

R&S®RT-ZPR20, R&S®RT-ZPR40

Power-Rail Probe

User Manual



1800.5035.02 – 02

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

- R&S®RT-ZPR20 (1800.5006.02)
- R&S®RT-ZPR40 (1800.5406.02)

© 2018 Rohde & Schwarz GmbH & Co. KG

Mühlhofstr. 15, 81671 München, Germany

Phone: +49 89 41 29 - 0

Fax: +49 89 41 29 12 164

Email: info@rohde-schwarz.com

Internet: www.rohde-schwarz.com

Subject to change – Data without tolerance limits is not binding.

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.

Trade names are trademarks of their owners.

Throughout this manual, products from Rohde & Schwarz are indicated without the ® symbol and without product type numbers, e.g. R&S®RT-ZPR20/40 is indicated as R&S RT-ZPR20/40.

Basic Safety Instructions

Always read through and comply with the following safety instructions!

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standards of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment they require are designed, built and tested in accordance with the safety standards that apply in each case. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed, built and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, you must observe all instructions and warnings provided in this manual. If you have any questions regarding these safety instructions, the Rohde & Schwarz group of companies will be happy to answer them.







Furthermore, it is your responsibility to use the product in an appropriate manner. This product is designed for use solely in industrial and laboratory environments or, if expressly permitted, also in the field and must not be used in any way that may cause personal injury or property damage. You are responsible if the product is used for any purpose other than its designated purpose or in disregard of the manufacturer's instructions. The manufacturer shall assume no responsibility for such use of the product.

The product is used for its designated purpose if it is used in accordance with its product documentation and within its performance limits (see data sheet, documentation, the following safety instructions). Using the product requires technical skills and, in some cases, a basic knowledge of English. It is therefore essential that only skilled and specialized staff or thoroughly trained personnel with the required skills be allowed to use the product. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation. Keep the basic safety instructions and the product documentation in a safe place and pass them on to the subsequent users.








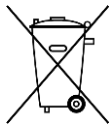



Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety instructions on personal safety, for example, that appear in relevant parts of the product documentation. In these safety instructions, the word "product" refers to all merchandise sold and distributed by the Rohde & Schwarz group of companies, including instruments, systems and all accessories. For product-specific information, see the data sheet and the product documentation.

Safety labels on products

The following safety labels are used on products to warn against risks and dangers.

Symbol	Meaning	Symbol	Meaning
	Notice, general danger location Observe product documentation		ON/OFF Power
	Caution when handling heavy equipment		Standby indication
	Danger of electric shock		Direct current (DC)

Basic Safety Instructions

Symbol	Meaning	Symbol	Meaning
	Caution ! Hot surface		Alternating current (AC)
	Protective conductor terminal To identify any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth		Direct/alternating current (DC/AC)
	Earth (Ground)		Class II Equipment to identify equipment meeting the safety requirements specified for Class II equipment (device protected by double or reinforced insulation)
	Frame or chassis Ground terminal		EU labeling for batteries and accumulators For additional information, see section "Waste disposal/Environmental protection", item 1.
	Be careful when handling electrostatic sensitive devices		EU labeling for separate collection of electrical and electronic devices For additional information, see section "Waste disposal/Environmental protection", item 2.
	Warning! Laser radiation For additional information, see section "Operation", item 7.		

Signal words and their meaning

The following signal words are used in the product documentation in order to warn the reader about risks and dangers.



Indicates a hazardous situation which, if not avoided, will result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in death or serious injury.



Indicates a hazardous situation which, if not avoided, could result in minor or moderate injury.



Indicates information considered important, but not hazard-related, e.g. messages relating to property damage.

In the product documentation, the word ATTENTION is used synonymously.

These signal words are in accordance with the standard definition for civil applications in the European Economic Area. Definitions that deviate from the standard definition may also exist in other economic areas or military applications. It is therefore essential to make sure that the signal words described here are always used only in connection with the related product documentation and the related product. The use of signal words in connection with unrelated products or documentation can result in misinterpretation and in personal injury or material damage.

Basic Safety Instructions

Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer, without the product's ventilation being obstructed. If the manufacturer's specifications are not observed, this can result in electric shock, fire and/or serious personal injury or death. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed.

1. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: predefined operating position is always with the housing floor facing down, IP protection 2X, use only indoors, max. operating altitude 2000 m above sea level, max. transport altitude 4500 m above sea level. A tolerance of $\pm 10\%$ shall apply to the nominal voltage and $\pm 5\%$ to the nominal frequency, overvoltage category 2, pollution degree 2.
2. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves). An installation that is not carried out as described in the product documentation could result in personal injury or even death.
3. Do not place the product on heat-generating devices such as radiators or fan heaters. The ambient temperature must not exceed the maximum temperature specified in the product documentation or in the data sheet. Product overheating can cause electric shock, fire and/or serious personal injury or even death.

Electrical safety

If the information on electrical safety is not observed either at all or to the extent necessary, electric shock, fire and/or serious personal injury or death may occur.

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the mains-supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with a protective conductor contact and protective conductor.
3. Intentionally breaking the protective conductor either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.
4. If there is no power switch for disconnecting the product from the mains, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the mains. In such cases, always ensure that the power plug is easily reachable and accessible at all times. For example, if the power plug is the disconnecting device, the length of the connecting cable must not exceed 3 m. Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, the disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cables on a regular basis to ensure that they are in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, ensure that the cable cannot be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.

Basic Safety Instructions

6. The product may be operated only from TN/TT supply networks fuse-protected with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages $V_{rms} > 30$ V, suitable measures (e.g. appropriate measuring equipment, fuse protection, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC 60950-1 / EN 60950-1 or IEC 61010-1 / EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the protective conductor terminal on site and the product's protective conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.

Basic Safety Instructions

2. Before you move or transport the product, read and observe the section titled "Transport".
3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal/Environmental protection", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. Laser products are given warning labels that are standardized according to their laser class. Lasers can cause biological harm due to the properties of their radiation and due to their extremely concentrated electromagnetic power. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).
8. EMC classes (in line with EN 55011/CISPR 11, and analogously with EN 55022/CISPR 22, EN 55032/CISPR 32)
 - Class A equipment:
Equipment suitable for use in all environments except residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings
Note: Class A equipment is intended for use in an industrial environment. This equipment may cause radio disturbances in residential environments, due to possible conducted as well as radiated disturbances. In this case, the operator may be required to take appropriate measures to eliminate these disturbances.
 - Class B equipment:
Equipment suitable for use in residential environments and environments that are directly connected to a low-voltage supply network that supplies residential buildings

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.

Basic Safety Instructions

- Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, protective conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

If the information regarding batteries and rechargeable batteries/cells is not observed either at all or to the extent necessary, product users may be exposed to the risk of explosions, fire and/or serious personal injury, and, in some cases, death. Batteries and rechargeable batteries with alkaline electrolytes (e.g. lithium cells) must be handled in accordance with the EN 62133 standard.

- Cells must not be taken apart or crushed.
- Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.
- Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.
- Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
- If a cell develops a leak, the fluid must not be allowed to come into contact with the skin or eyes. If contact occurs, wash the affected area with plenty of water and seek medical aid.
- Improperly replacing or charging cells or batteries that contain alkaline electrolytes (e.g. lithium cells) can cause explosions. Replace cells or batteries only with the matching Rohde & Schwarz type (see parts list) in order to ensure the safety of the product.
- Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.
- Follow the transport stipulations of the carrier (IATA-DGR, IMDG-Code, ADR, RID) when returning lithium batteries to Rohde & Schwarz subsidiaries.

Transport

- The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.
- Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.

Instrucciones de seguridad elementales

3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal/Environmental protection

1. Specially marked equipment has a battery or accumulator that must not be disposed of with unsorted municipal waste, but must be collected separately. It may only be disposed of at a suitable collection point or via a Rohde & Schwarz customer service center.
2. Waste electrical and electronic equipment must not be disposed of with unsorted municipal waste, but must be collected separately.
Rohde & Schwarz GmbH & Co. KG has developed a disposal concept and takes full responsibility for take-back obligations and disposal obligations for manufacturers within the EU. Contact your Rohde & Schwarz customer service center for environmentally responsible disposal of the product.
3. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
4. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

For additional information about environmental protection, visit the Rohde & Schwarz website.

Safety Instructions for Active Voltage Probes

When handling active voltage probes, the following basic rules must be observed. Prior to using an active voltage probe, read the applicable manual including the safety instructions. Keep the safety instructions and the product documentation in a safe place and pass them on to other users. Use active voltage probes exclusively within the measurement ranges specified in the applicable data sheets. Rohde & Schwarz accepts no responsibility for misuse of the product. Use only the accessories supplied with the active voltage probe.

WARNING

Risk of electric shock

Do not connect an active voltage probe to any voltage that exceeds the maximum permissible input voltage specified in the data sheet. Non-compliance with this instruction carries the risk of an electric shock.

Make sure not to cause any short circuits when performing measurements on sources with high output currents. Short circuits may cause injuries or burns.

CAUTION

Risk of injury caused by pointed object

The pins of the active voltage probes are extremely pointed and can easily penetrate clothes and the skin.

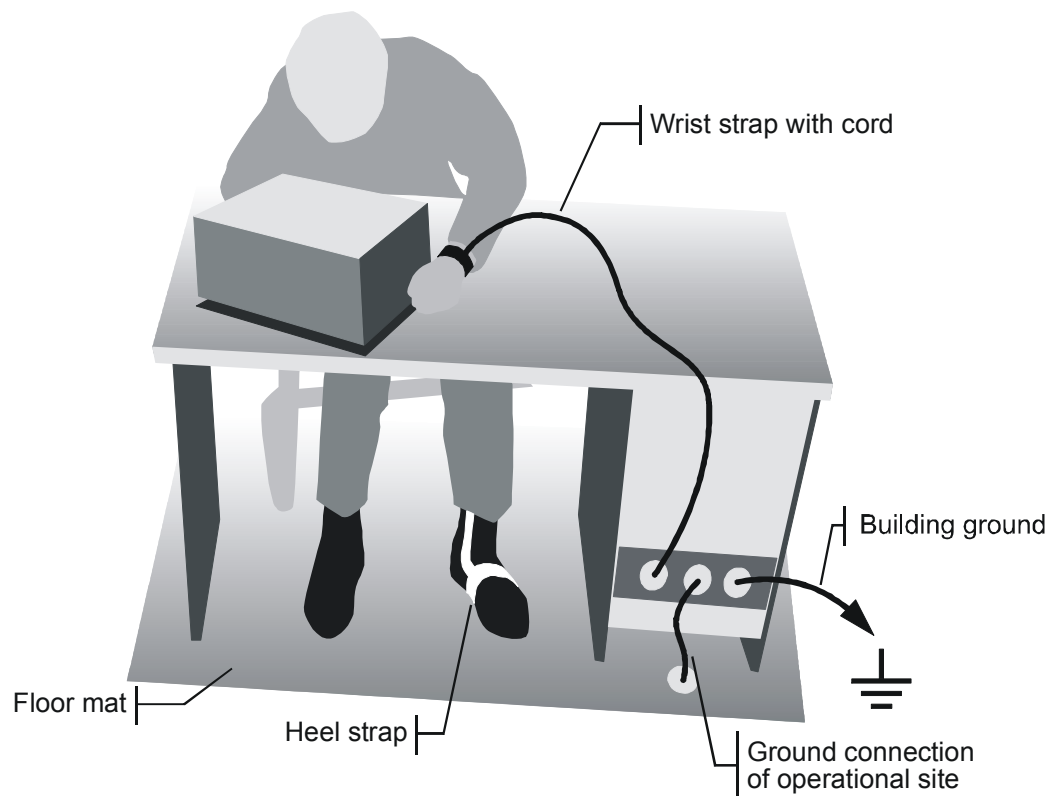
Therefore, handle the probe pins with great care. When transporting an active voltage probe, e.g. when carrying it in a pocket or tool bag, always use the box supplied with the probe. To exchange a probe pin, use tweezers or pliers to avoid injuries.

Instructions for Electrostatic Discharge Protection

NOTICE

Risk of damaging electronic components

To avoid damage of electronic components, the operational site must be protected against electrostatic discharge (ESD).



The following two methods of ESD protection may be used together or separately:

- Wrist strap with cord to ground connection
 - Conductive floor mat and heel strap combination
-

Customer Support

Technical support – where and when you need it

For quick, expert help with any Rohde & Schwarz equipment, contact one of our Customer Support Centers. A team of highly qualified engineers provides telephone support and will work with you to find a solution to your query on any aspect of the operation, programming or applications of Rohde & Schwarz equipment.

Up-to-date information and upgrades

To keep your instrument up-to-date and to be informed about new application notes related to your instrument, please send an e-mail to the Customer Support Center stating your instrument and your wish. We will take care that you will get the right information.

Europe, Africa, Middle East

Phone +49 89 4129 12345
customersupport@rohde-schwarz.com

North America

Phone 1-888-TEST-RSA (1-888-837-8772)
customer.support@rsa.rohde-schwarz.com

Latin America

Phone +1-410-910-7988
customersupport.la@rohde-schwarz.com

Asia/Pacific

Phone +65 65 13 04 88
customersupport.asia@rohde-schwarz.com

China

Phone +86-800-810-8228 /
+86-400-650-5896
customersupport.china@rohde-schwarz.com



Contents

1	Product Description.....	5
1.1	Key Features and Key Characteristics.....	5
1.1.1	Maximum Non-Destructive Input Voltage.....	5
1.2	Unpacking the Device.....	6
1.2.1	Inspecting the Contents.....	6
1.3	Description of the Probe.....	6
1.3.1	Probe Box.....	6
1.3.2	Supplied Accessories.....	7
1.3.3	Optional Accessories.....	9
1.3.4	Service Accessories.....	10
2	Putting into Operation.....	11
2.1	Installation.....	11
2.1.1	Connecting the Probe to the Oscilloscope.....	12
2.1.2	Identification of the Probe.....	13
2.2	Offset Compensation and Dynamic Range.....	13
2.3	AC Coupling Mode.....	14
2.4	R&S ProbeMeter.....	15
3	Connecting the Probe to the DUT.....	16
3.1	R&S RT-ZA25 Power Rail Browser Kit.....	16
3.2	R&S RT-ZA26 Pigtail Cable.....	19
3.3	SMA Extension Cable.....	20
4	Measurement Principles.....	21
4.1	Step Response.....	22
4.2	Frequency Response.....	22
4.3	Input Impedance.....	23
5	Maintenance and Service.....	25
5.1	Service Strategy.....	25
5.2	Returning the Probe for Servicing.....	25
5.3	Cleaning.....	25

5.4 Calibration Interval.....26

5.5 Discarding the Probe..... 26

5.6 Spare Parts..... 26

1 Product Description

1.1 Key Features and Key Characteristics

The R&S RT-ZPR20/40 power-rail probe is designed for power integrity measurements. The R&S RT-ZPR20/40 is specifically built to measure small signals in the millivolt range with very large DC-offset components up to ± 60 V. It is thus perfectly suited to measure small perturbations on DC power rails.

The probe consists of a probe box with an SMA connector and various accessories for different applications.

Since the probe is equipped with the Rohde & Schwarz probe interface, it can be connected to any Rohde & Schwarz base unit that is compatible with this interface and has the required firmware. When connected to the front panel of a supported Rohde & Schwarz oscilloscope, the probe is controlled via the software dialog of the oscilloscope. For a list of compatible base units, see "[Supported oscilloscopes](#)" on page 12 or the data sheet of the probe.

The key characteristics of the probe are the following:

- Bandwidth:
 - DC to 2.0 GHz for R&S RT-ZPR20
 - DC to 4.0 GHz for R&S RT-ZPR40
- Extremely low noise, only 10 % additional to your scope noise
- Dynamic range ± 850 mV
- High offset capability ± 60 V
- AC coupling with low-frequency cutoff at 10 Hz
- DC input resistance: 50 k Ω
- Extremely low zero and gain errors over temperature
- R&S ProbeMeter with dynamic range ± 60 V and measurement error < 0.1 %
- Rohde & Schwarz probe interface

1.1.1 Maximum Non-Destructive Input Voltage

The maximum non-destructive input voltage of the power rail probe is specified as the maximum voltage between the signal and the ground.

NOTICE

Maximum input voltage

The maximum input voltage is ± 60 V DC or ± 5 V AC (peak) between the center conductor and the ground. A higher input voltage may destroy the probe.

1.2 Unpacking the Device

The carrying case contains the following items:



- R&S RT-ZPR20/40 power-rail probe
- Accessory container
- Pigtail cables
- User manual
- R&S RT-ZPR20/40 data sheet
- Calibration certificate
- R&S RT-ZA25 power rail browser kit
- Documented calibration values (if ordered)

1.2.1 Inspecting the Contents

- Inspect the package for damage.
Keep a damaged package and the cushioning material until the contents have been checked for completeness and the device has been tested.
If the packaging material shows any signs of stress, notify the carrier as well as your Rohde & Schwarz service center. Keep the package and cushioning material for inspection.
- Inspect the probe.
If there is any damage or defect, or if the R&S RT-ZPR20/40 power-rail probe does not operate properly, notify your Rohde & Schwarz service center.
- Inspect the accessories.
If the contents are incomplete or damaged, notify your Rohde & Schwarz service center.
Accessories supplied with the device are listed in [Chapter 1.3.2, "Supplied Accessories"](#), on page 7.

1.3 Description of the Probe

The probe consists of the active probe box with an Rohde & Schwarz probe interface to connect to the oscilloscope, and an SMA connector to connect to the DUT. Use the SMA interface to connect the supplied solder-in and extension cables or the power rail browser.

All available accessories are documented in the following chapters.

1.3.1 Probe Box

The probe box connects the probe to 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 for simultaneously transmitting analog signals and digital data. All the analog voltages required by the probe are generated in the probe box. This approach ensures you can operate future probes on any base unit that features a Rohde & Schwarz probe interface. The probe box provides an SMA connector to screw on different accessories suitable for various measurement tasks.



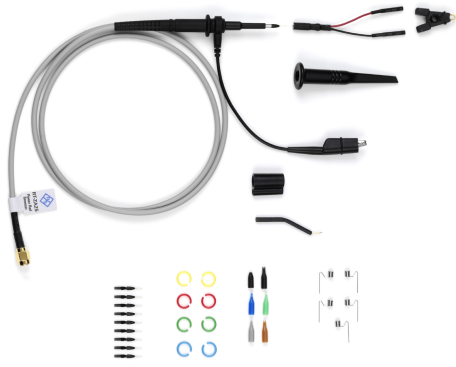


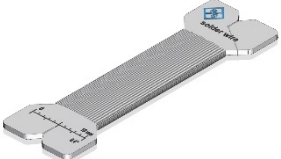
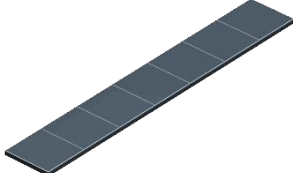
- (1) Rohde & Schwarz probe interface with 7 mm (276 mil) coaxial connector and 6 pogo pins
- (2) Release knob
- (3) SMA connector

1.3.2 Supplied Accessories

Before you can use the probe for measurements, you must connect one of the accessories to the probe box SMA connector.

[Table 1-1](#) shows the accessories that are supplied with the R&S RT-ZPR20/40 power-rail probe.

Table 1-1: Supplied accessories

Item	Quantity	Description
	1	R&S RT-ZA25 power rail browser kit includes: <ul style="list-style-type: none"> • Power rail browser • Ground lead with alligator clip • Ground spring (5) • IC cap (5) • Tip insulating cap • Tip (5) • Spring tip (5) • Sprung hook • Micro SMD clip • Dual adapter • Flexible ground lead with adapter • Coding rings (8) • Short tube • Long tube
	3	R&S RT-ZA26 pigtail cable, 15 cm
	1	SMA extension cable, 1 m (R&S RT-ZPR20) SMA extension cable low loss, 1 m (R&S RT-ZPR40)
	1	Solder wire, lead free, 5 m
	7	Adhesive pads

For a list of spare parts, see [Chapter 5.6, "Spare Parts"](#), on page 26.



1.3.3 Optional Accessories

If the delivered accessories do not meet individual customer requirements, Rohde & Schwarz offers different accessory sets for sale.

You can order the optional accessories from Rohde & Schwarz. The order numbers are listed in the data sheet.

Table 1-2: Optional accessories

Item	Description
	<p>R&S RT-ZA9 probe box to N / USB adapter</p> <p>The adapter connects the R&S RT-ZPR20/40 power-rail 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 base units (see "Supported oscilloscopes" on page 12).</p>
	<p>R&S RT-ZA10 SMA adapter</p> <p>SMA adapter with SMA (female) jack to BNC (male) plug.</p>

Item	Description
	<p>R&S RT-ZAP3 probe positioner</p> <p>Use the R&S RT-ZAP3 probe positioner to position and stabilize your probe.</p>
	<p>R&S RT-ZF20 power deskew fixture</p> <p>The R&S RT-ZF20 power deskew fixture is a tool to align the time delay (skew) of any combination of Rohde & Schwarz voltage and current probes. The fixture can be used with any oscilloscope.</p>

1.3.4 Service Accessories

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

Table 1-3: Service accessories

Item	Description
R&S RT-ZK1	<p>The service kit is used to calibrate the R&S RT-ZPR20/40, to make performance tests and for servicing. The service kit includes all adapters and accessories to connect the probe to the required measuring instruments.</p>
R&S RT-ZPR20/40 Service Manual	<p>The Service Manual contains a detailed description of the performance test to verify the probe specifications, and other important service procedures.</p>

2 Putting into Operation

The R&S RT-ZPR20/40 power-rail probe has been designed to withstand a moderate amount of physical and electrical stress. Treat the probe with care. It can be damaged if excessive force is applied to it.

NOTICE

Risk of device damage due to physical stress

Prevent the probe from receiving mechanical shock.

Always handle the probe by the probe box.

Avoid putting excessive strain on the probe cable or exposing it to sharp bends.

Store the probe in a shock-resistant case such as the foam-lined shipping case that came with the probe.

Avoid spilling liquids on the probe.

NOTICE

Risk of device damage due to excess power

Voltages above the specified limits of the R&S RT-ZPR20/40 power-rail probe may damage the probe. Do not exceed the specified limits.

NOTICE

Risk of damaging the device due to electrostatic discharge (ESD)

The probe box is an ESD-sensitive device which you should treat with care. Before using or handling the probe or accessories, always wear a grounded ESD wrist strap. Ensure that cables are discharged before being connected. Electrostatic discharge can quickly and imperceptibly damage or destroy high-performance probes, resulting in costly repairs.



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

2.1 Installation

This section introduces the use of the R&S RT-ZPR20/40 power-rail probe, which has been designed for use with Rohde & Schwarz oscilloscopes.



Supported oscilloscopes

A complete list of supported Rohde & Schwarz oscilloscopes is available in the Data Sheet.

All settings of the base unit described in this section refer to the R&S RTO2000 and R&S RTE oscilloscopes. These base units support the full software functionality of the R&S RT-ZPR20/40 probes.

If any other oscilloscope is used, differences in settings and menu navigation may be possible.

2.1.1 Connecting the Probe to the Oscilloscope

The R&S RT-ZPR20/40 power-rail probe has been designed for use with R&S RTx oscilloscopes.

NOTICE

Risk of damaging the device

To avoid damage to the device, take the following precautions:

- Only connect the extension cable to the probe box if the probe box is connected to the oscilloscope channel (this ensures that the probe is grounded)
- Always disconnect the accessories from the probe box before unsoldering or disconnecting it, moving it to a new position and resoldering or reconnecting it.
- Do not wiggle the probe cables up and down or twist them.

1. If your DUT is floating and not grounded, connect the DUT ground to the oscilloscope ground before connecting the probe to your DUT.
2. Connect the probe box (1) to the Rohde & Schwarz probe interface of the base unit (2). The probe snaps in when connected properly to the port.

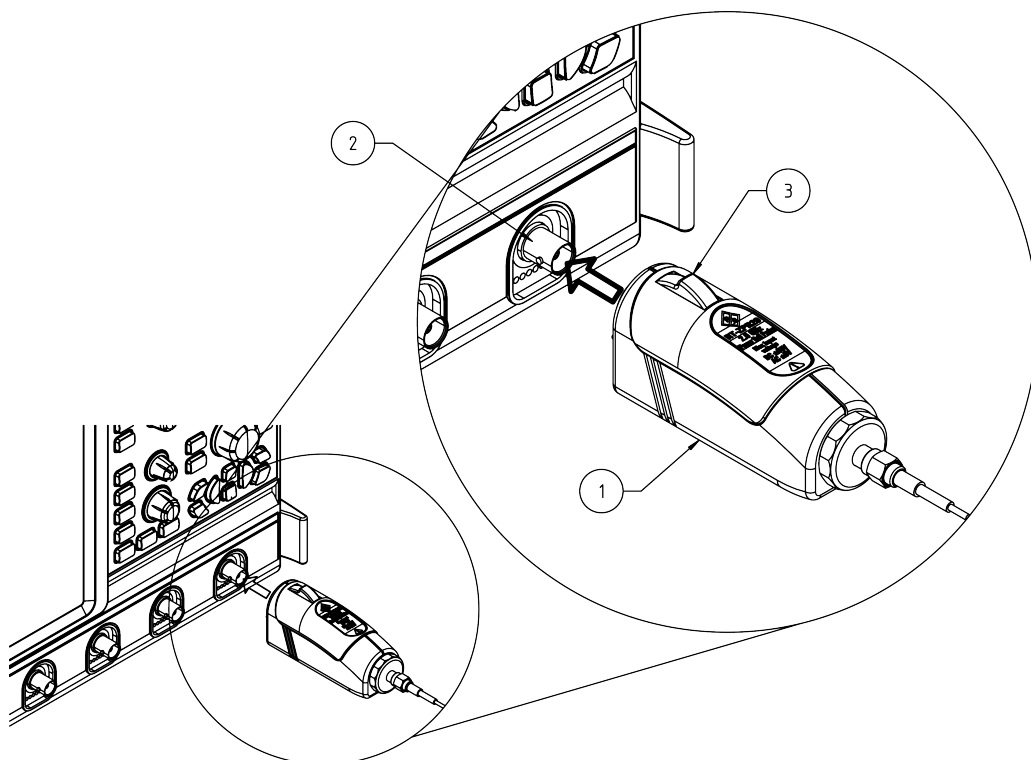


Figure 2-1: Connecting the probe to the Rohde & Schwarz oscilloscope

- ▶ To disconnect, press the release button (3) and pull the probe box away from the front panel of the base unit.

2.1.2 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 oscilloscope settings for attenuation and offset are automatically adjusted.

As soon as the probe is connected to the oscilloscope and the settings are adjusted, the waveform is shown for the channel to which the probe is connected.

1. On the "Vertical" menu, select "Probe Setup".
2. On the left side of the "Setup" tab, select the channel to which the probe is connected.
The complete probe information is shown on the "Probe Attributes" tab.

2.2 Offset Compensation and Dynamic Range

The dynamic range for the R&S RT-ZPR20/40 power rail probe determines the maximum voltage swing that may occur between the input terminal and ground.

The dynamic range of the R&S RT-ZPR20/40 is ± 0.850 V. If this range is exceeded, an unwanted signal clipping may occur.

The R&S RT-ZPR20/40 probe features a very comprehensive offset compensation function. The compensation of DC components directly inside the probe box even in front of the active probe amplifier is possible with an extremely wide compensation range of ± 60 V. This function is useful when measuring AC signals with a high superimposed DC component.

- Adjust the offset at the oscilloscope. You can use the vertical POSITION knob, or the setting in the "Probe Setup".
For details, refer to the user manual of your oscilloscope.

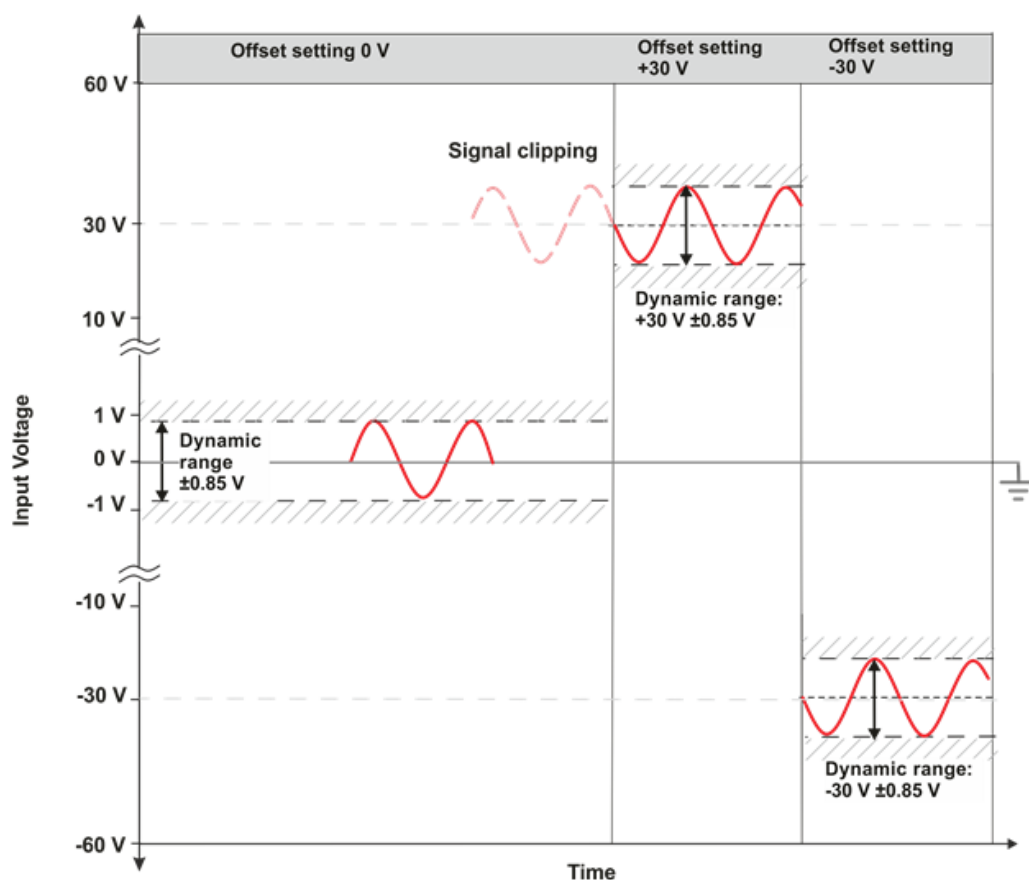


Figure 2-2: Offset compensation voltage and dynamic range

2.3 AC Coupling Mode

The R&S RT-ZPR20/40 power-rail probe features an internal AC coupling mode with a low frequency cutoff at 10 Hz to block DC components of the input signal. The AC coupling is set inside the probe, the full bandwidth of the probe remains.

To set the AC coupling mode using the probe menu

1. On the "Vertical" menu, select "Probe Setup".
2. Select the channel and tap "AC coupling".

2.4 R&S ProbeMeter

The integrated voltmeter can measure DC voltages with very high precision compared to the oscilloscope's DC accuracy. The DC measurement is performed continuously and in parallel to the time domain measurement of the oscilloscope. The measured DC voltage is immediately digitized at the probe tip, allowing for high-precision measurements.

To activate the R&S ProbeMeter:

- ▶ "Vertical" menu > "Probe Setup" > "Ch" tab > "ProbeMeter" = 'on'

After the R&S ProbeMeter has been activated, the measured values are displayed on the screen of the oscilloscope.

Advantages of the R&S ProbeMeter:

- Allows you to check DC voltages with different levels without having to adjust the measurement range of the oscilloscope
- Provides a simple means of setting the probe offset, oscilloscope's trigger level and vertical scaling if a waveform is not visible
- Independent of oscilloscope settings for offset, position, vertical scale, horizontal scale, and trigger.
- True DC measurement (integration time > 100 ms), not mathematical average of displayed waveform.
- Measurement range ± 60 V
- High measurement accuracy and low temperature sensitivity, typically 0.1% of reading over the entire temperature range.

3 Connecting the Probe to the DUT

This chapter describes how to connect the probe to the DUT using different accessories supplied for the R&S RT-ZPR20/40 probe. The various accessories are described and their use is explained.

The recommended configurations are designed to give the best probe performance for different probing situations. Thus, you can perform the measurements you need quickly and 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.

NOTICE

Risk of damaging the solder joint due to excessive mechanical stress

Some solder-in accessories are very fine and sensitive. Stabilize the probe using appropriate means (e.g. adhesive pads, probe positioner) in order to protect the solder joint from excessive mechanical stress.

Before soldering or unsoldering the pigtail cable disconnect the pigtail cable from the probe box.

NOTICE

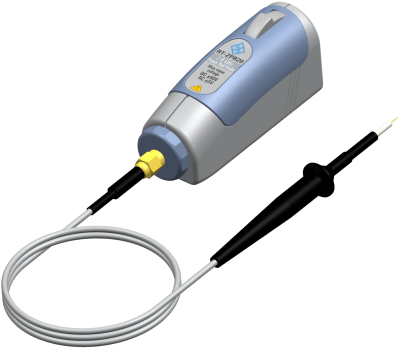
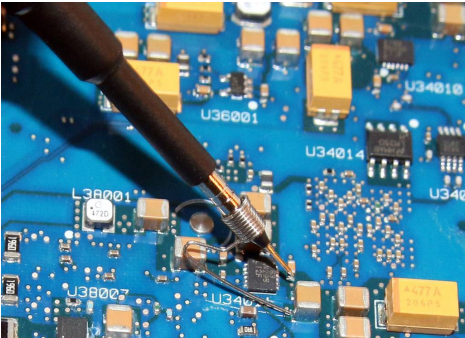

Risk of damaging the probe box due to excess heat

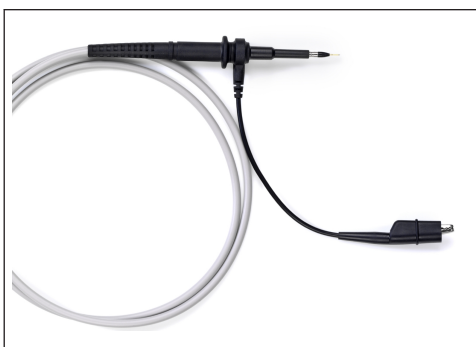
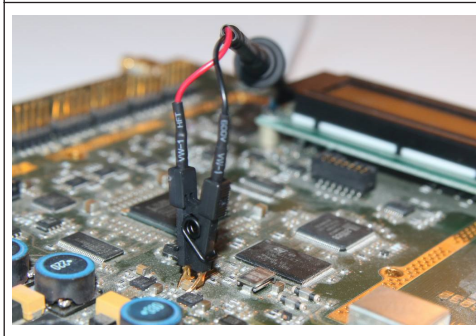
The R&S RT-ZPR20/40 probe box has a specified operating temperature range from 0 °C to 40 °C, whereas the pigtail and extension cables can withstand wider temperature ranges (see [Chapter 3.2, "R&S RT-ZA26 Pigtail Cable"](#), on page 19).

Do not subject the R&S RT-ZPR20/40 probe box to temperatures outside of its operating range.

3.1 R&S RT-ZA25 Power Rail Browser Kit

The R&S RT-ZA25 power rail browser kit allows handheld probing with maximum convenience at the DUT and is sufficient up to 350 MHz bandwidth.

 The image shows the R&S RT-ZA25 power rail browser kit. It consists of a blue and grey plastic housing with a yellow SMA connector on the left side. A black probe with a gold tip is attached to the right side. A coiled grey cable is connected to the SMA connector.	<p>Connect the R&S RT-ZA25 power rail browser to the SMA interface of the R&S RT-ZPR20/40 probe box. You can use the browser in the same way as conventional passive probes.</p> <p>Bandwidth: >350 MHz</p> <p>Length: 1 m</p> <p>Temperature range: 0 °C to +40 °C</p>
 A close-up photograph of the probe tip in contact with a blue printed circuit board (PCB). The probe tip is a spring-loaded or rigid signal tip. The PCB has various components and labels, including U36001, U34010, U34014, L38001, U38007, and U34014.	<p>For highest bandwidth and signal integrity, use the ground spring and spring loaded or rigid signal tips.</p>
 A photograph of the flexible ground lead with adapter. It features a coiled grey cable and a black plastic adapter with two gold SMA connectors.	<p>For convenient probing and medium bandwidth, use the flexible ground lead with adapter.</p>

	<p>Use the long distance ground lead with alligator clip to contact far away ground points. Due to the larger loop inductance, bandwidth is decreased.</p>
	<p>Use the Dual Adapter to plug onto pin strips or to connect the micro SMD clip. Use the micro SMD clip to connect surface mount devices, e.g. 0805, 0402 capacitors.</p>

⚠ WARNING

Risk of fatal injuries due to high voltages

Although the R&S RT-ZA25 has a similar appearance to standard high impedance passive probe, it is not equipped with a protective impedance and is therefore not suitable for measuring dangerously high voltages!

Never use the R&S RT-ZA25 to measure voltages beyond the maximum rating of ± 60 V DC, 30 V AC (RMS), or ± 42 V AC (peak).

Measuring higher voltages with this probe may lead to fatal injuries.

⚠ CAUTION

Risk of injuries

The included browser pins are exceptionally sharp and must be handled with extreme care. To prevent injuries, always use tweezers when inserting or removing pins.

NOTICE

Risk of damage due to excess force



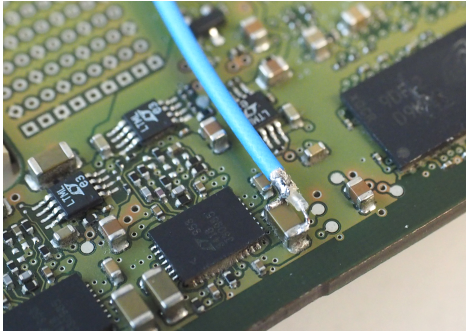
To avoid damaging the browser's pins, do not apply a side load to the browser.

Do not apply too much force when browsing. The weight of the probe in your hand should be sufficient.

Always remove the browser from the DUT before disconnecting the probe from the oscilloscope.

3.2 R&S RT-ZA26 Pigtail Cable

The R&S RT-ZA26 pigtail cable is a semi-permanent solder-in connection that supports the full bandwidth of the probe.

	<p>The R&S RT-ZA26 pigtail cable is well suited for creating solid contact with test points that are hard to reach (e.g. IC pins, SMT parts).</p> <p>Bandwidth:</p> <ul style="list-style-type: none"> • >2 GHz (R&S RT-ZPR20) • >3.5 GHz (R&S RT-ZPR40) <p>Length: 15 cm (1.15 m with SMA extension cable)</p> <p>Temperature range: -55 °C to +125 °C</p>
	<p>Do not connect the R&S RT-ZA26 pigtail cable directly to the probe box.</p> <p>Connect the R&S RT-ZA26 pigtail cable to the SMA extension cable. Connect the other end of the SMA cable to the R&S RT-ZPR20/40 probe box.</p>
	<p>For measurements, solder the center conductor to the signal and the outer shield conductor to the ground.</p>

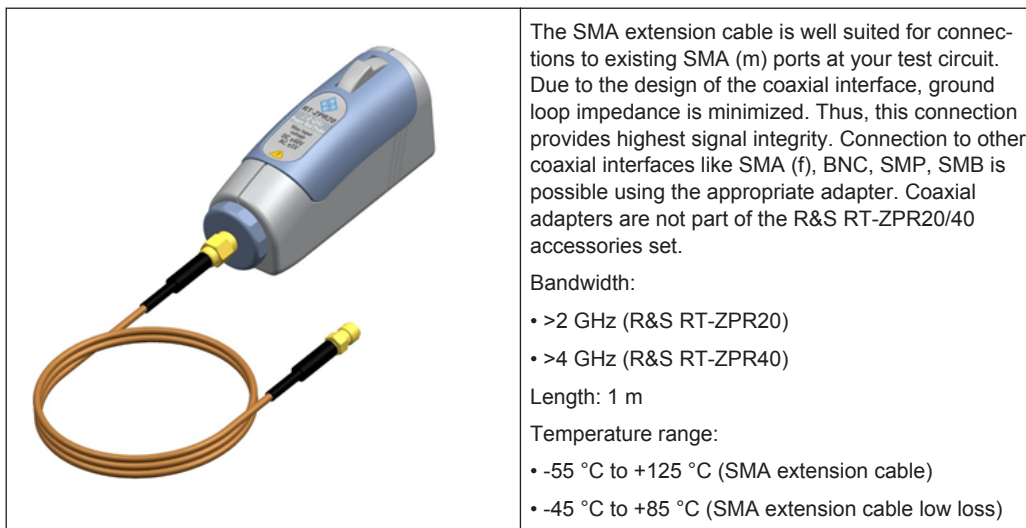
NOTICE**Risk of damaging the probe due to excess heat**

When using the R&S RT-ZA26 pigtail cable, do not subject the R&S RT-ZPR20/40 probe box to temperatures outside the valid range (see "[Risk of damaging the probe box due to excess heat](#)" on page 16). Excess heat may damage the probe.

Before soldering or unsoldering the pigtail cable always disconnect the cable from the probe box.

3.3 SMA Extension Cable

The supplied SMA extension cable is a semi-permanent screw connection that supports the full bandwidth of the probe.



4 Measurement Principles

The R&S RT-ZPR20/40 power-rail probe provides an electrical connection between the DUT and the oscilloscope. The probe transfers the voltage of the electrical signal tapped off the DUT to the oscilloscope, where it is displayed graphically.

Although a probe has a wide variety of specifications, these specifications can be grouped into two classes of basic requirements:

- High signal integrity of the transferred signal: With an ideal probe, the output signal that is transferred to the base unit would be identical to the input signal between the probe tips. Furthermore, signal integrity would be extremely high. Every real probe, however, transfers the input signal in altered form. A good probe causes only minimum alterations. How the probe can fulfill this requirement is mainly determined by its bandwidth.
- Low loading of the input signal: Every probe is a load for the signal to be measured. This means that the signal to be measured changes as soon as the probe is connected. A good probe should cause only a minimum change to the signal, so that the function of the DUT is not adversely affected. How well the probe can fulfill this requirement is mainly determined by its input impedance.

The parameters of a probe are usually specified for a minimized connection between the probe and the DUT. With longer connections, the connection inductance has a significant effect on the measurement. The high-frequency behavior of the power rail probe is typically characterized with $0\ \Omega$ source impedance. [Figure 4-1](#) shows the R&S RT-ZPR20/40 power-rail probe that is connected to the DUT.

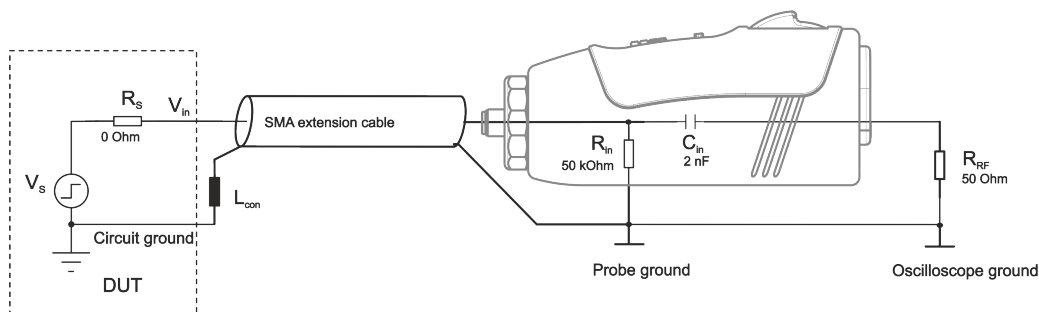


Figure 4-1: Equivalent circuit model of the R&S RT-ZPR20/40 probe

Abbreviation	Description
V_s	Voltage at the test point without probe connected
V_{in}	Voltage at the test point with probe connected, corresponds to the input voltage of the probe
R_s	Source impedance of the DUT
R_{in}	DC input resistance of the probe
R_{RF}	RF input resistance

Abbreviation	Description
C_{in}	Coupling capacitance
L_{con}	Parasitic inductance of the ground connection

4.1 Step Response

Figure 4-2 shows the step response of the R&S RT-ZPR20/40 with an ideal input step.

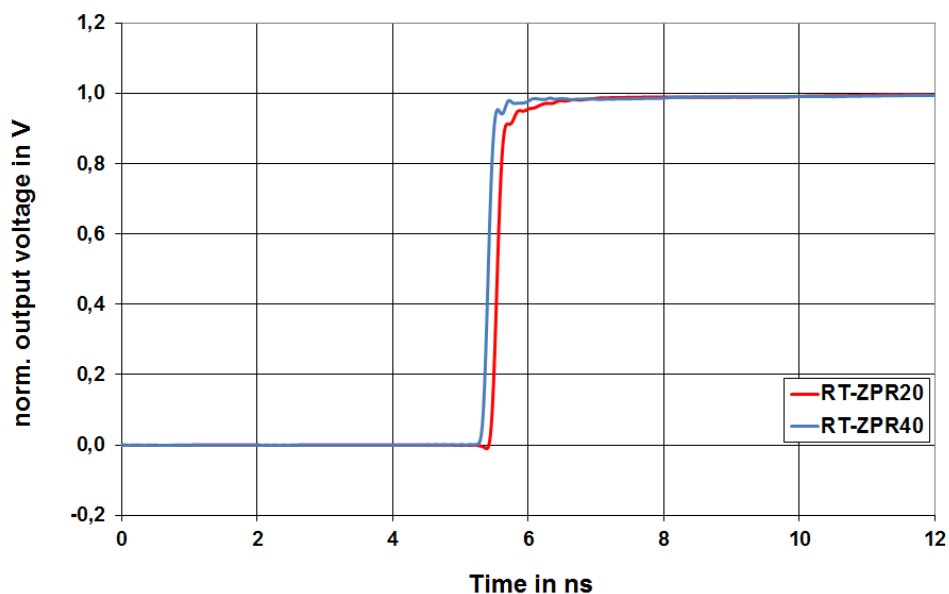


Figure 4-2: Example of the step response of the R&S RT-ZPR20/40 probe with the supplied SMA extension cable

4.2 Frequency Response

The R&S RT-ZPR20/40 probe is a dedicated power rail probe, designed for measurements at low impedance voltage sources such as DC power supplies with an output impedance < 1 Ohm.

A DUT with an output impedance (R_S) higher than 1 Ohm leads to a mismatch between DC gain and AC gain. The mismatch causes a step at 1 MHz and thus non-flat frequency response.

In the time domain, a non-ideal frequency response occurs as a step which only gradually approaches the final DC value.

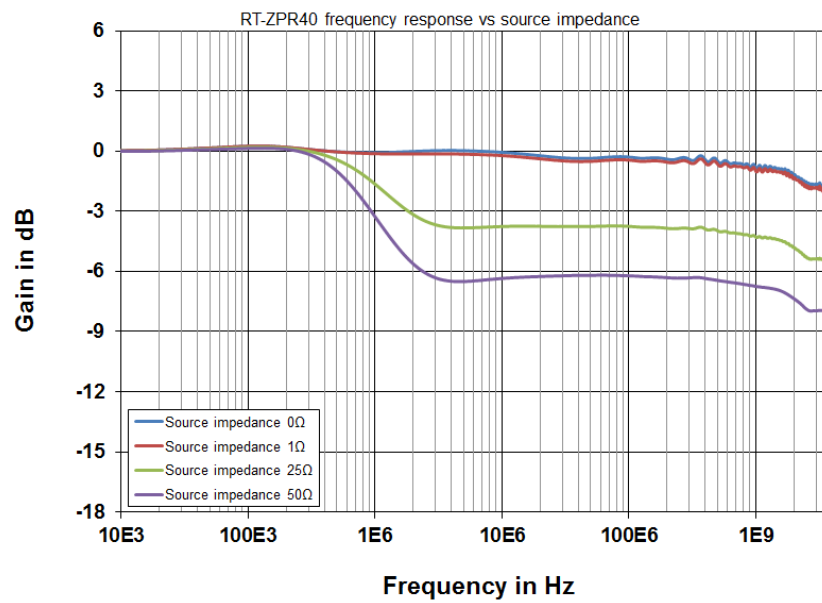


Figure 4-3: Example of the frequency response of the R&S RT-ZPR40 probe with SMA extension cable for different source impedances

4.3 Input Impedance

The input signal loading caused by the probe is determined by its input impedance Z_{in} . Figure 4-1 illustrates an equivalent circuit model. The resulting input impedance versus frequency is indicated in Figure 4-4.

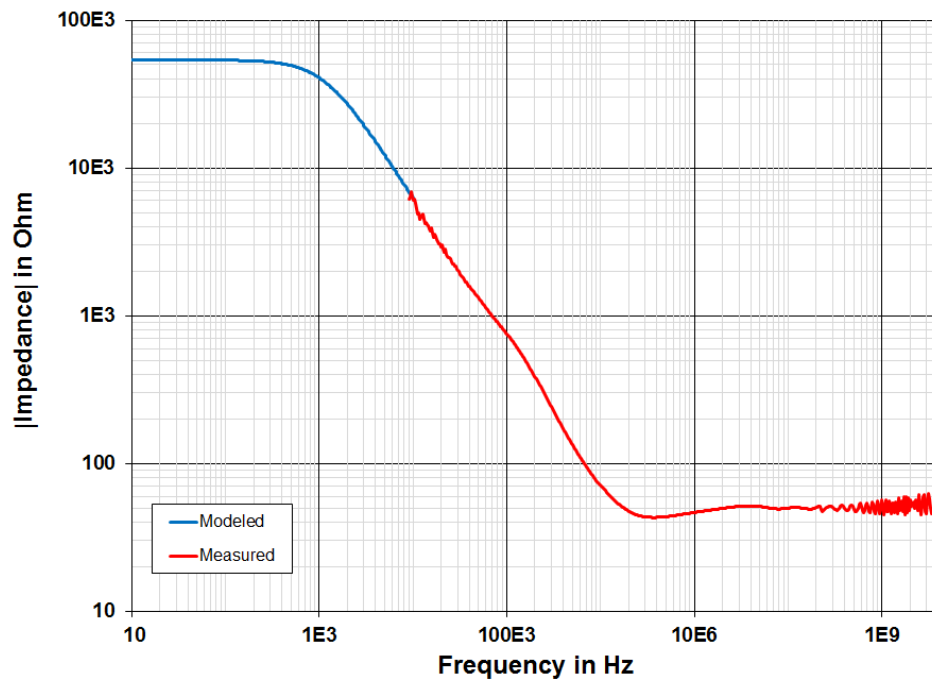


Figure 4-4: Example of the input impedance of the R&S RT-ZPR20/40 probe with SMA extension cable as a function of frequency

5 Maintenance and Service

5.1 Service Strategy

Like all Rohde & Schwarz devices, Rohde & Schwarz probes are of high quality and require only minimum service and repair. However, if the probe needs to be serviced, contact your Rohde & Schwarz service center. Return a defective probe to the Rohde & Schwarz service center for diagnosis and exchange.

You can return the R&S RT-ZPR20/40 power-rail probe for calibration. The service personnel will perform the required tests.

5.2 Returning the Probe for Servicing

Use the original packaging to return your Rohde & Schwarz probe 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 probe from damage and moisture (e.g. with bubble wrap).
3. Use some kind of protective material (e.g. crumpled newspaper) to stabilize the probe inside the box.
4. Seal the box with tape.
5. Address the package to your nearest Rohde & Schwarz service center.

5.3 Cleaning

NOTICE**Device damage caused by cleaning agents**

Cleaning agents contain substances that may damage the device; for example, solvent may damage the labeling or plastic parts.

Never use cleaning agents such as solvents (thinners, acetone, etc.), acids, bases or other substances

To clean the exterior of the probe, use a soft cloth moistened with either distilled water or isopropyl alcohol. Before using the probe again, make sure to dry it completely.

5.4 Calibration Interval

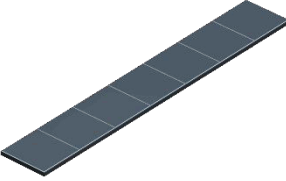


The recommended calibration interval for R&S RT-ZPR20/40 power-rail probe is two years. For servicing, send the probe to your nearest Rohde & Schwarz service center (see [Chapter 5.2, "Returning the Probe for Servicing"](#), on page 25).

5.5 Discarding the Probe

Handle and dispose the probe in accordance with local regulations.

5.6 Spare Parts

The following accessories can be ordered at the Rohde & Schwarz service center. Use the order numbers provided in the following table.

Pos	Item	Description	Part Number
1		Adhesive pads	1800.4268.00
2		Solder wire, lead free, 5 m	1800.4097.00
3		SMA extension cable, 1 m For R&S RT-ZPR20	1800.5241.00

Pos	Item	Description	Part Number
4		SMA extension cable low loss, 1 m For R&S RT-ZPR40	1337.9081.00
Spare parts for the R&S RT-ZA25 power rail browser kit			
5		Ground lead with alligator clip	1800.5335.00
6		Dual adapter	1800.5341.00
7		Micro SMD clip	1800.5358.00
8		Flexible ground lead with adapter	1800.5364.00

The following accessories can be ordered from Rohde & Schwarz. The order numbers are listed in the data sheet.

- R&S RT-ZA25 power rail browser kit
- R&S RT-ZA26 pigtail cable, 15 cm