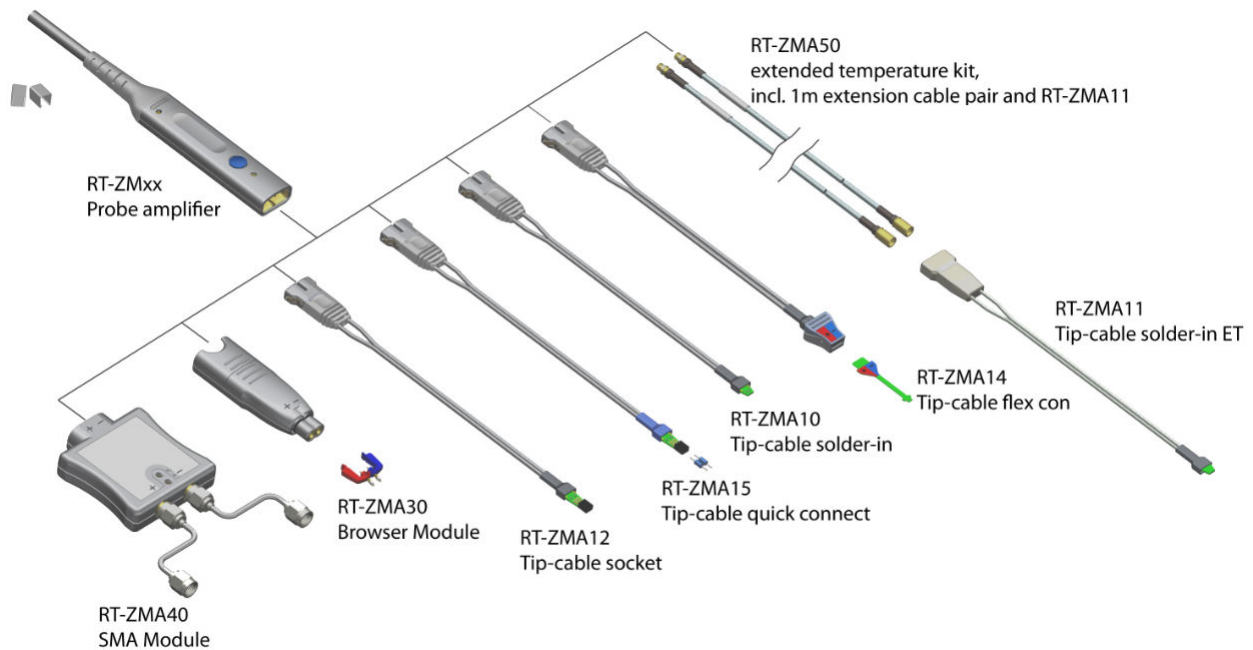




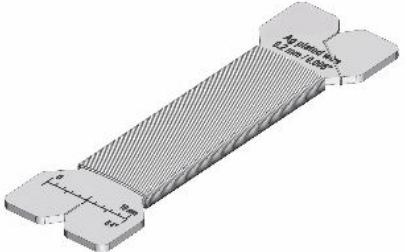
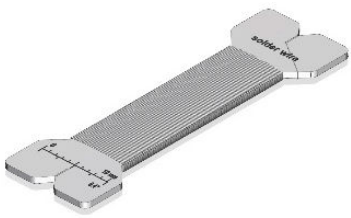
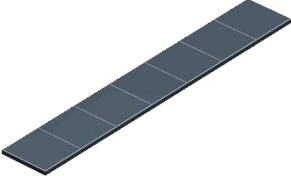
Figure 2-2: R&S RT-ZM probing system compatibility chart

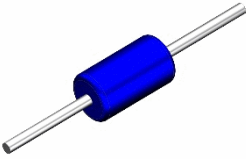

2.4 Accessories and items

2.4.1 Accessories supplied

Table 2-1 shows the accessories that are supplied with the R&S RT-ZM modular probe.

Table 2-1: Accessories supplied

Item	Quantity	Description
	1	Lead, 15 cm / 5.9 in
	1	Solder wire 0.1mm, Ag plated, 10 m
	1	Solder wire 0.2mm, Ag plated, 10 m
	1	Solder wire, lead free, 5 m
	7	Adhesive pads

Item	Quantity	Description
	20	Solder in resistor (270 Ω) for R&S RT-ZMA15
	20	Solder lead for R&S RT-ZMA12/15

For a list of spare parts, see [Chapter 5.7, "Spare parts"](#), on page 48.




2.4.2 Optional accessories

If the delivered accessories do not meet individual customer requirements, Rohde & Schwarz offers different accessory sets for sale. The order numbers are provided in the data sheet.

Table 2-2: Optional clips and leads

Accessories	Items	Quantity
R&S RT-ZA4 mini clips	Mini clip	10
R&S RT-ZA5 micro clips	Micro clip	4
R&S RT-ZA6 lead set	Lead, 6 cm / 2.4 in	5
	Lead, 15 cm / 5.9 in	5

Table 2-3: Optional adapters

Accessories	Items	Quantity
	<p>R&S RT-ZA9 probe box to N / USB adapter</p> <p>The adapter connects the R&S RT-ZM modular probe to any other oscilloscope or any other measurement instrument (e.g. a network or spectrum analyzer).</p> <p>Using the USB interface of the adapter, the probe can be powered and controlled from any conventional PC. However, full software functionality is only provided by the supported oscilloscopes (see data sheet).</p>	1
	<p>R&S RT-ZA50 probe interface extender</p> <p>The adapter is a breakout box that leads out the R&S probe interface to the following standard connectors: USB-C for power and control, SMA for signal and DC jack for auxiliary supply.</p> <p>Together with the R&S RT-ZA51 probe to 3.5 mm adapter, it moves the R&S probe interface closer to your test setup.</p>	1
	<p>R&S RT-ZA51 probe to 3.5 mm adapter</p> <p>The probe adapter has an R&S probe interface and standard connectors USB-C, 3.5 mm and DC jack. Using this adapter, you can power and control your Rohde & Schwarz probe without an appropriate Rohde & Schwarz oscilloscope.</p> <p>Together with the R&S RT-ZA50 probe to 3.5 mm adapter, it moves the R&S probe interface closer to your test setup.</p>	1

2.4.3 Service accessories

To order accessories for servicing the probe, contact your Rohde & Schwarz service center. The following accessories are available:

Table 2-4: Service accessories

Item	Description
R&S RT-ZK3	The service kit is used to calibrate the probe, to do performance tests, and for servicing. The service kit includes all adapters and accessories to connect the probe to the required measuring instruments.
R&S RT-ZM Service Manual	The service manual contains a detailed description of the performance test to verify the specifications, and other important service procedures.

3 Connecting the probe

3.1 Handling the probe

The R&S RT-ZM can withstand a moderate amount of physical and electrical stress. To avoid damage, treat the probe with care:

- Handle the probe by the probe amplifier or probe box.
- Prevent the probe from receiving mechanical shock.
- Avoid strain on the probe cable and route it carefully.
- Do not spill liquids on the probe.

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.

Discharge cables and probe clips before you connect them.

3.2 Connecting the probe to the oscilloscope

The probe is designed for usage with oscilloscopes that have a Rohde & Schwarz probe interface. Supported Rohde & Schwarz oscilloscopes are listed in the probe's data sheet.

1. If your DUT is floating and not grounded, connect the DUT ground to the oscilloscope ground before connecting any probe tip module to your DUT.
2. **NOTICE!** Risk of damaging the probe.

Connecting the probe to the oscilloscope

Connect the probe only to an instrument with Rohde & Schwarz probe interface. Never connect it to a usual BNC jack, because this can damage the probe interface.

Connect the probe box (1) to the Rohde & Schwarz probe interface of the oscilloscope (2).

The probe snaps in when connected properly to the port.

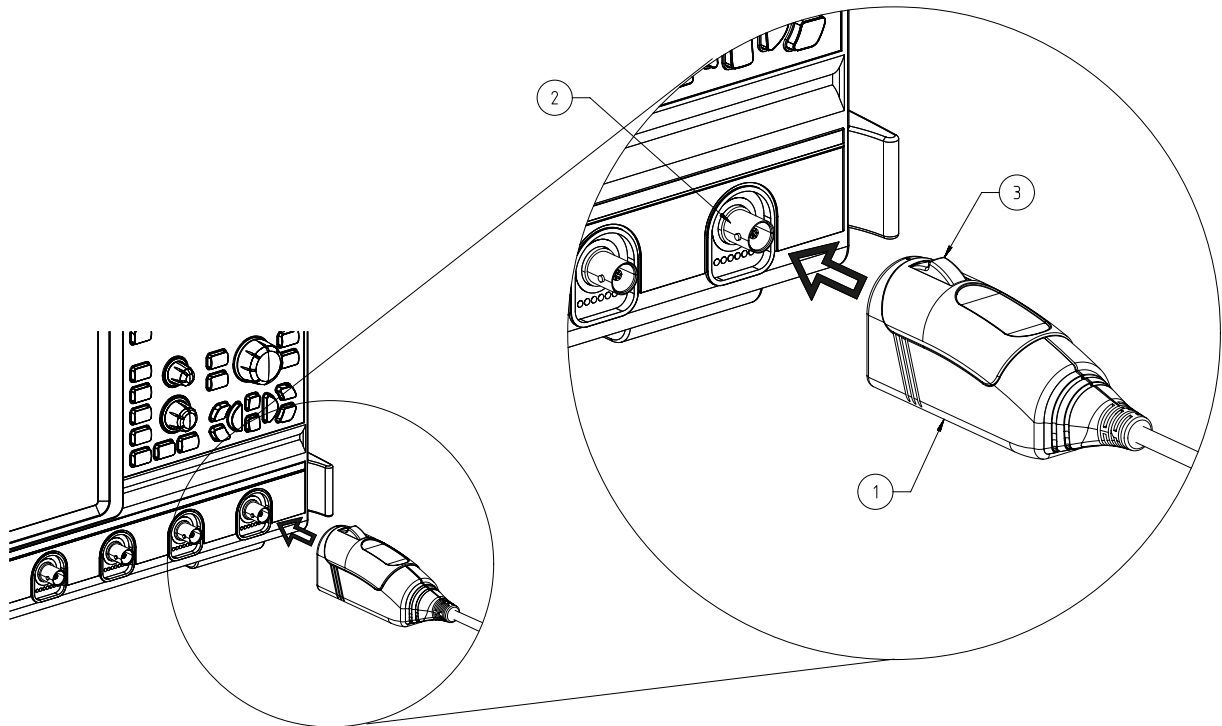


Figure 3-1: Connecting the probe to the Rohde & Schwarz oscilloscope

- ▶ To disconnect the probe:
 - a) Press and hold the release button (3).
 - b) Pull the probe box away from the oscilloscope.

During usage, the probe slightly heats up. Warming is normal behavior and not a sign of malfunction.

3.3 Identification of the probe

When the probe is connected to the oscilloscope, the oscilloscope recognizes the probe and reads out the probe-specific parameters.

The complete probe information is shown in the probe settings dialog. For more information, refer to the user manual of your oscilloscope.

3.4 Connecting the probe to the DUT

This chapter describes how to connect the probe to the DUT using different R&S RT-ZMA tip modules offered for the R&S RT-ZM probe family. The various tip modules are described and their use is explained. Note that you always need a tip module. Measurements without any tip module are not possible.

The recommended configurations are designed to give the best probe performance for different probing situations, to measure with confidence in the performance and signal fidelity. Using the recommended connection configurations is your key to making accurate oscilloscope measurements with known performance levels.

The maximum non-destructive input voltage is ± 30 V DC. A higher input voltage can destroy the probe.

Probe frequency correction

For R&S RT-ZMAxx probe tip modules, typical S-parameters are determined and stored in the oscilloscope. When the connected R&S RT-ZMA tip module is selected in the oscilloscope probe menu, the appropriate correction parameters are automatically processed by the Rohde & Schwarz oscilloscope. Correction leads to a more accurate probe frequency response and an enhanced measurement accuracy.

Supported oscilloscopes are listed in the data sheet.

3.4.1 Handling the probe tip modules and the probe amplifier

Handle the probe amplifier and connection pins carefully. Observe the following procedures when connecting and disconnecting them.

To connect the probe tips to the probe amplifier

1. Connect the probe to an oscilloscope channel to ensure that the amplifier is grounded.
2. Push the tip module straight in the probe amplifier to connect them.

To disconnect the probe tips from the probe amplifier

- ▶ **NOTICE!** Risk of damaging the device. Do not bend the probe tip module to pop it loose from the amplifier. Do not wiggle the probe tip module up and down or twist it to remove the connector from the probe amplifier.

Pull the tip module connectors straight out of the sockets.

3.4.2 Considerations for soldering

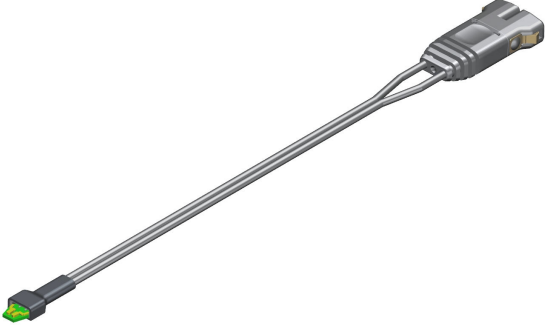

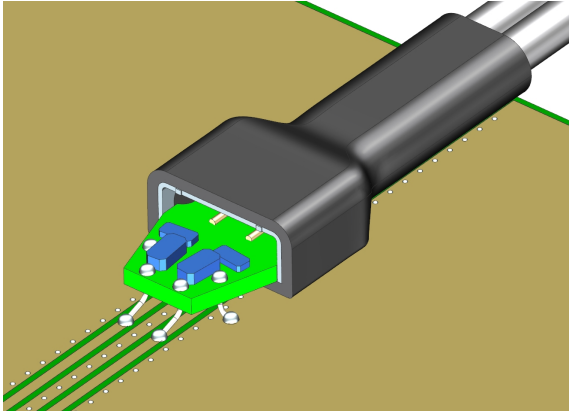
For best measurement results and to avoid damaging the probe, observe the following when soldering in the probe tips:

- Always disconnect the probe tip module from the probe amplifier before unsoldering or disconnecting it, moving it to a new position and resoldering or reconnecting it.
- Do not leave the soldering iron in contact with the probe tip for more than a few seconds at a time. Excess heat can damage the probe.
- Some solder-in accessories are very fine and sensitive. Stabilize the probe using appropriate means (e.g. adhesive pads, probe positioner) to protect the solder joint from excessive mechanical stress.
- Always keep soldered leads as short as possible for best performance and signal integrity.

3.4.3 R&S RT-ZMA10 tip cable solder-in

The R&S RT-ZMA10 tip cable solder-in is a semi-permanent solder-in connection that supports the full bandwidth of the probe amplifier. It is well suited for creating solid contact with test points that are hard to reach (e.g. IC pins).

Connecting the probe to the DUT

	<p>Bandwidth: up to 16 GHz MultiMode compatible Length: 15 cm Variable span range of the leads: 0 mm to 5 mm (0 mil to 200 mil). Temperature range: -30 °C to +80 °C</p>
	

Measurements in MultiMode

In this configuration, you can measure single-ended, differential and common mode signals without resoldering the tip cable.

1. Solder both signal leads (P,N) in front of the tip board and to the DUT.
2. Solder both ground wires (GND) at the outside of the tip board and to the DUT.


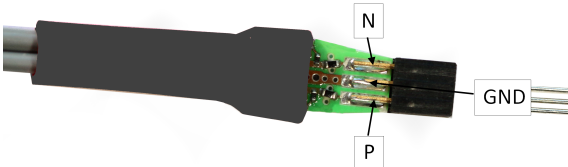
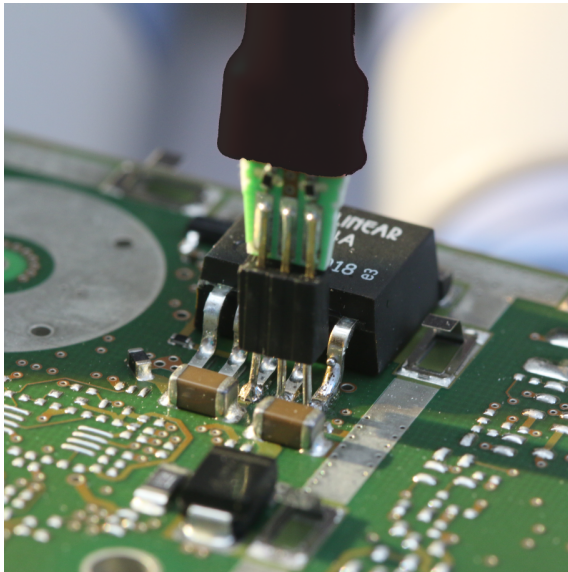
Measurements in DM mode

In this configuration, you can measure only differential measurements.

1. Solder both signal leads (P,N) to your DUT.
2. Leave ground vias open.

3.4.4 R&S RT-ZMA12 tip cable square pin

The R&S RT-ZMA12 tip cable square pin is used to plug onto pins and make a connection to the DUT that is easy to plug and remove. It is well suited for creating contact with soldered in test leads and can be used to plug onto pin strips with a pitch of 1.27 mm (50 mil).

	<p>Bandwidth: up to 6 GHz MultiMode compatible Length: 15 cm Distance range: 1.27 mm (50 mil) Temperature range: -30°C to +80°C</p>
	

Measurements with MultiMode

In this configuration, you can measure single-ended, differential and common mode signals without resoldering the tip cable.

1. Permanently solder both signal leads (P,N) to the DUT.
2. Permanently solder the ground wire (GND) to the DUT.
3. Connect and reconnect your socket head to your measurement point.

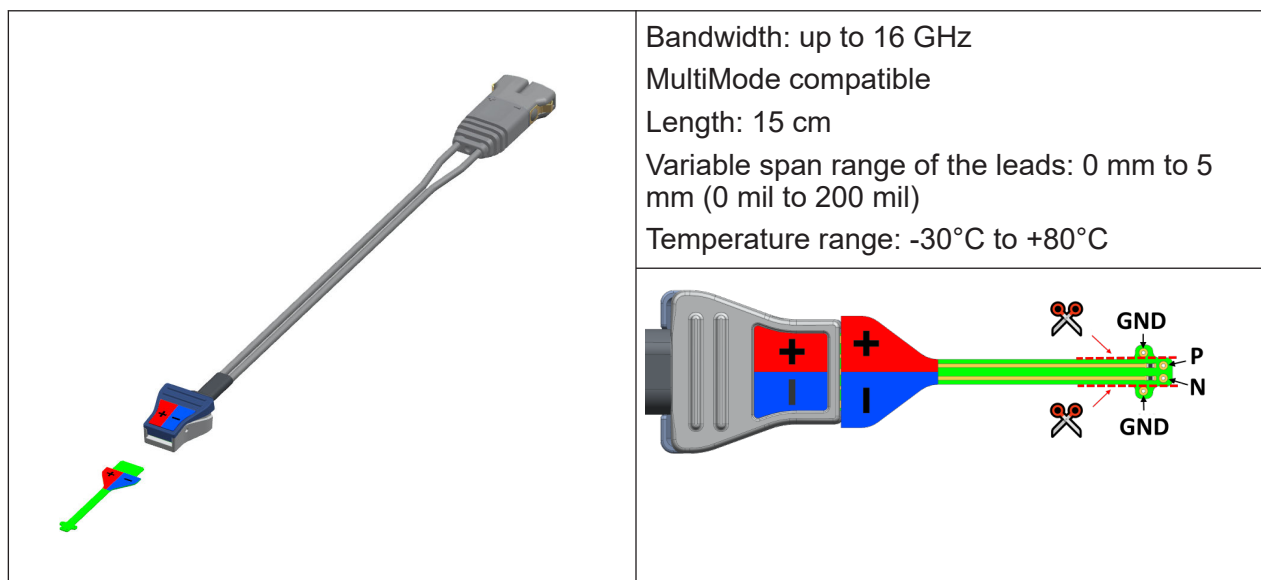
Measurements in DM Mode

In this configuration, you can measure only differential signals.

1. Solder both signal leads (P,N) to your DUT.
2. Leave ground vias open.

3.4.5 R&S RT-ZMA14 tip cable flex connect

The R&S RT-ZMA14 tip cable flex connect makes it easy to clamp and remove connection onto solder-in flex tips soldered directly to the DUT. It supports the full bandwidth of the probe amplifier. You can solder as many flex tips as needed to your DUT and easily connect and reconnect different test points using the clamp connector of the tip cable.



Measurements with MultiMode

In this configuration, you can measure single-ended, differential and common mode signals without resoldering the tip cable.

1. Disconnect the flex tip from the R&S RT-ZMA14 tip cable.
2. **NOTICE!** Use adhesive pads or low-temperature hot glue to protect your probe accessories and DUT from damage.
Permanently solder the flex tips to the DUT.
3. Permanently solder the ground wires (GND) to the two ground vias at both sides of the flex tips and to the DUT.

Connecting the probe to the DUT

4. Use the clamp connector to connect and reconnect the RT-ZMA14 tip cable.

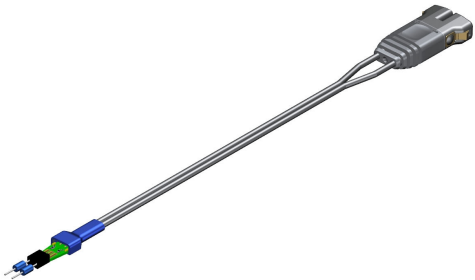
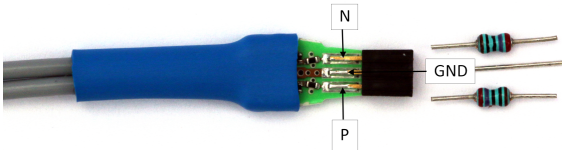
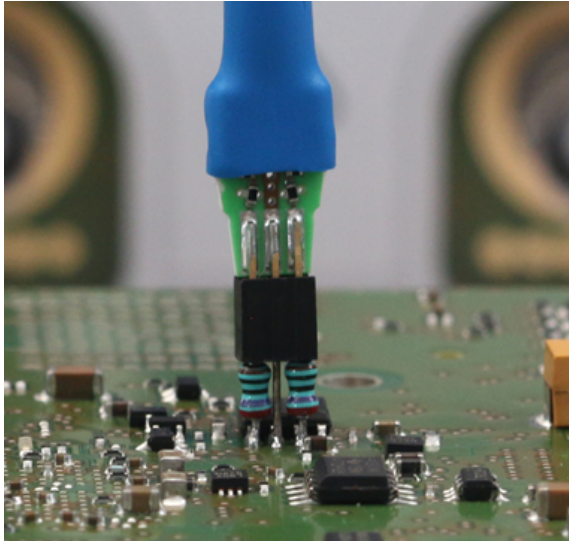
Measurements in DM Mode

In this configuration, you can measure only differential signals.

1. Permanently solder the flex tips to the DUT.
2. Leave ground wires open.
3. Optionally cut off the ground vias to reach smaller probing areas.
4. Use the clamp connector to connect and reconnect the RT-ZMA14 tip cable.

3.4.6 R&S RT-ZMA15 tip cable quick connect

The R&S RT-ZMA15 tip cable quick connect makes it easy to plug and remove connection onto resistors soldered directly to the DUT. It supports the full bandwidth of the probe amplifier. It is suited for creating contact with soldered-in 270 Ω resistors, and easily reconnecting different test points.

	<p>Bandwidth: up to 12 GHz MultiMode compatible Length: 15 cm Distance range: 1.27 mm (50 mil) Temperature range: -30°C to +80°C</p>
	

Measurements with MultiMode

In this configuration, you can measure single-ended, differential and common mode signals.

Use only the 270 Ω resistors from the R&S RT-ZMA accessories set for optimal flatness and bandwidth.

1. Permanently solder the 270 Ω resistors (P,N) to the DUT.
2. Permanently solder the ground wire (GND) between the two resistors to the DUT.
3. Connect and reconnect the socket head to the measurement point.

Measurements in DM mode

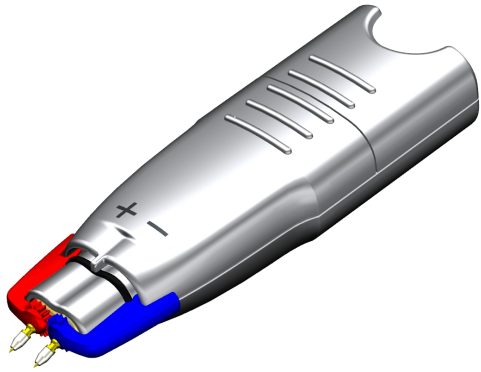
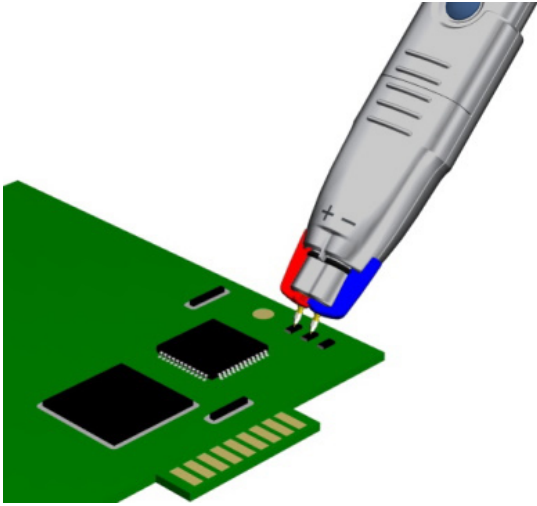
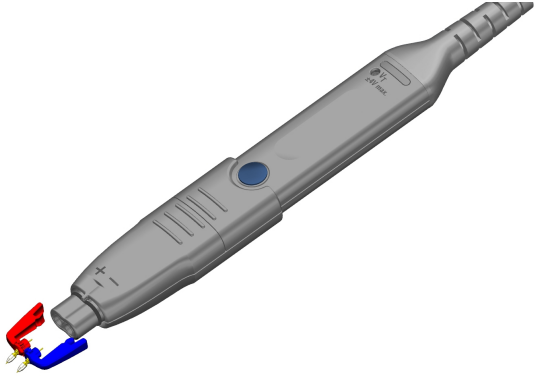
In this configuration, you can measure only differential signals.

1. Permanently solder the 270 Ω resistors (P,N) to the DUT.
2. Connect and reconnect the socket head to the measurement point.

3.4.7 R&S RT-ZMA30 browser module

The R&S RT-ZMA30 browser module allows handheld probing with maximum convenience at the DUT and supports the full bandwidth of the probe amplifier. It has spring-loaded pins with damping resistors close to the test point.

Connecting the probe to the DUT

	<p>Bandwidth: up to 16 GHz Distance range: 0.5 mm to 8 mm (20 mil to 315 mil) Axial travel: 0.5 mm (20 mil) <i>Not</i> MultiMode compatible, the module has no ground connector.</p>
	 <p>Replaceable parts, spring-loaded resistor tips</p>

Using the R&S RT-ZMA30 browser module sets the probe amplifier to DM mode.

Measurements of signals

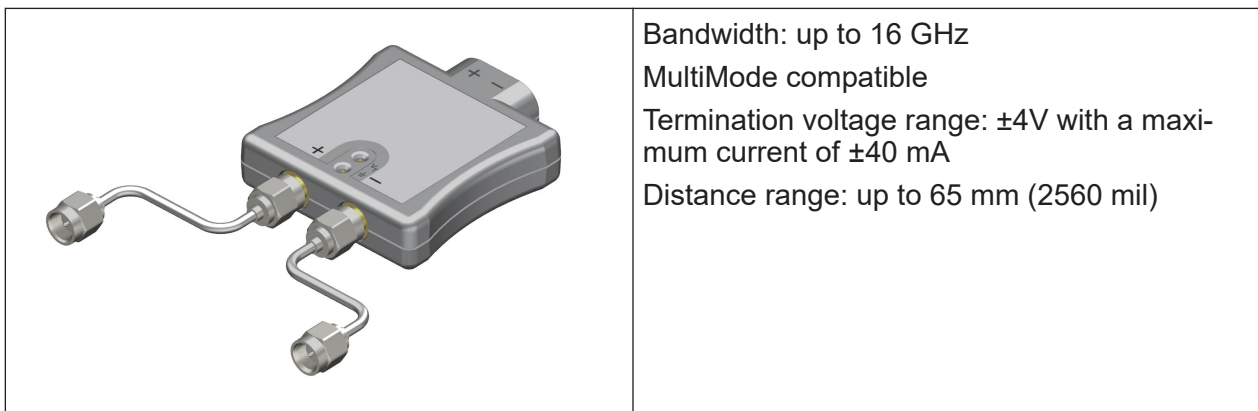
1. **CAUTION!** The browser module pins are very sharp, handle them carefully. Insert the pins in the browser module if needed.
2. **NOTICE!** Applying a side load to the browser module can damage the browser's pins. Do not apply too much force when browsing. The weight of the probe in your hand is usually sufficient. To measure differential signals, connect both pins to the differential pair at the DUT.
3. To measure single-ended signals, connect the positive pin to the signal and the negative pin to the ground.
4. Turn the levers to set the pin distance.

Disconnecting from the DUT

1. Remove the browser module from the DUT.
2. Disconnect the probe amplifier from the oscilloscope.

3.4.8 R&S RT-ZMA40 SMA module

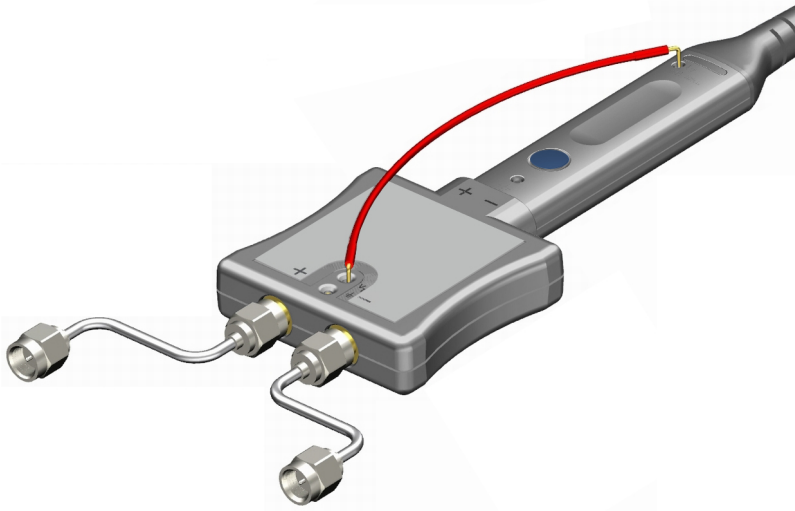
The R&S RT-ZMA40 SMA module allows you to connect two 2.92 mm, 3.5 mm, or SMA cables to make a MultiMode measurement on a single oscilloscope channel. It supports the full bandwidth of the probe amplifier.



Connecting to the DUT

1. To connect the SMA module to the output sockets of the DUT, use the S-shaped semi-rigid cables supplied with the SMA module.
The S-shaped semi-rigid cables are phase-matched to prevent unwanted signal conversion and assure best signal integrity.
2. Change the angle of the S-shaped semi-rigid cables to adjust the distance of the input sockets.
3. Connect the supplied red DC lead: to the V_T terminal of the R&S RT-ZM probe amplifier and to the V_T terminal of the R&S RT-ZMA40 SMA module.

Connecting the probe to the DUT



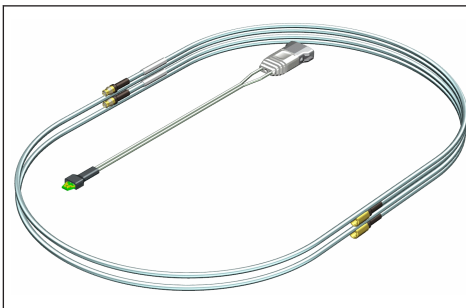
The R&S RT-ZMA40 SMA module applies a termination voltage (± 4 V) to the DUT to enable measurements against a common mode DC voltage instead of ground. This measurement is required for many digital signal standards. The termination voltage can be controlled by the oscilloscope. Necessary termination voltage is detected automatically, but can also be set manually.

Disconnecting from the DUT

1. Remove the SMA module from the DUT.
2. Disconnect the probe amplifier from the oscilloscope.

3.4.9 R&S RT-ZMA50 extreme temperature kit

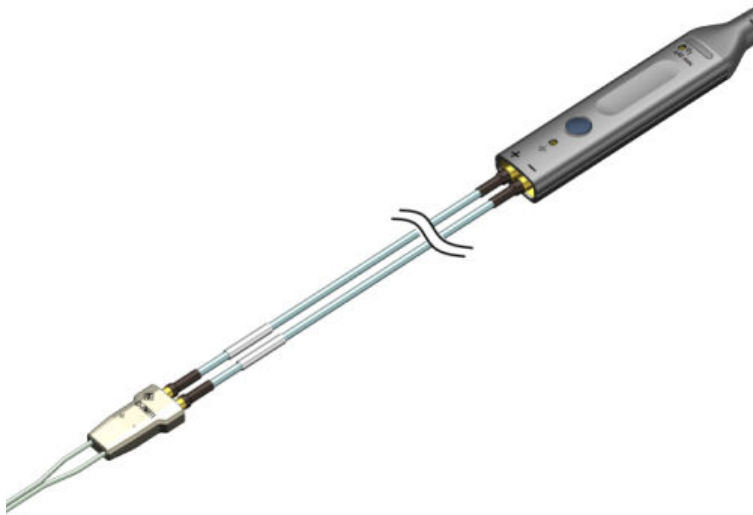
The R&S RT-ZMA50 extreme temperature kit contains a R&S RT-ZMA11 solder-in tip cable and a pair of matched extension cables for measurements in extreme temperature environments. It is well suited for creating solid contact with test points in extreme temperature areas, e.g. temperature chambers.



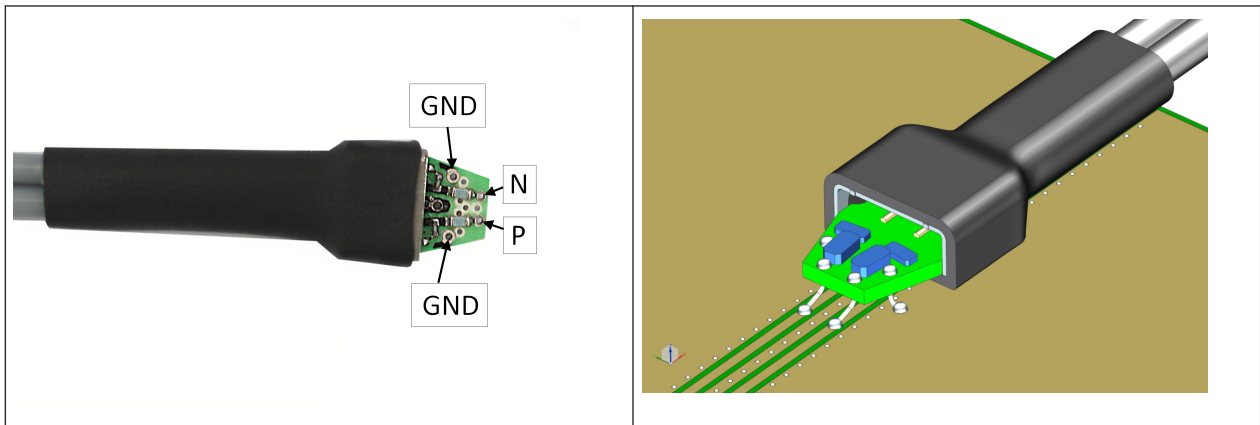
Bandwidth: up to 12 GHz
 MultiMode compatible
 Length: 115 cm
 Variable span range of the leads: 0 mm to 5 mm (0 mil to 200 mil)
 Temperature range: -55° C to $+125^{\circ}$ C

Connecting the tip cable into the probe amplifier

1. **NOTICE!** Keep the R&S RT-ZM probe amplifier outside the temperature chamber. It has a specified operating temperature range from 0°C to 40°C. Connect the R&S RT-ZMA11 tip cable solder-in ET to the 1-m extension cable pair.



2. Connect the other end of the extension cable pair to the R&S RT-ZM probe amplifier.



Measurements in MultiMode

In this configuration, you can measure single-ended, differential and common mode signals without resoldering the tip cable.

1. Solder both signal leads (P,N) in front of tip board and to the DUT.

Connecting the probe to the DUT

2. Solder both ground wires (GND) at the outside of the tip board and to the DUT.

Measurements in DM mode

In this configuration, you can measure only differential measurements.

1. Solder both signal leads (P,N) to your DUT.
2. Leave ground vias open.

4 Features and characteristics of modular probes


4.1 MultiMode

The R&S RT-ZM probe family features the MultiMode function which allows you to switch between single-ended, differential and common mode measurements without reconnecting or resoldering the probe.

Four different input voltages can be measured with the MultiMode feature:

- **P-Mode:** (pos.) Single-ended input voltage (V_p)
Voltage between the positive input terminal and ground
- **N-Mode:** (neg.) Single-ended input voltage (V_n)
Voltage between the negative input terminal and ground
- **DM-Mode:** Differential mode input voltage (V_{dm})
Voltage between the positive and negative input terminal
- **CM-Mode:** Common mode input voltage (V_{cm})
Mean voltage between the positive and negative input terminal vs. ground

$$V_{dm} = V_p - V_n$$
$$V_{cm} = \frac{V_p + V_n}{2}$$

 In the N-Mode, the signal at negative input terminal is not inverted.

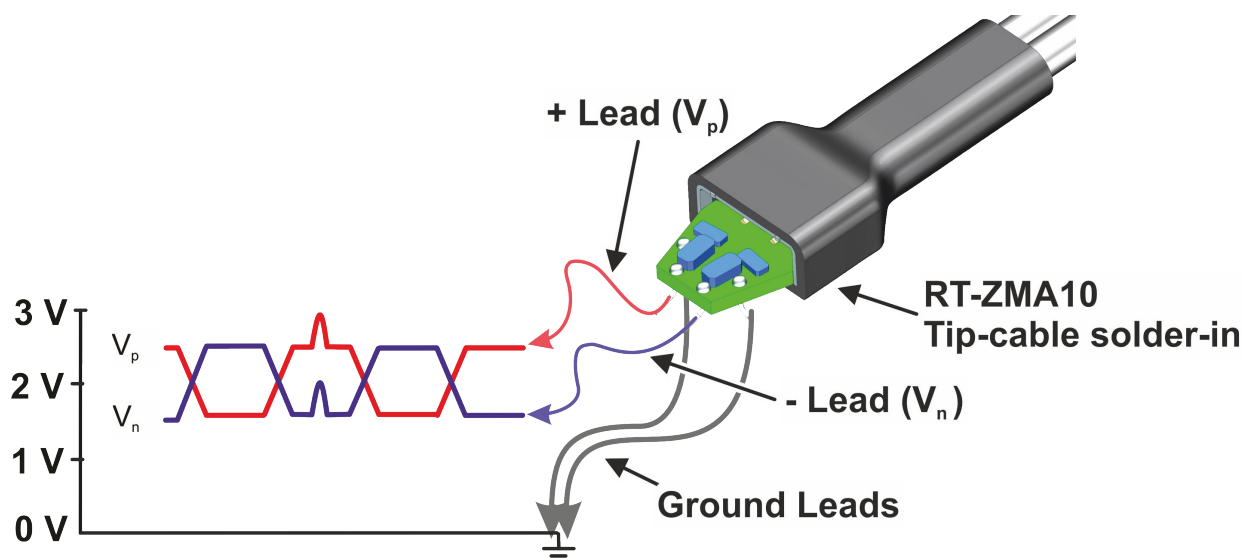


Figure 4-1: Input voltage at probe tip

The R&S RT-ZM probes have three input terminals: the positive signal input (+), the negative signal input (-), and ground.

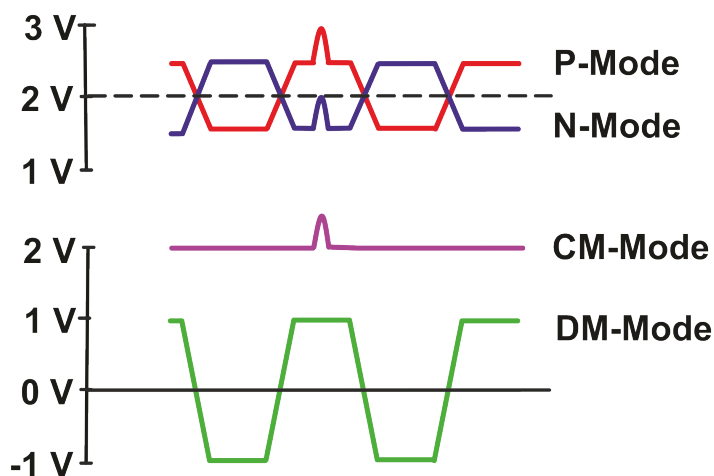


Figure 4-2: Displayed voltage on oscilloscope screen

The setting of the probe mode is part of the probe settings of the channel to which the probe is connected. You can also configure the micro button at the probe amplifier to select the "Probe Mode". For more details, see the oscilloscope's user manual.

i The MultiMode feature is not supported by R&S RT-ZMA30 browser module because there is no ground connection.

4.2 Dynamic range and operating voltage window

Two separate specifications are necessary to characterize the permissible input voltage range of a R&S RT-ZM MultiMode probe.

Measurement mode Single-Ended P, Single-Ended N, or Common Mode

Dynamic Range	± 2.50 V at 10:1 attenuation
	± 0.50 V at 2:1 attenuation

The dynamic range for single-ended (P-Mode, N-Mode) or common mode (CM-Mode) measurements designates the maximum voltage (V_p , V_n) that can occur between each of the two input terminals (V_p , V_n) and ground at the probe tip.

Differential measurement mode

Dynamic Range	± 2.50 V at 10:1 attenuation
	± 0.50 V at 2:1 attenuation
Operating voltage window (each pin to ground)	± 7.0 VDC to 100 kHz
	± 5.0 V > 100 kHz at 10:1 attenuation
	± 1.0 V > 100 kHz at 2:1 attenuation

- The dynamic range for differential measurement (DM-Mode) designates the maximum differential voltage V_{dm} that can occur between the positive and negative signal terminal at the probe tip.
- At the same time, the two voltage values at each of the two signal terminals V_p and V_n referenced to the common ground must not exceed a specific limit value. This limitation is referred to as the operating voltage window (some manufacturers also use the less precise term "common mode range" for the same parameter).
- If one of these ranges is exceeded, an unwanted signal clipping can occur. When measuring differential signals, frequently change to common mode measurement to check for unallowed common mode signals.
- The attenuation is automatically selected by the oscilloscope's "V/div" setting

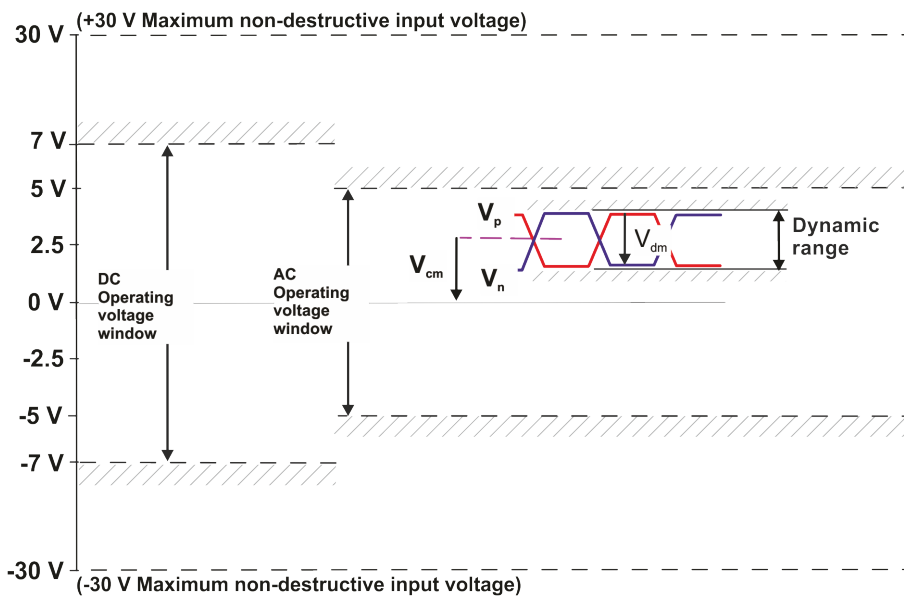


Figure 4-3: Operating voltage window for differential measurement mode DM at 10:1 attenuation for all offset settings at 0 V

4.3 Offset compensation

The R&S RT-ZM probe features the most comprehensive offset compensation function. The compensation of DC components directly at the probe tip even in front of the active probe amplifier is possible with an extremely wide compensation range of ± 16 V.

The offset compensation feature is available for every MultiMode setting:

MultiMode setting	Offset compensation	Offset compensation range	Application
DM-Mode	Differential DC voltage	± 16 V	Probing single-ended signals with the R&S RT-ZMA30 browser module, e.g. power rails with high DC component and small AC signal.
CM-Mode	Common mode DC voltage	± 16 V	Measurements of signals with high common mode levels, e.g. current measurements with a shunt resistor.

MultiMode setting	Offset compensation	Offset compensation range	Application
P-Mode	DC voltage at positive input terminal	± 24 V	Measurement of single-ended AC signals with high superimposed DC component at the positive input terminal. Note: The maximum voltage difference between the positive and negative input terminals is 16 V.
N-Mode	DC voltage at negative input terminal	± 24 V	Measurement of single ended AC signals with high superimposed DC component at the negative input terminal. Note: The maximum voltage difference between the positive and negative input terminals is 16 V.

You can set the offset compensation at the oscilloscope in various ways:

- Use the vertical [Position] knob. Before adjusting the offset, make sure that the function of the knob is set to "Offset".
- Use the probe settings menu of the channel to which the probe is connected.
- Use the micro button to compensate the DC component of the measurement signal, which is helpful during measurements of input signals with different DC offsets. Therefore, assign "Set offset to mean" to the micro button function.

Setting an offset compensation voltage and then switching the probe measurement mode does not affect the offset settings.

For example, you can measure a differential signal superimposed with a high DC common mode component. First switch to CM-mode and compensate the common mode offset using the vertical [Position] knob until the measurement trace is in the center of the oscilloscope screen. Then switch back to DM-mode to measure the differential signal.

For more details on setting the offset compensation voltage, refer to the user manual of your Rohde & Schwarz oscilloscope.

4.3.1 Differential offset

The differential offset function can compensate a DC voltage applied between the positive (V_p) and the negative (V_n) input terminal at the probe tip. Setting a differential offset compensation in DM measurement mode is directly visible on the oscilloscope screen as a voltage offset of the measured waveform.

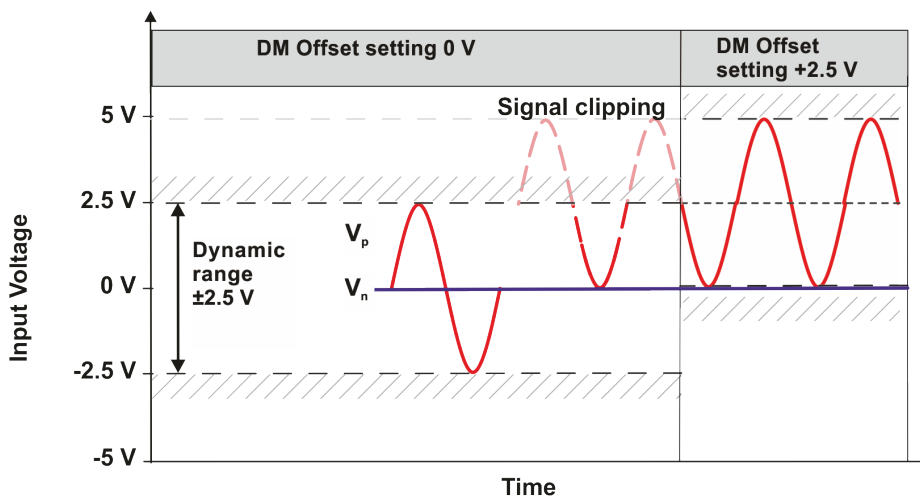


Figure 4-4: Differential offset compensation for a single-ended measurement (negative input connected to ground) using an R&S RT-ZM15/30/60/90/130/160

4.3.2 Common mode offset

The common mode offset function can compensate a DC voltage applied to both input terminals at the probe tip (referenced to ground). Setting a common mode offset compensation in CM measurement mode is directly visible on the oscilloscope screen as a voltage offset of the measured waveform.

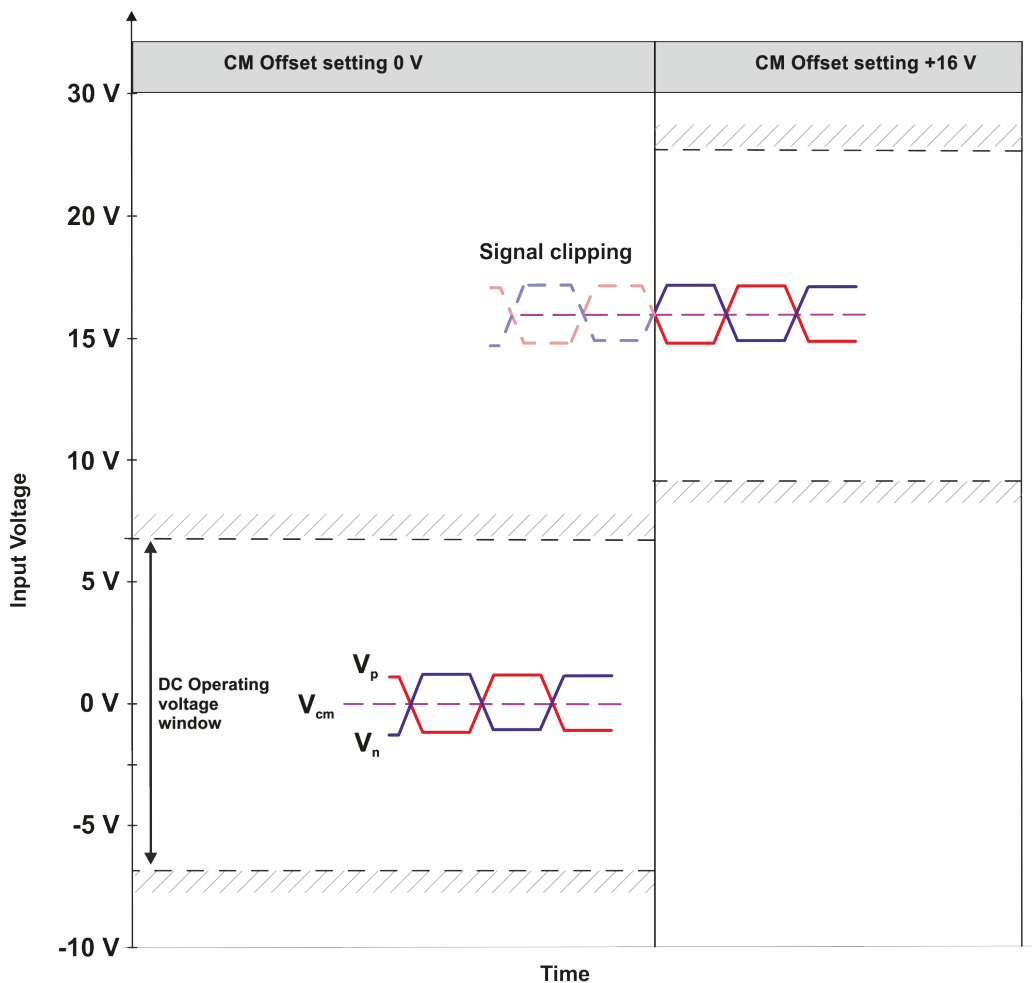


Figure 4-5: Common mode (CM) offset compensation for a differential measurement

4.3.3 Positive input single-ended offset

The P offset function can compensate a DC voltage applied to the positive input terminal (V_p) at the probe tip (referenced to ground). Setting a P offset compensation in single-ended P measurement mode is directly visible on the oscilloscope screen as a voltage offset of the measured waveform.

This function is useful when measuring single-ended AC signals with high superimposed DC component at the positive input terminal referenced to ground.

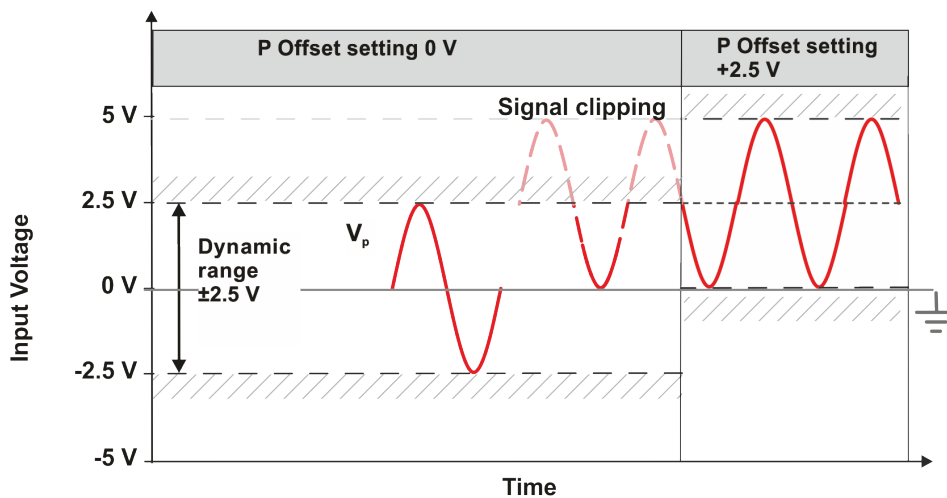


Figure 4-6: P offset compensation for a single-ended measurement at the positive input terminal

4.3.4 Negative input single-ended offset

The N offset function can compensate a DC voltage applied to the negative input terminal (V_n) at the probe tip (referenced to ground). Setting an N offset compensation in single-ended N measurement mode is directly visible on the oscilloscope screen as a voltage offset of the measured waveform.

This function is useful when measuring single-ended AC signals with high superimposed DC component at the negative input terminal referenced to ground.

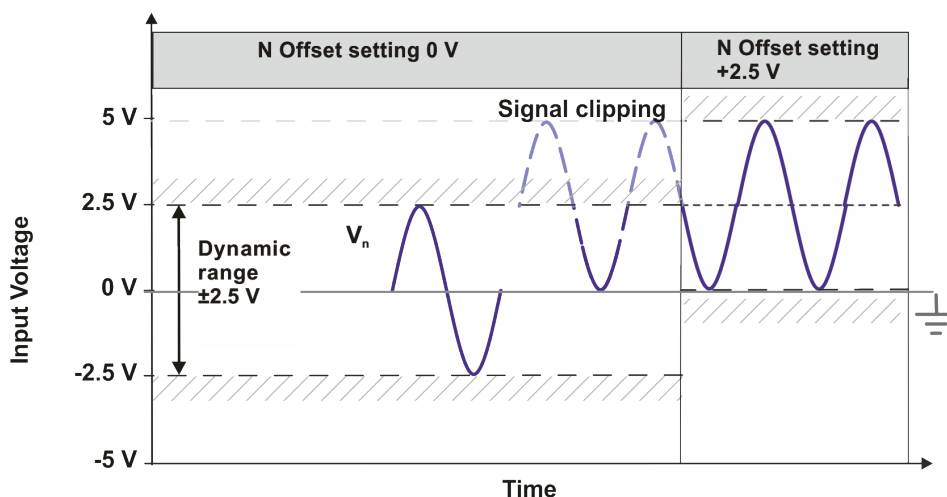


Figure 4-7: N offset compensation for a single-ended measurement at the negative input terminal

4.4 Micro button

The micro button provides easy and quick access to important functions of the Rohde & Schwarz oscilloscope. After a function has been assigned, pressing the micro button remotely controls this specific function on the base unit. For example, "Run continuous" or "Run single" are often assigned to the micro button.

The configuration of the micro button is part of the probe settings of the channel to which the probe is connected. For more details, see the oscilloscope's user manual.

4.5 R&S ProbeMeter

The R&S ProbeMeter is an integrated voltmeter that measures DC voltages with higher precision compared to the oscilloscope's DC accuracy. The DC voltage is measured continuously and runs parallel to the time domain measurement of the oscilloscope.

High-precision measurements are achieved by immediate digitization of the measured DC voltage at the probe tip.

The R&S ProbeMeter measures the differential and common mode DC voltages simultaneously, and independently of the MultiMode setting.

When the R&S ProbeMeter is active, the measured values are displayed on the oscilloscope. The R&S ProbeMeter state is part of the probe settings of the channel to which the probe is connected. For details, refer to the user manual of the Rohde & Schwarz oscilloscope.

Advantages of the R&S ProbeMeter:

- Measures DC voltages of different levels, no need to adjust the measurement range of the oscilloscope.
- True DC measurement (integration time > 100 ms), not mathematical average of displayed waveform.
- High measurement accuracy and low temperature sensitivity.
- Simple means of setting the oscilloscope's trigger level and vertical scaling if a waveform is not visible.
- Independent of oscilloscope settings for position, vertical scale, horizontal scale, and trigger.

- Independent of probe settings for measurement mode and gain.
- Unique way to detect unexpected or inadmissible common mode voltages, e.g. bias points - measurement of common mode DC voltages without reconnecting the probe.
- Differential measurement range ± 2.5 V + offset compensation setting. Common mode measurement range ± 7 V + common mode offset compensation setting.

4.6 Input impedance

The input signal loading caused by a probe tip module is determined by its input impedance. The following plots show the single-ended and differential input impedance of various RT-ZMA tip modules.

The single-ended input impedance is the loading seen by a single-ended source from the single-ended input of the probe tip module. The differential input impedance is the loading seen by a differential source from the differential input of the probe tip module.

The measurement data used for these plots was made using a calibrated Rohde & Schwarz vector network analyzers. Values below 20 MHz were determined using simulation data from equivalent circuits.

Input impedance

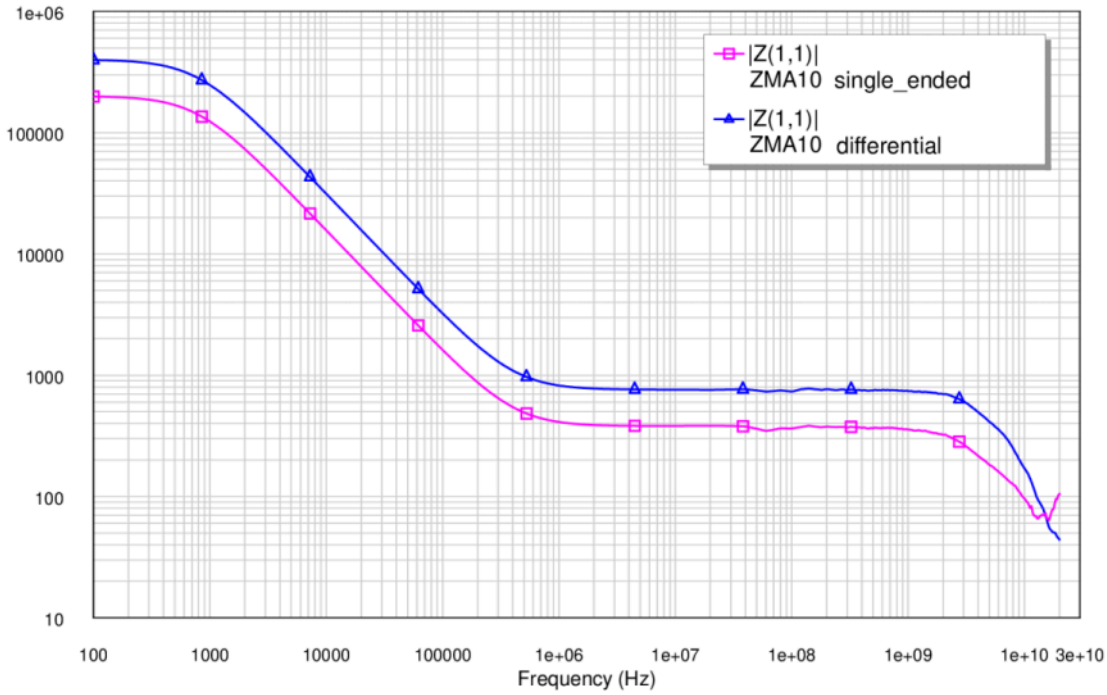


Figure 4-8: Input impedance R&S RT-ZMA10

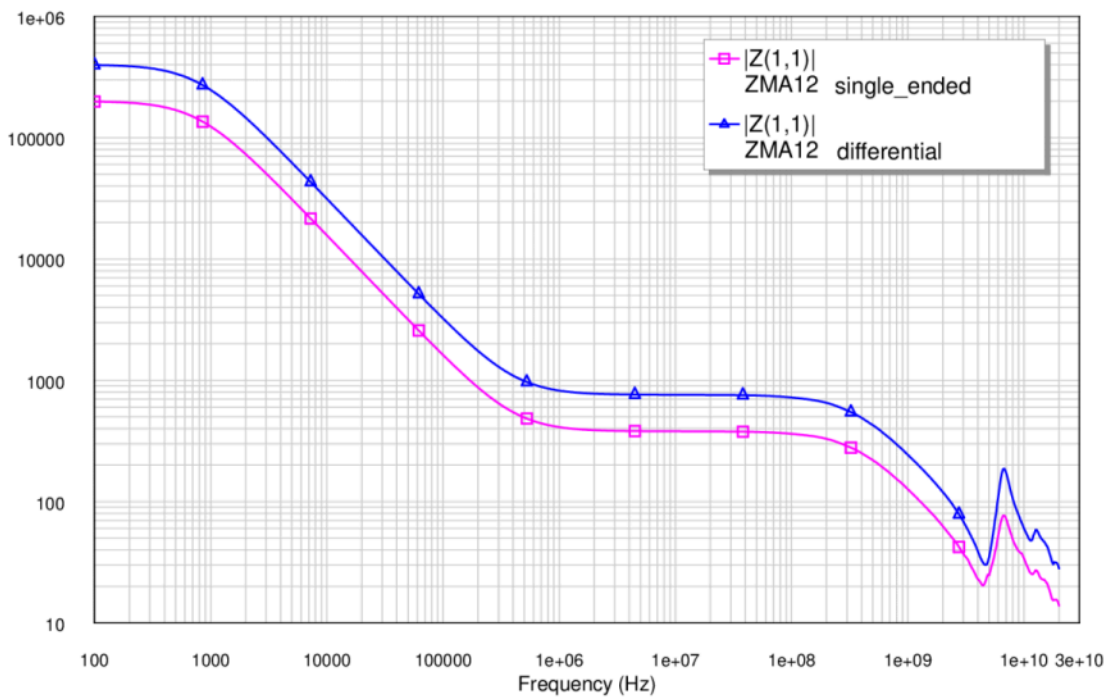


Figure 4-9: Input impedance R&S RT-ZMA12

Input impedance

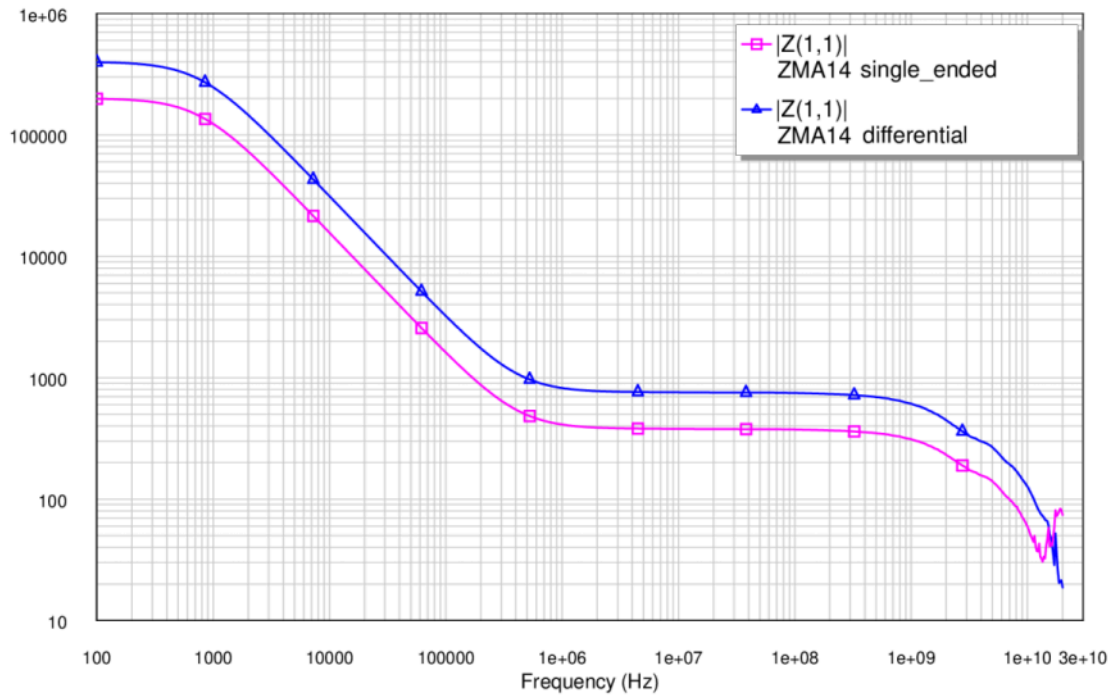


Figure 4-10: Input impedance R&S RT-ZMA14

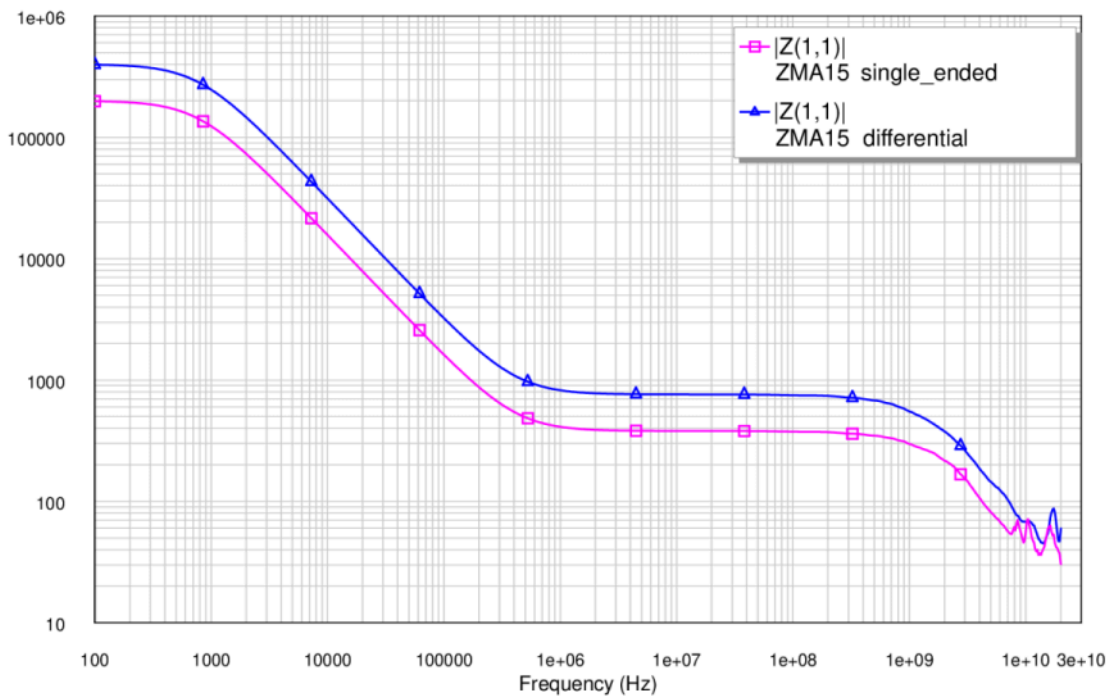


Figure 4-11: Input impedance R&S RT-ZMA15

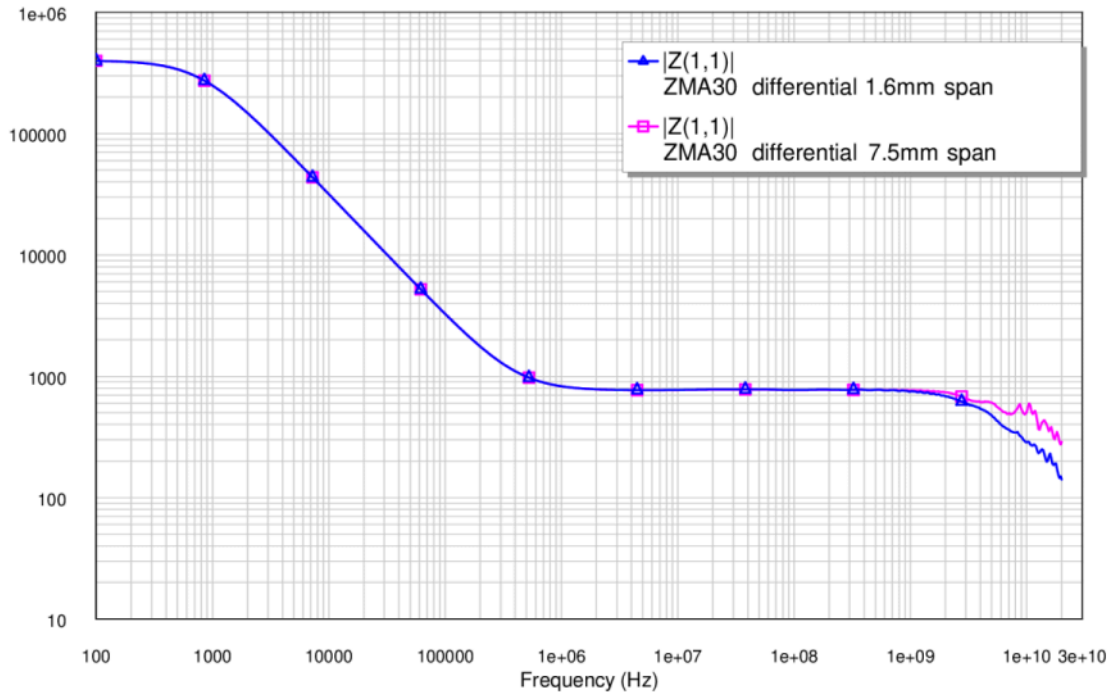


Figure 4-12: Input impedance R&S RT-ZMA30

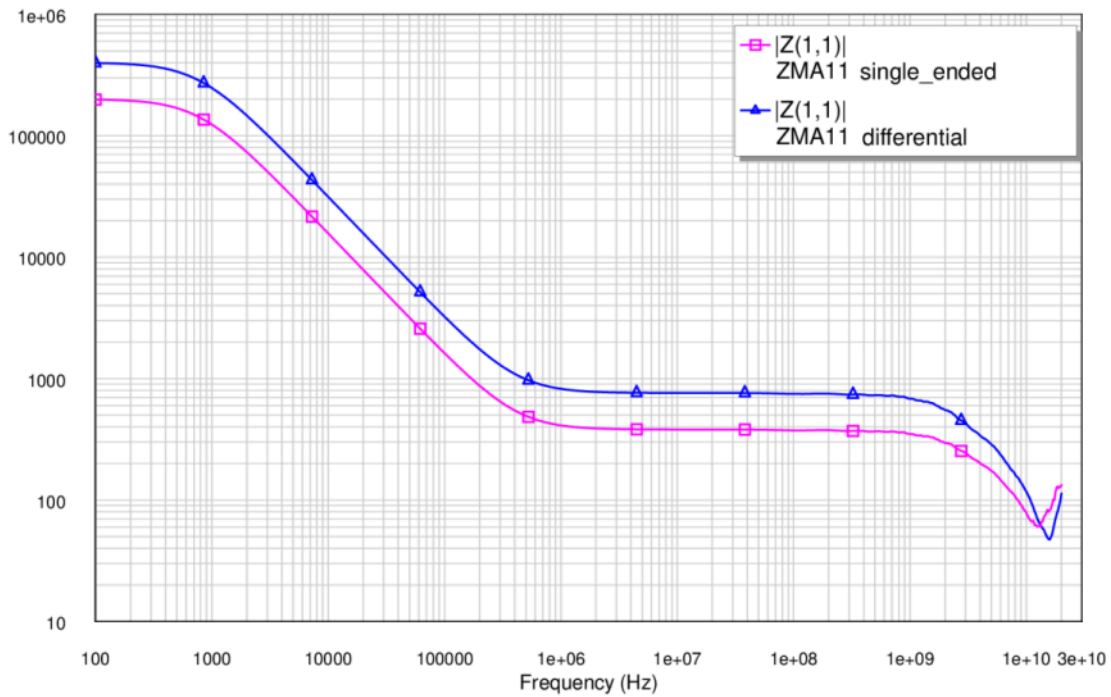


Figure 4-13: Input impedance R&S RT-ZMA50 with R&S RT-ZMA11 tip

5 Maintenance and service

Like all Rohde & Schwarz products, Rohde & Schwarz probes and adapters are of high quality and require only minimum service and repair. However, if service or calibration is needed, contact your Rohde & Schwarz service center. Return a defective product to the Rohde & Schwarz service center for diagnosis and exchange.

5.1 Cleaning

1. Clean the outside of the product using a soft cloth moistened with either distilled water or isopropyl alcohol. Keep in mind that the casing is not waterproof.
Note: Do not use cleaning agents. Solvents (thinners, acetone), acids and bases can damage the labeling or plastic parts.
2. Dry the product completely before using it.

5.2 Contacting customer support

Technical support – where and when you need it

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

Contact information

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



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

5.3 Returning for servicing

Use the original packaging to return your R&S RT-ZM to your Rohde & Schwarz-service center. A list of all service centers is available on:

www.services.rohde-schwarz.com

If you cannot use the original packaging, consider the following:

1. Use a sufficiently sized box.
2. Protect the product from damage and moisture (e.g. with bubble wrap).
3. Use some kind of protective material (e.g. crumpled newspaper) to stabilize the product inside the box.
4. Seal the box with tape.
5. Address the package to your nearest Rohde & Schwarz service center.

5.4 Calibration interval

The recommended calibration interval for R&S RT-ZM modular probe is two years. For servicing, send the probe to your nearest Rohde & Schwarz service center (see [Chapter 5.3, "Returning for servicing"](#), on page 47).

5.5 Storage and transport

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

Store the product in a shock-resistant case, e.g. in the shipping case.

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

5.6 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 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 service life. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.



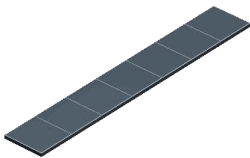
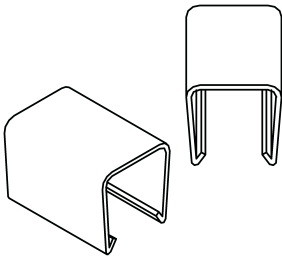
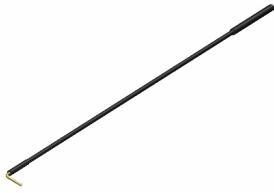
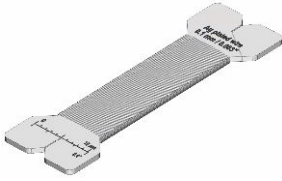
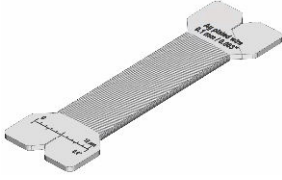
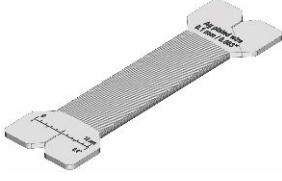
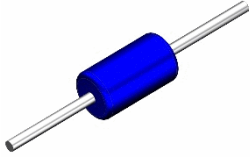
Figure 5-2: Labeling in line with EU directive WEEE

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.

5.7 Spare parts

You can order the following accessories from the Rohde & Schwarz service center. Use the order numbers provided in the following table.

Table 5-1: Accessories for R&S RT-ZM

Pos	Item	Description	Material number
1		Adhesive pads	1800.4268.00
2		Cable marker	1800.4245.00
3		Lead wire black (ground)	1800.4222.00
4		Solder wire 0.2mm Ag plated	1800.4074.00
5		Solder wire 0.1mm Ag plated	1800.4051.00
6		Spool solder wire	1800.4097.00
7		Solder in resistor 270 Ω	3623.2791.00


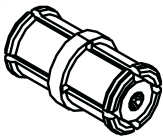

Pos	Item	Description	Material number
8		Solder lead	3623.2791.00
9		SMP bullet	1419.3386.00
10		SMP bullet removal tool	1800.4451.00
11	Pogo pin	Pogo pin connector, 6 pins	3584.6396.00
12	R&S RT-ZK3	R&S RT-ZK3 service kit	1419.3934.02

Table 5-2: Accessories for R&S RT-ZMA14


Pos	Item	Description	Material number
1		10 Flex Tips 332 Ohms solder-in	1337.9781.02

Table 5-3: Accessories for R&S RT-ZMA30

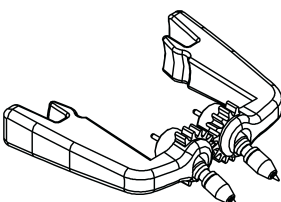
Pos	Item	Description	Material number
1		Browser pins	1800.4416.00 1800.4422.00

Table 5-4: Accessories for R&S RT-ZMA40

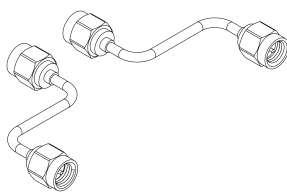
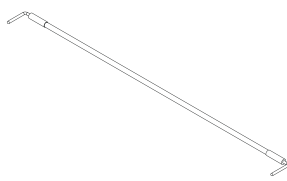
Pos	Item	Description	Material number
1		Semi rigid cable	1419.4276.00
2		Lead wire red (termination voltage)	1800.4239.00

Table 5-5: Parts for ESD prevention

Pos.	Item	Material number
1	ESD wrist strap	0008.9959.00
2	ESD grounding cable	1043.4962.00