

R&S®RT-ZD10/20/30/40

Active Differential Probe

Service Manual



1410.5270.02 – 02



ROHDE & SCHWARZ

Test & Measurement

Service Manual

The Service Manual describes the following R&S®RT-ZD10/20/30/40 models and options:

- R&S®RT-ZD10 (1410.4715.02)
- R&S®RT-ZD20 (1410.4409.02)
- R&S®RT-ZD30 (1410.4609.02)
- R&S®RT-ZD40 (1410.5205.02)

The firmware of the instrument makes use of several valuable open source software packages. the most important of them are listed below, together with their corresponding open source license.

Package	Link	License
Atmel	http://www.atmel.com/dyn/products/tools_card.asp?tool_id=4092	
Boost	http://www.boost.org	1.0

Rohde&Schwarz would like to thank the open source community for their valuable contribution to embedded computing.

© 2013 Rohde & Schwarz GmbH & Co. KG
81671 Munich, Germany

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 the owners.

The following abbreviations are used throughout this manual:

R&S®RT-ZD10/20/30/40 is abbreviated as R&S RT-ZD10/20/30/40.

R&S®ProbeMeter is abbreviated as R&S ProbeMeter.

Table of Contents

Safety Instructions
 Instructions for Electrostatic Discharge Protection
 Procedure in Case of Service and Ordering of Spare Parts

1	Performance Test.....	8
1.1	Test Equipment	8
1.2	Test Instructions	10
1.3	Preparations	11
1.3.1	Configuring the Probe Box Adapter	11
1.3.2	Reading Back the Correction Parameters of the Probe	13
1.3.3	Setting the Probe Offset Compensation Voltage to Zero	14
1.3.4	DC Voltage Source Calibration	15
1.4	Probe Adaptation	16
1.4.1	Insertion and adjusting the adapters.....	16
1.4.2	Probe Adaptation for Rise Time Measurements	17
1.4.3	Probe Adaptation for DC Measurements	18
1.5	Rise time	19
1.6	DC Characteristics	24
1.6.1	Attenuation Error.....	24
1.6.2	Zero Error.....	28
1.6.3	Common mode rejection, DC	29
1.7	R&S ProbeMeter	32
1.7.1	Measurement error, differential mode	32
1.7.2	Measurement error, common mode & common mode rejection	33
1.8	R&S RT-ZD20/30/40 Performance Test Report.....	35
2	Adjustment	38
3	Repair.....	39
3.1	Functional Description	39
3.1.1	Probe Head	39
3.1.2	Probe Box	40
3.2	Service Tools	41

3.2.1	R&S RT-ZK2 Service Kit (1410.5305.02)	41
3.2.2	R&S RT-Z Device Manager Software	42
3.3	Troubleshooting	46
3.3.1	Functional Check	46
3.3.2	Selftest	46
3.3.3	Micro Button	47
3.3.4	Replacing the pogo pins	47
4	Software Update / Installing Options.....	51
4.1	Installing a new R&S RT-ZD20/30/40 Firmware.....	51
5	Documents	54
5.1	Spare Parts RT-ZD.....	54
5.2	Accessories RT-ZD20/30	55
5.3	Accessory List RT-ZD20/30.....	55
5.4	Accessories RT-ZD40	57
5.5	Accessory List RT-ZD40.....	57

Index

device manager	42	probe box adapter.....	11
installation	43	ProbeMeter.....	32, 33
software update	51	replacement.....	39
start up	45	probe box	40
performance test.....	8	test	
attenuation error	24	micro button.....	47
instructions	10	self test	46
preparation	11	test equipment	8
report	35	tools.....	41
step response	19	device manager	42
zero error	28	service kit	41

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.

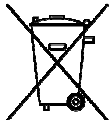
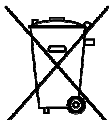
Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety 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 supply voltage
	Caution when handling heavy equipment	⏻	Standby indication
	Danger of electric shock	— — —	Direct current (DC)

Basic Safety Instructions

Symbol	Meaning	Symbol	Meaning
	Warning! Hot surface		Alternating current (AC)
	Protective conductor terminal		Direct/alternating current (DC/AC)
	Ground		Device fully protected by double (reinforced) insulation
	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 severity 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 AC 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 AC supply network, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the AC supply network. 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 IEC60950-1/EN60950-1 or IEC61010-1/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

2. 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.

1. Cells must not be taken apart or crushed.
2. 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.
3. 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.
4. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
5. 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.
6. 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.
7. 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.

Transport

1. 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.
2. 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.
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.

Instrucciones de seguridad elementales

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.

Instrucciones de seguridad elementales

¡Es imprescindible leer y cumplir las siguientes instrucciones e informaciones de seguridad!

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estándares de seguridad y de ofrecer a nuestros clientes el máximo grado de seguridad. Nuestros productos y todos los equipos adicionales son siempre fabricados y examinados según las normas de seguridad vigentes. Nuestro sistema de garantía de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el certificado de conformidad de la UE y ha salido de nuestra planta en estado impecable según los estándares técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las indicaciones, informaciones de seguridad y notas de alerta. El grupo de empresas Rohde & Schwarz está siempre a su disposición en caso de que tengan preguntas referentes a estas informaciones de seguridad.

Además queda en la responsabilidad del usuario utilizar el producto en la forma debida. Este producto está destinado exclusivamente al uso en la industria y el laboratorio o, si ha sido expresamente autorizado, para aplicaciones de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda sufrir daño. El uso del producto fuera de sus fines definidos o sin tener en cuenta las instrucciones del fabricante queda en la responsabilidad del usuario. El fabricante no se hace en ninguna forma responsable de consecuencias a causa del mal uso del producto.

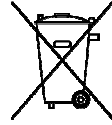
Instrucciones de seguridad elementales

Se parte del uso correcto del producto para los fines definidos si el producto es utilizado conforme a las indicaciones de la correspondiente documentación del producto y dentro del margen de rendimiento definido (ver hoja de datos, documentación, informaciones de seguridad que siguen). El uso del producto hace necesarios conocimientos técnicos y ciertos conocimientos del idioma inglés. Por eso se debe tener en cuenta que el producto solo pueda ser operado por personal especializado o personas instruidas en profundidad con las capacidades correspondientes. Si fuera necesaria indumentaria de seguridad para el uso de productos de Rohde & Schwarz, encontraría la información debida en la documentación del producto en el capítulo correspondiente. Guarde bien las informaciones de seguridad elementales, así como la documentación del producto, y entréguelas a usuarios posteriores.

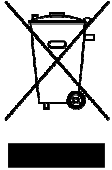
Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto. Deberán tenerse en cuenta todas las demás informaciones de seguridad, como p. ej. las referentes a la protección de personas, que encontrarán en el capítulo correspondiente de la documentación del producto y que también son de obligado cumplimiento. En las presentes informaciones de seguridad se recogen todos los objetos que distribuye el grupo de empresas Rohde & Schwarz bajo la denominación de "producto", entre ellos también aparatos, instalaciones así como toda clase de accesorios. Los datos específicos del producto figuran en la hoja de datos y en la documentación del producto.

Señalización de seguridad de los productos

Las siguientes señales de seguridad se utilizan en los productos para advertir sobre riesgos y peligros.

Símbolo	Significado	Símbolo	Significado
	Aviso: punto de peligro general Observar la documentación del producto		Tensión de alimentación de PUESTA EN MARCHA / PARADA
	Atención en el manejo de dispositivos de peso elevado		Indicación de estado de espera (standby)
	Peligro de choque eléctrico		Corriente continua (DC)
	Advertencia: superficie caliente		Corriente alterna (AC)
	Conexión a conductor de protección		Corriente continua / Corriente alterna (DC/AC)
	Conexión a tierra		El aparato está protegido en su totalidad por un aislamiento doble (reforzado)
	Conexión a masa		Distintivo de la UE para baterías y acumuladores Más información en la sección "Eliminación/protección del medio ambiente", punto 1.

Instrucciones de seguridad elementales

Símbolo	Significado	Símbolo	Significado
	Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)		Distintivo de la UE para la eliminación por separado de dispositivos eléctricos y electrónicos Más información en la sección "Eliminación/protección del medio ambiente", punto 2.
	Advertencia: rayo láser Más información en la sección "Funcionamiento", punto 7.		

Palabras de señal y su significado

En la documentación del producto se utilizan las siguientes palabras de señal con el fin de advertir contra riesgos y peligros.



Indica una situación de peligro que, si no se evita, causa lesiones graves o incluso la muerte.



Indica una situación de peligro que, si no se evita, puede causar lesiones graves o incluso la muerte.



Indica una situación de peligro que, si no se evita, puede causar lesiones leves o moderadas.



Indica información que se considera importante, pero no en relación con situaciones de peligro; p. ej., avisos sobre posibles daños materiales.

En la documentación del producto se emplea de forma sinónima el término CUIDADO.

Las palabras de señal corresponden a la definición habitual para aplicaciones civiles en el área económica europea. Pueden existir definiciones diferentes a esta definición en otras áreas económicas o en aplicaciones militares. Por eso se deberá tener en cuenta que las palabras de señal aquí descritas sean utilizadas siempre solamente en combinación con la correspondiente documentación del producto y solamente en combinación con el producto correspondiente. La utilización de las palabras de señal en combinación con productos o documentaciones que no les correspondan puede llevar a interpretaciones equivocadas y tener por consecuencia daños en personas u objetos.

Estados operativos y posiciones de funcionamiento

El producto solamente debe ser utilizado según lo indicado por el fabricante respecto a los estados operativos y posiciones de funcionamiento sin que se obstruya la ventilación. Si no se siguen las indicaciones del fabricante, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte. En todos los trabajos deberán ser tenidas en cuenta las normas nacionales y locales de seguridad del trabajo y de prevención de accidentes.

Instrucciones de seguridad elementales

1. Si no se convino de otra manera, es para los productos Rohde & Schwarz válido lo que sigue: como posición de funcionamiento se define por principio la posición con el suelo de la caja para abajo, modo de protección IP 2X, uso solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4500 m sobre el nivel del mar. Se aplicará una tolerancia de $\pm 10\%$ sobre el voltaje nominal y de $\pm 5\%$ sobre la frecuencia nominal. Categoría de sobrecarga eléctrica 2, índice de suciedad 2.
2. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptos para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (p. ej. paredes y estantes). Si se realiza la instalación de modo distinto al indicado en la documentación del producto, se pueden causar lesiones o, en determinadas circunstancias, incluso la muerte.
3. No ponga el producto sobre aparatos que generen calor (p. ej. radiadores o calefactores). La temperatura ambiente no debe superar la temperatura máxima especificada en la documentación del producto o en la hoja de datos. En caso de sobrecalentamiento del producto, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

Seguridad eléctrica

Si no se siguen (o se siguen de modo insuficiente) las indicaciones del fabricante en cuanto a seguridad eléctrica, pueden producirse choques eléctricos, incendios y/o lesiones graves con posible consecuencia de muerte.

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.
4. Si el producto no está equipado con un interruptor para desconectarlo de la red, o bien si el interruptor existente no resulta apropiado para la desconexión de la red, el enchufe del cable de conexión se deberá considerar como un dispositivo de desconexión. El dispositivo de desconexión se debe poder alcanzar fácilmente y debe estar siempre bien accesible. Si, p. ej., el enchufe de conexión a la red es el dispositivo de desconexión, la longitud del cable de conexión no debe superar 3 m). Los interruptores selectores o electrónicos no son aptos para el corte de la red eléctrica. Si se integran productos sin interruptor en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.

Instrucciones de seguridad elementales

6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión $U_{\text{eff}} > 30 \text{ V}$ se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.
12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.
13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.
17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados —los llamados alérgenos (p. ej. el níquel)—. Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación/protección del medio ambiente", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).
8. Clases de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
 - Aparato de clase A:
Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.
Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos pueden causar perturbaciones radioeléctricas en entornos residenciales debido a posibles perturbaciones guiadas o radiadas. En este caso, se le podrá solicitar al operador que tome las medidas adecuadas para eliminar estas perturbaciones.
 - Aparato de clase B:
Aparato adecuado para su uso en entornos residenciales, así como en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.

Instrucciones de seguridad elementales

Reparación y mantenimiento

1. El producto solamente debe ser abierto por personal especializado con autorización para ello. Antes de manipular el producto o abrirlo, es obligatorio desconectarlo de la tensión de alimentación, para evitar toda posibilidad de choque eléctrico.
2. El ajuste, el cambio de partes, el mantenimiento y la reparación deberán ser efectuadas solamente por electricistas autorizados por Rohde & Schwarz. Si se reponen partes con importancia para los aspectos de seguridad (p. ej. el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Después de cada cambio de partes relevantes para la seguridad deberá realizarse un control de seguridad (control a primera vista, control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

Si no se siguen (o se siguen de modo insuficiente) las indicaciones en cuanto a las baterías y acumuladores o celdas, pueden producirse explosiones, incendios y/o lesiones graves con posible consecuencia de muerte. El manejo de baterías y acumuladores con electrolitos alcalinos (p. ej. celdas de litio) debe seguir el estándar EN 62133.

1. No deben desmontarse, abrirse ni triturarse las celdas.
2. Las celdas o baterías no deben someterse a calor ni fuego. Debe evitarse el almacenamiento a la luz directa del sol. Las celdas y baterías deben mantenerse limpias y secas. Limpiar las conexiones sucias con un paño seco y limpio.
3. Las celdas o baterías no deben cortocircuitarse. Es peligroso almacenar las celdas o baterías en estuches o cajones en cuyo interior puedan cortocircuitarse por contacto recíproco o por contacto con otros materiales conductores. No deben extraerse las celdas o baterías de sus embalajes originales hasta el momento en que vayan a utilizarse.
4. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.
5. En caso de falta de estanqueidad de una celda, el líquido vertido no debe entrar en contacto con la piel ni los ojos. Si se produce contacto, lavar con agua abundante la zona afectada y avisar a un médico.
6. En caso de cambio o recarga inadecuados, las celdas o baterías que contienen electrolitos alcalinos (p. ej. las celdas de litio) pueden explotar. Para garantizar la seguridad del producto, las celdas o baterías solo deben ser sustituidas por el tipo Rohde & Schwarz correspondiente (ver lista de recambios).
7. Las baterías y celdas deben reciclarse y no deben tirarse a la basura doméstica. Las baterías o acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de eliminación y reciclaje.

Transporte

1. El producto puede tener un peso elevado. Por eso es necesario desplazarlo o transportarlo con precaución y, si es necesario, usando un sistema de elevación adecuado (p. ej. una carretilla elevadora), a fin de evitar lesiones en la espalda u otros daños personales.

Instrucciones de seguridad elementales

2. Las asas instaladas en los productos sirven solamente de ayuda para el transporte del producto por personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como p. ej. grúas, carretillas elevadoras de horquilla, carros etc. Es responsabilidad suya fijar los productos de manera segura a los medios de transporte o elevación. Para evitar daños personales o daños en el producto, siga las instrucciones de seguridad del fabricante del medio de transporte o elevación utilizado.
3. Si se utiliza el producto dentro de un vehículo, recae de manera exclusiva en el conductor la responsabilidad de conducir el vehículo de manera segura y adecuada. El fabricante no asumirá ninguna responsabilidad por accidentes o colisiones. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Asegure el producto dentro del vehículo debidamente para evitar, en caso de un accidente, lesiones u otra clase de daños.

Eliminación/protección del medio ambiente

1. Los dispositivos marcados contienen una batería o un acumulador que no se debe desechar con los residuos domésticos sin clasificar, sino que debe ser recogido por separado. La eliminación se debe efectuar exclusivamente a través de un punto de recogida apropiado o del servicio de atención al cliente de Rohde & Schwarz.
2. Los dispositivos eléctricos usados no se deben desechar con los residuos domésticos sin clasificar, sino que deben ser recogidos por separado.
Rohde & Schwarz GmbH & Co.KG ha elaborado un concepto de eliminación de residuos y asume plenamente los deberes de recogida y eliminación para los fabricantes dentro de la UE. Para desechar el producto de manera respetuosa con el medio ambiente, dirijase a su servicio de atención al cliente de Rohde & Schwarz.
3. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
4. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

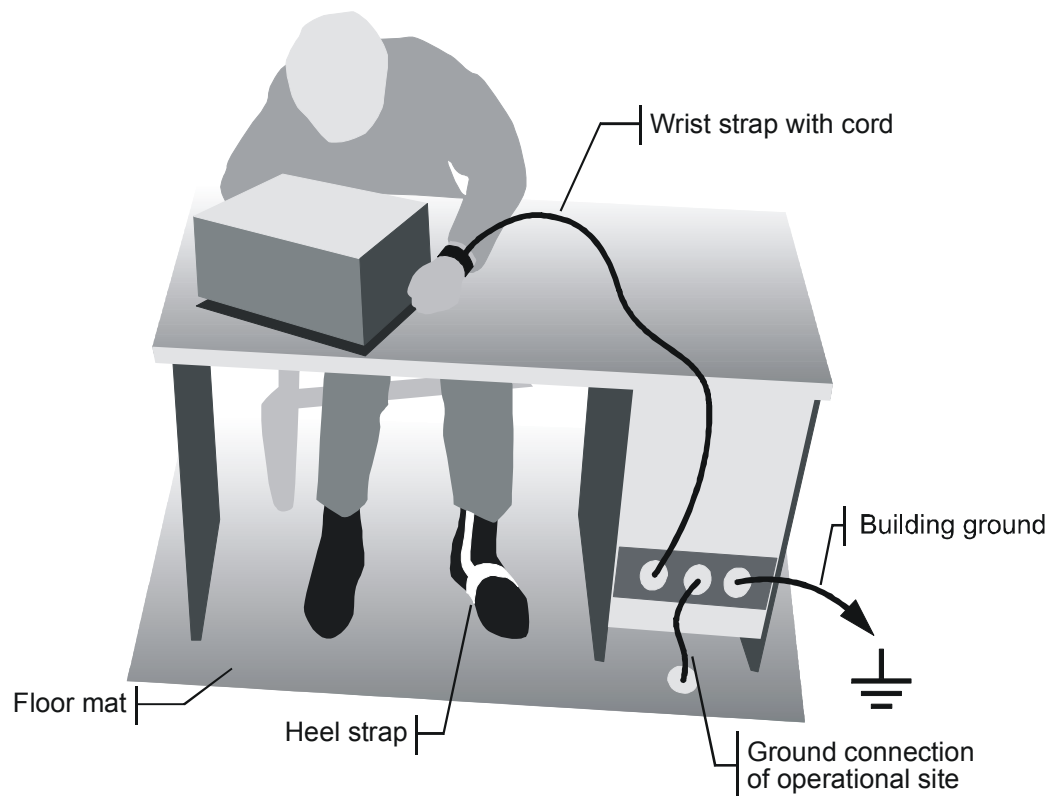
Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

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:

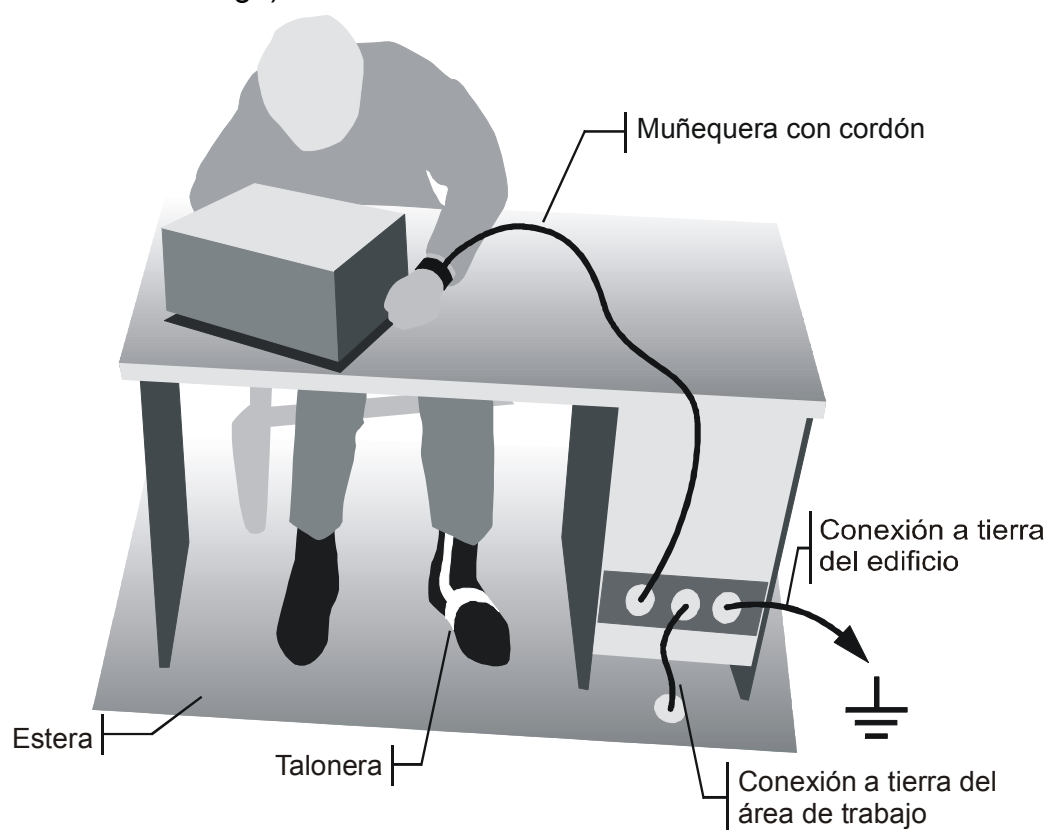
- Wrist strap with cord to ground connection
 - Conductive floor mat and heel strap combination
-

Instrucciones para la protección contra descargas electroestáticas

AVISO

Riesgo de avería de los componentes electrónicos

Para evitar averías en los componentes electrónicos, el área de trabajo tiene que estar protegido contra descargas electroestáticas ESD (electrostatic discharge).



Los siguientes dos métodos de protección ESD pueden ser usados juntos o separados:

- Muñequera con cordón para conexión a tierra
- Combinación de estera antiestática y talonera

Procedure in Case of Service and Ordering of Spare Parts

This section contains information on shipping an instrument to your service center and ordering spare parts.

Please contact your local Rohde & Schwarz service center if you need service or repair work of your equipment or to order spare parts. The list of the Rohde & Schwarz representatives is provided at the beginning of this service manual. You can find the current address of your representative on our homepage www.rohde-schwarz.com. Navigate to Service & Support / Service Locations.

Shipping the Instrument

We require the following information in order to answer your inquiry fast and correctly and to determine whether the warranty is still valid for your instrument:

- Instrument model
- Serial number
- Firmware version
- Must the instrument be returned with this firmware?
- Detailed error description in case of repair
- Indication of desired calibration
- Contact person for possible questions

In some countries, an RMA process is available for the return shipment of the instrument. For details, contact your local representative.

When shipping the instrument, be careful to provide for sufficient mechanical and antistatic protection.

- Use the original packaging for transporting or shipping the instrument. The protective caps for the front and rear prevent damage to the operating elements and the connectors.
- If you do not use the original packaging, provide for sufficient padding to prevent the instrument from slipping inside the box. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

Rohde & Schwarz offers repair and calibrations of the test systems it produces. The calibration documentation fulfills ISO 17025 requirements.

Shipping Defective Modules

Also when shipping a module, be careful to provide for sufficient mechanical and antistatic protection.

- Ship the module in a sturdy, padded box.
- Wrap the module in antistatic foil.

If the packaging is only antistatic but not conductive, additional conductive packaging is required. The additional packaging is not required if the tightly fitting packaging is conductive.

Exception:

If the module contains a battery, the tightly fitting packaging must always consist of antistatic, non-chargeable material to protect the battery from being discharged.

Ordering Spare Parts

To deliver spare parts promptly and correctly, we need the following information:

- Stock number (see list of spare parts in chapter "Documents")
- Designation
- Component number according to list of spare parts
- Number of pieces
- Instrument type for which the spare part is needed
- Instrument stock number
- Instrument serial number
- Contact person for possible questions

Refurbished Modules

Refurbished modules are an economical alternative to original modules. Bear in mind that refurbished modules are not new, but repaired and fully tested parts. They may have traces from use, but they are electrically and mechanically equivalent to new modules.

Your Rohde & Schwarz representative will be happy to inform you about which modules are available as refurbished modules.

Taking Back Defective Replaced Modules

Defective modules of the replacement program which cannot be repaired are taken back within three months following delivery. A repurchasing value is credited.

Excluded are parts which cannot be repaired, e.g. printed boards that are burnt, broken or damaged by attempts to repair them, incomplete modules, and parts with severe mechanical damage.

Please return the defective replacement modules, together with the accompanying document for returned merchandise, which you received with the spare module. We need the following information:

- Stock number, serial number and designation of the removed part
- Detailed error description
- Stock number, serial number and type of instrument from which the module was removed
- Date of removal
- Name of the engineer/technician who replaced the module
- R&S ordering number
- Service reference number (if available)

Documentation Overview

The user documentation for the R&S RT-ZD10/20/30/40 includes the following:

- User Manual
- Service Manual
- Release Notes

User Manual

This manual describes all instrument functions in detail. It contains the following chapters:

Chapter 1	Product Description
Chapter 2	Putting into Operation
Chapter 3	Connecting the Probe to the DUT
Chapter 4	Measurement Principles
Chapter 5	Maintenance and Service
Chapter 6	Functional Check

Service Manual

This manual tells you how to check compliance with rated specifications, describes instrument functionality and provides instructions on repair, troubleshooting and fault elimination. The manual contains the following chapters:

Chapter 1	Performance Test Provides all the information necessary to check for compliance with rated specifications. The required test equipment is listed.
Chapter 2	Adjustment Contains information on adjusting the DUT.
Chapter 3	Repair Describes simple measures for repair and fault diagnosis.
Chapter 4	Software Update / Installing Options Contains information on updating the firmware.
Chapter 5	Documents Contains spare parts lists.

Release Notes

The release notes describe the installation of the firmware, new and modified functions, eliminated problems, and last-minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes. The current release notes are provided on the Internet.

1 Performance Test

This chapter provides information on executing performance tests. The required equipment, the test procedure and the detailed test goals are described. At the end of this chapter, templates for test reports are supplied for your convenience. Fields in the report that the user must fill out before or during the test are indicated by a gray background.

1.1 Test Equipment

Item	Type of equipment	Required characteristics or features	Recommended model	R&S order No.	Application
1	DC voltage source	± 40 V, Output floating	Keithley SourceMeter Model 2601A		DC Characteristics R&S ProbeMeter
2	Banana interface cable	Accessory for Keithley SourceMeter	Keithley 2600-BAN		DC Characteristics R&S ProbeMeter
3	Digital multimeter (DMM)		Agilent 34401A		DC Characteristics R&S ProbeMeter
4	Network analyzer (VNA)	10 MHz to 16 GHz time domain option	R&S ZVK R&S ZVR-B2 or R&S ZVA40 R&S ZVAB-K2	1127.8651.60 1044.1009.02 1145.1110K40 1164.1657.02	Rise time
5	Calibration kit	PC 2.92 mm, 40 GHz	R&S ZV-Z34	1128.3530.02	Rise time
6	3 SMA (m) 50 Ohm termination	Impedance $50 \Omega \pm 5 \%$ Return loss ≥ 26.4 dB, DC to 8 GHz		0249.7823.00	Rise time
7	Network Analyzer test cable	PC 2.92 mm (f/m)	R&S ZV-Z15 or R&S ZV-Z95	1134.4193.02 1301.7608.25	Rise time
8	PC 3.5(f) to N(f) adapter		Rosenberger 03KR105-K00S3		Rise time
9	Service kit	see Table 2	R&S RT-ZK2	1410.5305.02	DC Characteristics R&S ProbeMeter
10	PC	Windows XP, USB port			Rise time DC Characteristics R&S ProbeMeter

Table 1: Test equipment

Contents of Service Kit

Item	Type of equipment	Required characteristics or features	Recommended model	R&S order No.	Application
9a	Probe tip adapter 2		incl. in R&S RT-ZK2	1409.3411.03	
9b	Probe box adapter		incl. in R&S RT-ZK2		
9c	SMA(m) to BNC(m) adapter (2x)		incl. in R&S RT-ZK2		
9d	BNC(f) to dual banana adapter (3x)		incl. in R&S RT-ZK2		
9e	N(f) to BNC(f) adapter		incl. in R&S RT-ZK2		
9f	BNC termination (m) 50 Ω		incl. in R&S RT-ZK2		
9g	BNC T connector		incl. in R&S RT-ZK2		
9h	BNC (m/m) cable 50 cm		incl. in R&S RT-ZK2		
9i	USB A/B cable 50 cm		incl. in R&S RT-ZK2		
9j	CD	R&S RT-Z device manager software, R&S RT-ZD10/20/30/40 service manual	incl. in R&S RT-ZK2	1410.5170.08	
9k	Browser adapter (RT-ZD10/20/30)			1417.0509.00	
9l	Adapter square pin (RT-ZD10/20/30)			1417.0573.00	
9m	Socket adapter, variable spacing (RT-ZD40)			1417.0667.00	
9n	Browser adapter, spring loaded (RT-ZD40)			1417.0680.00	

Table 2: Contents of the R&S RT-ZK2 Service Kit

1.2 Test Instructions

The following preparations must be made prior to checking the warranted product performance:

- Three hours storage at ambient temperature (between 20 °C to 30 °C) followed by 30 minutes warm-up operation at ambient temperature.
- Specified environmental conditions met.
- Additional uncertainties introduced by the measurement equipment must be taken into account when checking the warranted product performance.

1.3 Preparations

To run the performance test, you must first take the following preparatory measures.

1.3.1 Configuring the Probe Box Adapter

To correctly run the performance test, you must configure the probe box adapter by means of a jumper as shown in Figure 1-1.

Test equipment:

- Windows PC with R&S RT-Z device manager software (item 10 and item 9j)
- Probe box adapter (item 9b)
- USB cable (item 9i)
- R&S RT-ZD10/20/30/40 probe (DUT)

Test setup:

- ▶ Connect the jumper to the two vertical pins closest to the USB connector (see Figure 1-1).
- ▶ Connect the probe box adapter to your computer via USB cable.
- ▶ Connect the DUT to the probe box adapter (see Figure 1-2).

Start the R&S RT-Z device manager software (for installation see chapter [3.2.2 "R&S RT-Z Device Manager Software"](#)).

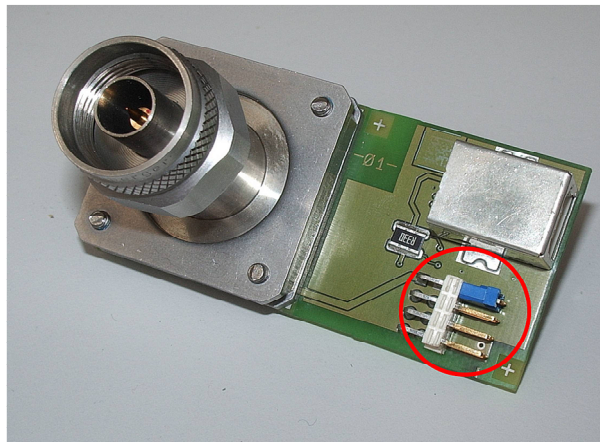


Figure 1-1: Probe box adapter, jumper setting

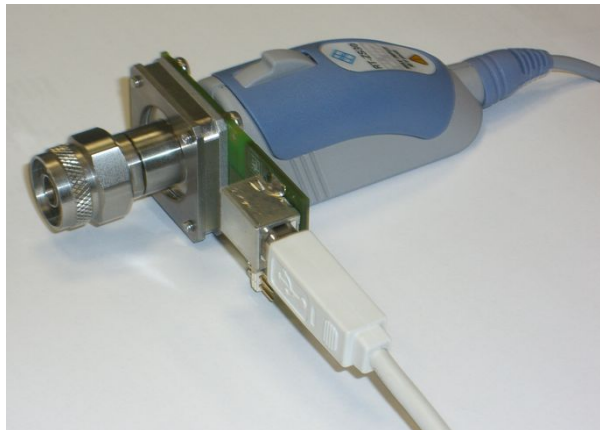


Figure 1-2: Probe box adapter with USB cable and probe

Evaluation:

Check if the DUT is initialized correctly after starting the R&S RT-Z device manager software. The DUT type and serial number must be indicated in the R&S RT-Z Device Manager window (see Figure 1-3).

If the probe cannot be initialized,

- check the USB connection between the probe box adapter and the PC
- check if the latest Device Manager Software RT-Z is installed (for installation refer to chapter [3.2.2, R&S RT-Z Device Manager Software](#))

If the R&S RT-Z device manager does not recognize the probe, the probe is defective.

R&S RT-Z device manager:

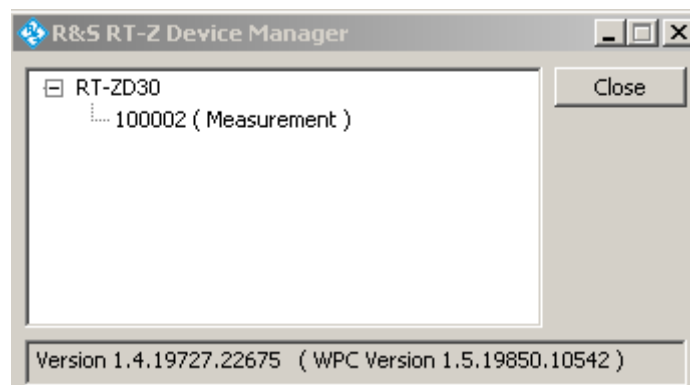


Figure 1-3: R&S RT-Z device manager initializing view

1.3.2 Reading Back the Correction Parameters of the Probe

The output voltage of the probe is numerically corrected to increase measurement accuracy. The correction parameters are stored in the probe box and must be taken into account when evaluating the following tests:

- DC characteristics

The correction parameters are read back using the R&S RT-Z device manager software and must be entered in the performance test report in section 1.8.

Test equipment: – See chapter 1.3.1 "Configuring the Probe Box Adapter".

- Test setup:**
- ▶ Connection: See chapter 1.3.1 "Configuring the Probe Box Adapter".
 - ▶ Start R&S RT-Z device manager (for installation see chapter 3.2.2 "R&S RT-Z Device Manager Software").
 - ▶ Open the Data tab (see Figure 1-4).
 - ▶ Read back the DUT data set by pressing the "Read Device" button.
 - ▶ The drop-down list that appears contains all correction parameters created during the last adjustment. Enter the values for fVrfc and fArfc in the performance test report in section 1.8 under **Correction Parameters**.

R&S RT-Z device manager software settings:

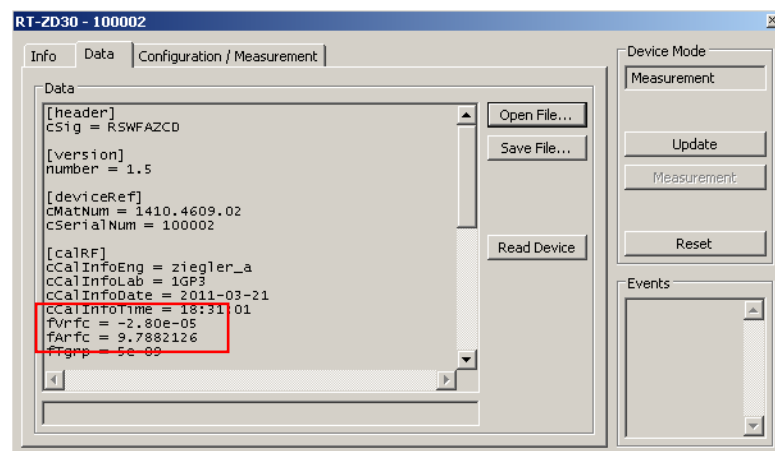


Figure 1-4: Data tab in R&S RT-Z device manager

1.3.3 Setting the Probe Offset Compensation Voltage to Zero

The probe offset compensation voltage can be changed by setting the “Offset Compensation Voltage” in R&S RT-Z device manager. Before running the performance test, make sure that the offset compensation voltage is set to 0 V.

Procedure for setting the offset compensation voltage to zero

Test equipment: – See chapter 1.3.1 "Configuring the Probe Box Adapter".

- Test setup:**
- ▶ Connection: See section 1.3.1 "Configuring the Probe Box Adapter".
 - ▶ Start R&S RT-Z device manager.
 - ▶ Open the Configuration / Measurement (see Figure 1-5).
 - ▶ Check if the offset compensation voltage” box” is deactivated (see Figure 1-5).

R&S RT-Z device manager software settings:

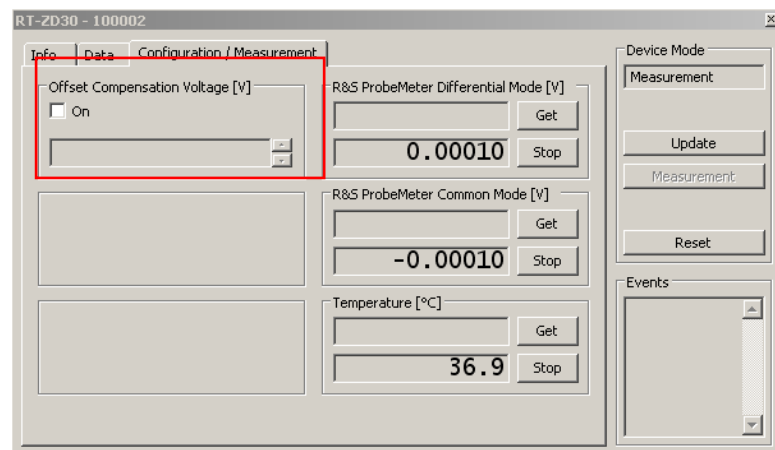


Figure 1-5: R&S RT-Z device manager, offset compensation voltage

1.3.4 DC Voltage Source Calibration

To increase the accuracy of the DC voltage source (item 1), the source is checked using the digital multimeter (item 3). The values determined will be taken as a reference for the following tests:

- DC characteristics
- ProbeMeter

Procedure for determining the DC voltage source reference values

Test equipment:

- DC voltage source (item 1)
- Banana interface cable (item 2)
- Digital multimeter (item 3)

Test setup: ► Connect the DC voltage source outputs LO and HI to the digital multimeter inputs LO and HI using the banana interface cable.

Digital multimeter settings:

- Function: DC V (DC voltage measurement)
- 10 PLC integration time (slow 5 digit resolution)

DC voltage source settings:

- Function: Source voltage
- Sense Mode: 2-wire
- Output ON

Measurement:

- Set the voltages on the DC voltage source. Take into account the range settings.
- Set the measurement range on the digital multimeter.
- Read off the measured voltage on the digital multimeter and enter the value in Table 3.

DC voltage source		Digital multimeter		
Range	Setting	Range	Measured voltage	
100 mV	0 V	100 mV	V_{Source0}	
1 V	1 V	1 V	V_{Source1p}	
1 V	–1 V	1 V	V_{Source1n}	
6 V	2 V	10 V	V_{Source2p}	
6 V	–2 V	10 V	V_{Source2n}	
40 V	5 V	10 V	V_{Source5p}	
40 V	–5 V	10 V	V_{Source5n}	
*) 40 V	8 V	10 V	V_{Source8p}	
*) 40 V	–8 V	10 V	V_{Source8n}	

Table 3: DC source calibration

*) These voltages are only relevant for probes with serial number > 200 000

1.4 Probe Adaptation

This chapter describes the adaptation of differential R&S Probes to the Probe tip adapter 2 included in the service Kit RT-ZK2.

The Probe tip adapter 2 is grouped into 3 different sections.

- Section 1 supports RF measurements for differential probes
- Section 2 supports RF measurements for single ended probes
- Section 3 supports DC measurements for single ended probes and differential probes

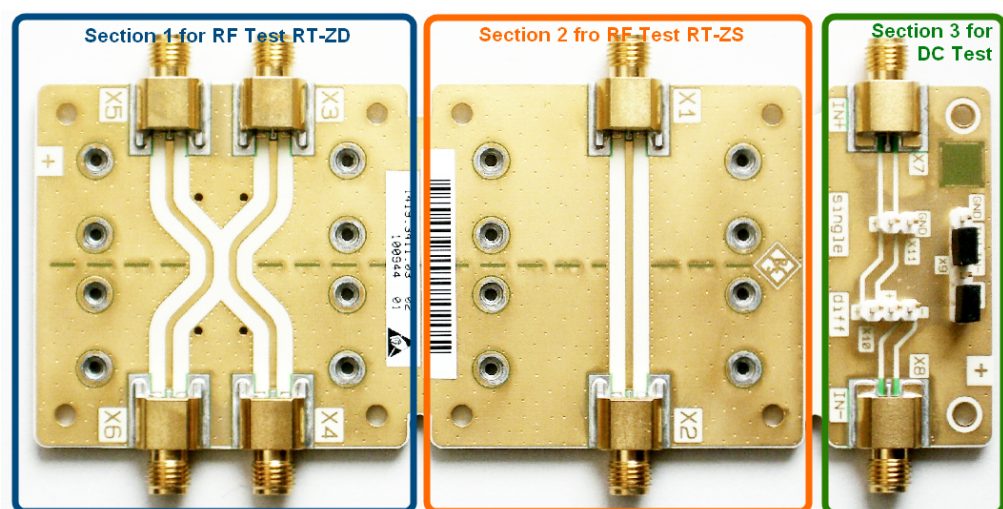
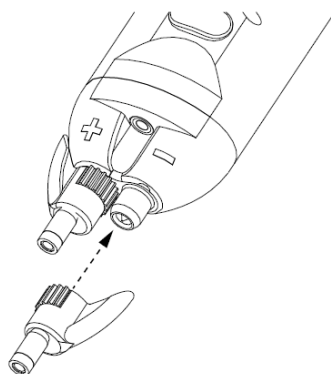


Figure 1-6: Probe tip adapter 2

1.4.1 Insertion and adjusting the adapters



The socket and browser adapters each consist of two separate parts: a red one for the positive socket, and the blue part for the negative socket.

The sockets (socket adapter) or pins (browser adapter) are mounted off-center, and the outside is designed like a cogwheel, thus the distance between the pins can be adjusted.

First, insert one part on the appropriate socket. Then insert the second part to the other socket, and make sure that the levers are symmetrical and the cogs are meshing.

To adjust the distance between the sockets/pins, turn the levers. A built-in stop prevents unwanted turning of the signal pins when probing.

1.4.2 Probe Adaptation for Rise Time Measurements

This table discusses the probe tip configuration for the rise time measurement of the device under test described in the performance test.

⚠ WARNING

Risk of injuries

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

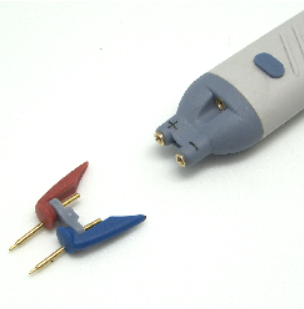
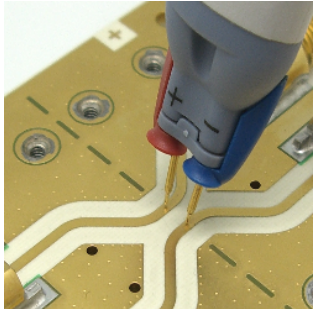
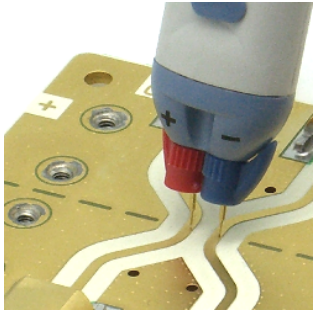
Probe	Browser Adapter	Using accessories	Probe Adaptation to Probe Tip Adapter 2
RT-ZD10 RT-ZD20 RT-ZD30	1417.0509.00 Browser adapter		
RT-ZD40	1417.0680.00 Browser adapter, spring loaded		

Table 4: Probe Adaptation for RF Measurements

1.4.3 Probe Adaptation for DC Measurements

This table discusses the probe tip configuration for all DC measurements of the device under test described in the performance test.

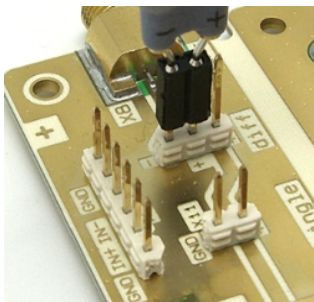
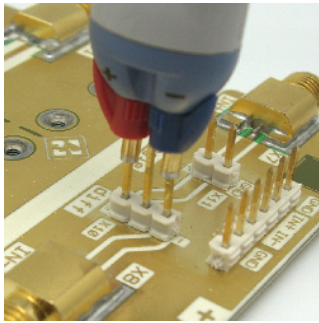
Probe	Browser Adapter	Browser Adaptation to Probe	Probe Adaptation to Probe Tip Adapter 2
RT-ZD10 RT-ZD20 RT-ZD30	1417.073.00 Adapter, square pin		
RT-ZD40	1417.0667.00 Socket adapter, variable spacing		

Table 5: Probe Adaptation for DC Measurements

1.5 Rise time

Verifying the rise time of the DUT.

Test equipment:

- Network Analyzer (item 4)
- Network Analyzer test cable (item 7)
- Calibration kit (item 5)
- PC 3.5 to N adapter (item 8)
- SMA termination (item 6)
- Probe tip adapter 2 (item 9a)
- Probe box adapter (item 9b)
- USB cable (item 9i)
- PC (item 10)

Network Analyzer settings:

- [**STATUS** : PRESET]
- [**STIMULUS** : START : 20 MHz]
- [**STIMULUS** : STOP : 16 GHz]
- [**SWEEP** : SWEEP : LIN SWEEP]
- [**SWEEP** : SWEEP : ARBITRARY : NUMBER OF POINTS : 800]
- [**SWEEP** : AVG : IF BANDWIDTH : 10 kHz]
- [**SWEEP** : SOURCE : POWER : 0 dBm]
- [**SWEEP** : AVG : AVERAGE]
- [**SWEEP** : AVG : AVG FACTOR : 10]

Test setup for network analyzer calibration:

► Connect the test cable to port 1 of the network analyzer (see [Figure 1-7](#)).

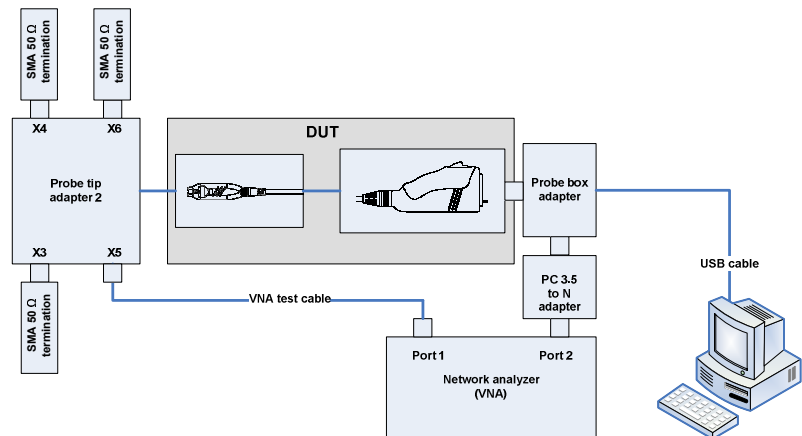


Figure 1-7: Network analyzer setup for calibration

Network analyzer calibration:

- [**CAL** : START NEW CAL : FULL TWO PORT :
- PORT 1 : CON K 2.92 mm male :
- PORT 2 : CON K 2.92 mm male :
- TOSM]

► Perform a full two-port calibration.

Test setup:**Figure 1-8: Test Setup for Rise Time Measurement****Probe box adaptation**

- ▶ Connect the probe box adapter to port 2 of the network analyzer using the PC 3.5 to N adapter
- ▶ Connect the probe box adapter to the PC using the USB cable.

Probe Tip Adapter 2 adaptation

- ▶ Connect X5 of the probe tip adapter to port 1 of the network analyzer using the network analyzer test cable.
- ▶ Connect SMA termination to X3, X4 and X6 of the probe tip adapter as shown in [Figure 1-8: Test Setup for Rise Time Measurement](#)

Probe adaptation for p-side

- ▶ Connect the probe box of the probe to the probe box adapter
- ▶ Prepare the probe for RF measurements by using the appropriate accessory (refer to [Table 4: Probe Adaptation for RF Measurements](#))
- ▶ Connect the p side of the probe tip to the signal line from connector X5 to X6 (refer to [Table 4: Probe Adaptation for RF Measurements](#))
- ▶ Keep the Probe connected to the probe tip adapter till the measurement is completed.

Note:

Any instability of the probe connection during the measurement may result in a wrong measurement value.

Measurement p-side rise time

The rise time will be determined between the 10 % and 90 % level of the pulse.
All measurements have to be performed in the time domain mode of the vector network analyzer.

**Network
analyzer
settings:**

- [**RESPONSE** : MEAS : S21]
- [**RESPONSE** : FORMAT : REAL]
- [**SYSTEM** : MODE : TIME DOMAIN : DOMAIN : TIME]
- [**SYSTEM** : MODE : TIME DOMAIN : DEF TRANSF TYP : CHIRP]
- [**SYSTEM** : MODE : TIME DOMAIN : DEF TRANSF TYP : STEP]
- [**SYSTEM** : MODE : TIME DOMAIN : DEF TRANSF TYP : LOWPASS]
- [**SYSTEM** : MODE : TIME DOMAIN : DEF TRANSF TYP : LOWPASS DC S-PARAM : 0 U]
- [**SYSTEM** : MODE : TIME DOMAIN : DEF TRANSF TYP : NO PROFILING]
- [**RESPONSE** : SCALE : 20 mU]

Determine the
LOW and TOP
level values of the
output step:

- [**STIMULUS**> START : 0 ns]
- [**STIMULUS**> STOP : 25 ns]

The display should look like in Figure 1-9.

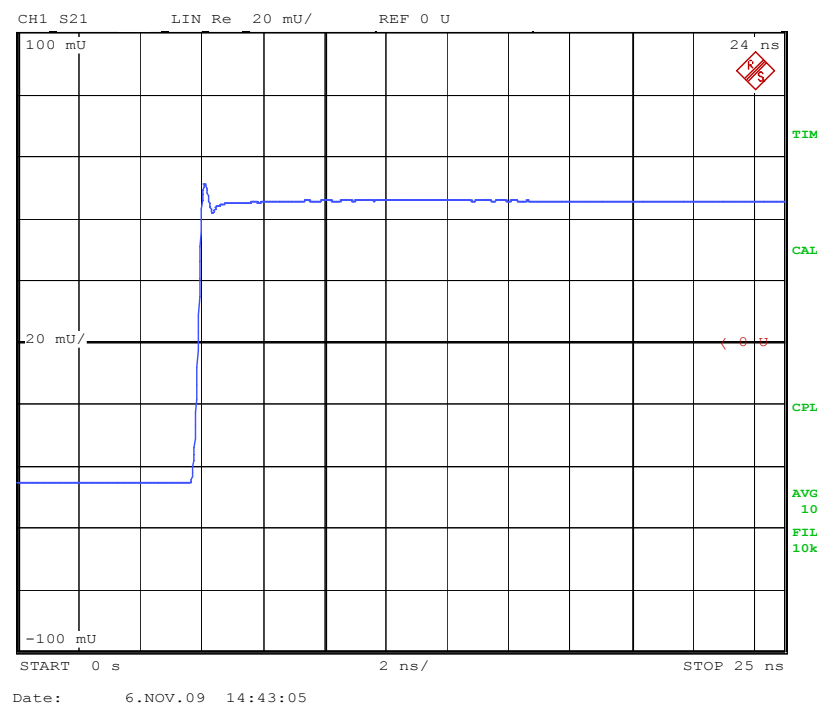


Figure 1-9: Step response

Find the center point of the rising edge of the step response by using marker search functions:

- [**MARKER** : MARKER : ALL MARKER OFF]
- [**MARKER** : SEARCH : TARGET MODE: 0 U]
- [**MARKER** : SEARCH : SEARCH]
- [**MARKER** : MARKER : MARKER INFO]

► Write down the time t_{50} (e.g. 5.8 ns) of the marker.

- Determine the LOW level value:
- [**STIMULUS** : START : $t_{\text{start}} = t_{50} - 20 \text{ ns}$]
 - [**STIMULUS** : STOP : $t_{\text{stop}} = t_{50} - 10 \text{ ns}$]
 - [**RESPONSE** : TRACE : SMOOTHING : ON]
 - [**RESPONSE** : TRACE : SMOOTHING APERTURE : 100%]

Set LOW level marker, 15 ns before t_{50} .

- [**MARKER** : MARKER: MARKER 2 : $t_{\text{LL}} = t_{50} - 15 \text{ ns}$] (e.g. -9.2 ns)
- ▶ Read off the MARKER 2 value and write the value down as V_{LL} (e.g. -46.6 mU).

- Determine the TOP level value:
- [**STIMULUS** : START : $t_{\text{start}} = t_{50} + 10 \text{ ns}$]
 - [**STIMULUS** : STOP : $t_{\text{stop}} = t_{50} + 20 \text{ ns}$]
 - [**RESPONSE** : TRACE : SMOOTHING : ON]
 - [**RESPONSE** : TRACE : SMOOTHING APERTURE : 100%]

Set the TOP level marker, 15 ns after t_{50} .

- [**MARKER** : MARKER: MARKER 3 : $t_{\text{TL}} = t_{50} + 15 \text{ ns}$] (e.g. 20.8 ns)
- ▶ Read off MARKER 3 value and write the value down as V_{TL} (e.g. 47.8 mU).

- Determine the 10% and 90% levels of the step response:
- ▶ Determine the step height of the step response:
 $V = V_{\text{TL}} - V_{\text{LL}}$ (e.g. 94.4 mU)

- ▶ Calculate the 10 % and 90 % level of the step response:

$$V_{10\%} = V_{\text{LL}} + \frac{V}{10} \quad (\text{e.g. } -37.16 \text{ mU})$$

$$V_{90\%} = V_{\text{TL}} - \frac{V}{10} \quad (\text{e.g. } 38.36 \text{ mU})$$

Network analyzer settings:

Deactivate the smoothing function:

- [**RESPONSE** : TRACE : SMOOTHING : OFF]

Set markers to 10% and 90% of the step response:

Set the time span 2 ns around the rising edge:

- [**STIMULUS** : START : $t_{\text{start}} = t_{50} - 1 \text{ ns}$] (e.g. 5.8 ns - 1 ns)
- [**STIMULUS** : STOP : $t_{\text{stop}} = t_{50} + 1 \text{ ns}$] (e.g. 5.8 ns + 1 ns)

Set marker 2 to 10 % level

- [**MARKER** : MARKER : MARKER 2]
- [**MARKER** : SEARCH : TARGET MODE: $V_{10\%}$]
- [**MARKER** : SEARCH : SEARCH]

Set marker 3 to 90 % level

- [**MARKER** : MARKER: MARKER 3]
- [**MARKER** : SEARCH : TARGET MODE: $V_{90\%}$]
- [**MARKER** : SEARCH : SEARCH]

Rise time for performance test report:

The rise time of the step response is the time difference between marker 2 and marker 3. Therefore, set marker 2 as reference.

- [**MARKER** : MARKER: DELTA : $\Delta\text{REF} = \text{marker 2}$]

- Enter the rise time value (time display of marker 3) in the performance test report in section 1.8 under **Step Response, Rise time p-side**.

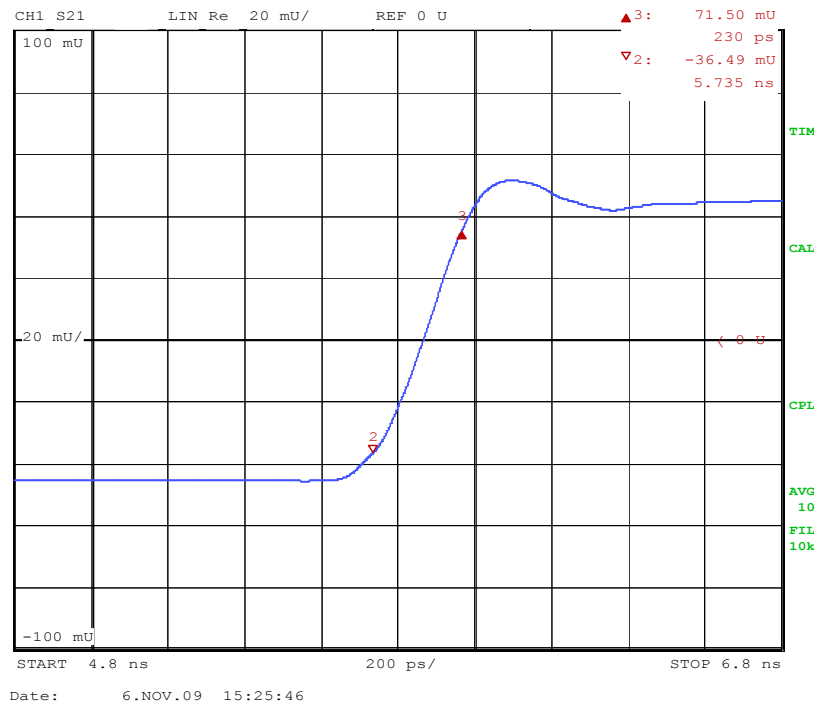


Figure 1-10: Determining the rise time

Probe adaptation for n-side

- Connect the Probe box to the Probe box adapter
- Prepare the probe for RF measurements by using the appropriate accessory (refer to [Table 4: Probe Adaptation for RF Measurements](#))
- Connect the n side of the probe tip to the signal line from connector X5 to X6 (refer to [Table 4: Probe Adaptation for RF Measurements](#))
- Keep the Probe connected to the probe tip adapter till the measurement is completed.

Measurement n-side rise time

- Repeat the steps for measuring the rise time
- Enter the rise time value (time display of marker 3) in the performance test report in section 1.8 under **Step Response, Rise Time n-side**.

1.6 DC Characteristics

1.6.1 Attenuation Error

Verifying the DC gain of the DUT

- Test equipment:**
- Windows PC with R&S RT-Z device manager software (item 10 and item 9j)
 - DC voltage source (item 1)
 - Banana interface cable (item 2)
 - Digital multimeter (item 3)
 - Probe tip adapter 2 (item 9a)
 - Probe box adapter (item 9b)
 - SMA to BNC adapter (item 9c)
 - BNC to dual banana adapter (item 9d)
 - N to BNC adapter (item 9e)
 - BNC termination (item 9f)
 - BNC T connector (item 9g)
 - BNC cable (item 9h)
 - USB cable (item 9i)

Test setup:

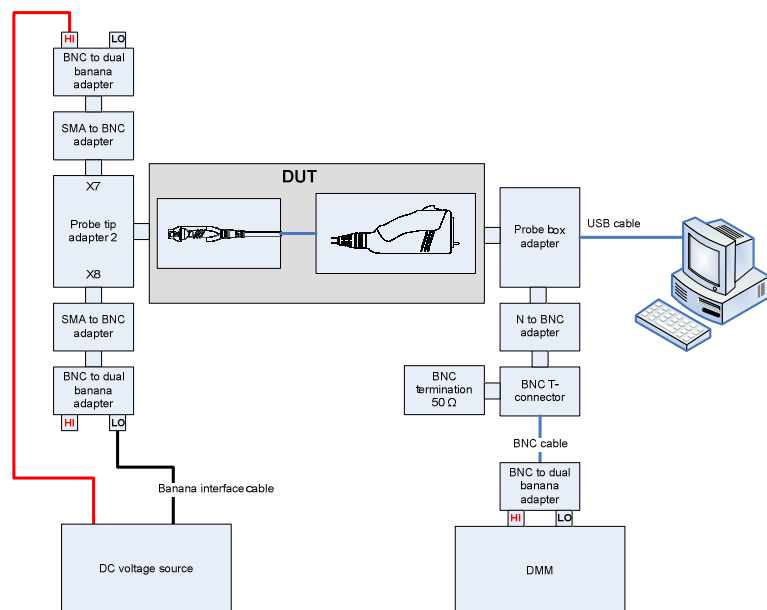


Figure 1-11: Test setup for attenuation error measurement

Probe box adaptation

- ▶ Terminate the probe box adapter with the N to BNC adapter, BNC T connector and BNC termination, see [Figure 1-12: DC characteristics test setup, probe box adapter](#)
- ▶ Connect the other output of the BNC T connector to the digital multimeter using the BNC cable and the BNC to dual banana adapter.

Note: Ensure that the LO port of the digital multimeter is connected to the ground conductor (see [Figure 1-13: Banana to BNC Adapter](#) for polarity identification).

- ▶ Connect the DUT to the probe box adapter.
- ▶ Connect the probe box adapter to the PC using the USB cable.

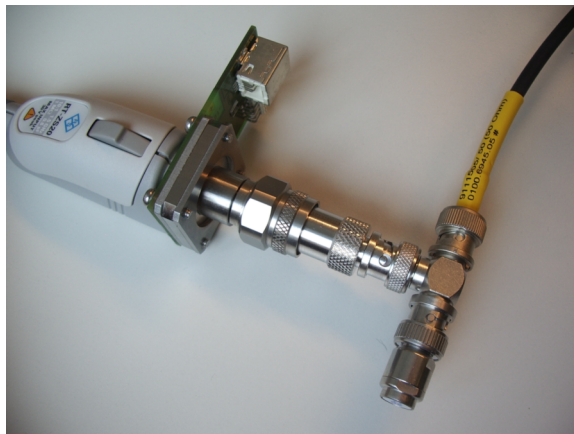


Figure 1-12: DC characteristics test setup, probe box adapter

Probe Tip Adapter 2 adaptation

- ▶ Connect port X7 of the probe tip adapter 2 to the banana interface cable of the DC voltage source ("HI" port) using the SMA to BNC adapter and the BNC to dual banana adapter.

Note: Ensure that the Hi port of the dual banana adapter is connected to the signal conductor (see [Figure 1-13: Banana to BNC Adapter](#) for polarity identification).

- ▶ Connect port X8 of the probe tip adapter to the banana interface cable of the DC voltage source ("LO" port) using the SMA to BNC adapter and the BNC to dual banana adapter.

Note: Ensure that the LO port of the dual banana adapter is connected to the signal conductor (see [Figure 1-13: Banana to BNC Adapter](#) for polarity identification).

Banana to BNC Adapter polarity identification

- The ground is marked by a grounding mark flag on adapter

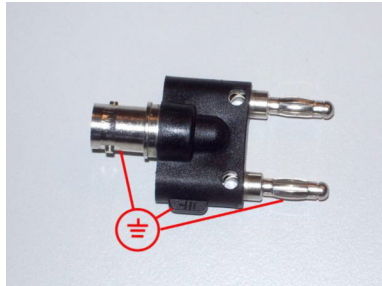


Figure 1-13: Banana to BNC Adapter

Probe Adaptation

- Connect the Probe box to the Probe box adapter
- Prepare the probe for DC measurements by using the appropriate accessory (refer to [Table 5: Probe Adaptation for DC Measurements](#))
- Connect the probe to the DC Test section (diff pins) of the Probe PIN Adapter 2, see [Table 5: Probe Adaptation for DC Measurements](#)

Note: Ensure the polarity of the R&S Probe matches the polarity of the Probe Tip Adapter 2

Probe Tip Adapter Configuration**Jumper settings**

- Remove all jumpers from the Probe Tip Adapter 2 section DC Test

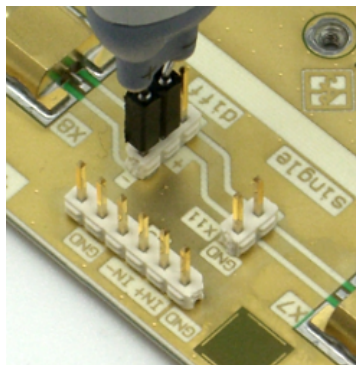


Figure 1-14: Jumper settings for Attenuation Error measurement

Digital multimeter settings:

- Function: DC voltage measurement
- 10 PLC integration time (slow 5 digit – default setting)

DC voltage source settings:

- Function: Source voltage
- Sense Mode: 2-wire
- Output ON

- Measurement:**
- Set the voltages and the associated measurement range on the DC voltage source
 - Set the corresponding measurement range on the digital multimeter.
 - Read off the measured voltage on the digital multimeter and write down the value.

DC voltage source		Digital multimeter		
Range	Setting	Range	Measured voltage	
100 mV	0 V	100 mV	V_{out0}	
1 V	1 V	100 mV	V_{out1p}	
1 V	-1 V	100 mV	V_{out1n}	
6 V	2 V	1 V	V_{out2p}	
6 V	-2 V	1 V	V_{out2n}	
40 V	5 V	1 V	V_{out5p}	
40 V	-5 V	1 V	V_{out5n}	

Table 6: Attenuation error voltage

Evaluation for performance test report:

The correction parameter A_{RFC} was already determined in chapter 1.3.2 "Reading Back the Correction Parameters of the Probe" and entered in the performance test report in section 1.8.

The corresponding input voltages $V_{Sourcexy}$ are not the voltages set on the DC voltage source, but the voltages determined in section 1.3.4 "DC Voltage Source Calibration". They are entered in Table 3.

The attenuation error is ε_{xp} ($x = 1, 2, 5, y = p, n$):

$$\varepsilon_{xp} = \left[\frac{(V_{outxy} - V_{out0}) \cdot A_{RFC}}{V_{Sourcexy} - V_{Source0}} - 1 \right] \cdot 100$$

- Enter values in the performance test report in section 1.8 under **Attenuation error**.

1.6.2 Zero Error

Verifying the zero error of the DUT

Test equipment: – See chapter 1.6.1 "Attenuation Error".

Test setup:

- ▶ For the test setup and Probe connection refer to chapter 1.6.1: [Attenuation Error](#)
- ▶ Switch off the output voltages on the DC voltage source.

Probe Tip Adapter Jumper Settings Configuration

To measure the Zero Error of the Probe the positive and negative Probe input has to be set to ground. Therefore set the Probe Tip Adapter 2 jumpers as follow: ([Figure 1-15: Test setup probe tip adapter 2 for zero error measurement](#))

- ▶ Set jumper 1 to "GND" "IN +"
- ▶ Set jumper 2 to "IN -" "GND"

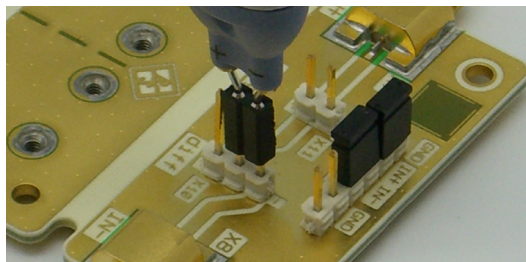


Figure 1-15: Test setup probe tip adapter 2 for zero error measurement

Digital multimeter settings:

- Function: DC voltage measurement
- Range: 100 mV
- 10 PLC integration time (slow 5 digit – default setting)

Measurement :

- ▶ Read off the measurement value on the digital multimeter. The value is V_{out0m} .

Evaluation for performance test report:

Calculation of the zero error referenced to probe input.

The correction parameters fA_{RFC} and fV_{RFC} were already determined in section 1.3.2 "[Reading Back the Correction Parameters of the Probe](#)" and entered in the performance test report in section 1.8.

$$V_{Zero} = A_{RFC} \cdot (V_{out0m} + V_{RFC})$$

- ▶ Enter the value in the performance test report in section 1.8 under **Zero Error**.

1.6.3 Common mode rejection, DC

Test equipment: ► See chapter 1.6.1 "Attenuation Error"

Test setup:

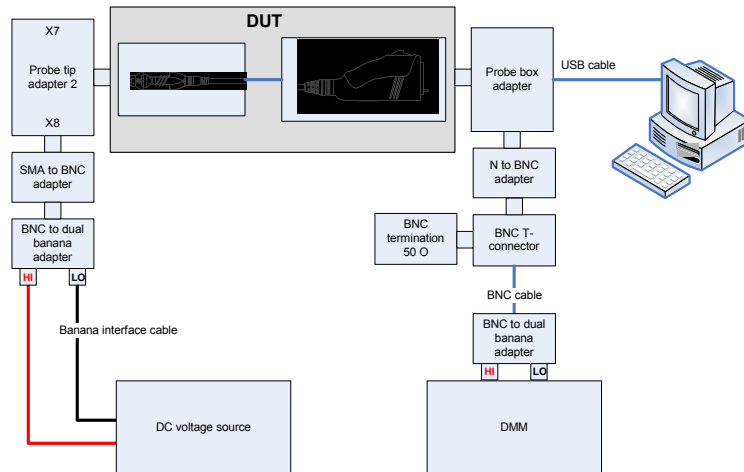


Figure 1-16: Test Setup for Common mode rejection measurement

Probe box adaptation

- For the test setup of the Probe box adaptation refer to chapter 1.6.1: Attenuation Error

Probe Tip Adapter 2 adaptation

- Connect port X8 of the probe tip adapter to the banana interface cable of the DC voltage source ("HI" port) using the SMA to BNC adapter and the BNC to dual banana adapter.

Note: Ensure that the HI port of the dual banana adapter is connected to the signal conductor. And the LO port of the dual banana adapter is connected to the ground conductor, see Figure 1-13: Banana to BNC Adapter for polarity identification.

Probe Tip Adapter Jumper settings Configuration

To measure in Common Mode the positive and negative input of the probe has to be driven by the same signal. Therefore set one jumper as follow

- Set jumper 1 to "IN+" "IN-"

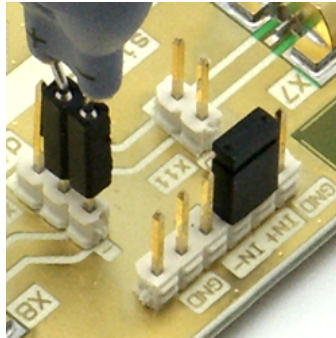


Figure 1-17: Jumper setting for common mode rejection measurement

Probe Adaptation ► Connect the Probe box to the Probe box adapter

- For the probe adaptation refer to chapter [1.6.1 Attenuation Error](#)

Note: Ensure the polarity of the R&S Probe matches the polarity of the Probe Tip Adapter 2

Digital multimeter settings:

- Function: DC voltage measurement
- 10 PLC integration time (slow 5 digit – default setting)

DC voltage source settings:

- Function: Source voltage
- Sense Mode: 2-wire
- Output ON

Measurement:

- Set the voltages and the associated measurement range on the DC voltage source
- Set the corresponding measurement range on the digital multimeter.
- Read off the measured voltage on the digital multimeter and write down the value.

DC voltage source		Digital multimeter		
Range	Setting	Range	Measured voltage	
40 V	5 V	1 V	$V_{out,cm,5p}$	
40 V	-5 V	1 V	$V_{out,cm,5n}$	

Table 7: Attenuation error voltage

Evaluation for performance test report:

The corresponding diff. output voltages V_{out5p} and V_{out5n} are the voltages determined in section 1.6.1 "Attenuation Error". They are entered in Table 6: Attenuation error voltage

$$CMRR_{DC} = 20 * \log \left| \frac{V_{out5p} - V_{out5n}}{V_{out,cm,5p} - V_{out,cm,5n}} \right|$$

- Enter values in the performance test report in section 1.8 under **CMRR_{DC}**.

1.7 R&S ProbeMeter

1.7.1 Measurement error, differential mode

Test equipment: – See chapter [1.6.1 Attenuation Error](#).

Test setup: ► For the test setup and Probe connection refer to chapter [1.6.1 Attenuation Error](#)

R&S RT-Z device manager software settings: ► Start R&S RT-Z device manager and select the Configuration / Measurement tab. With the button “Get” the actual reading can be frozen in the associated field.

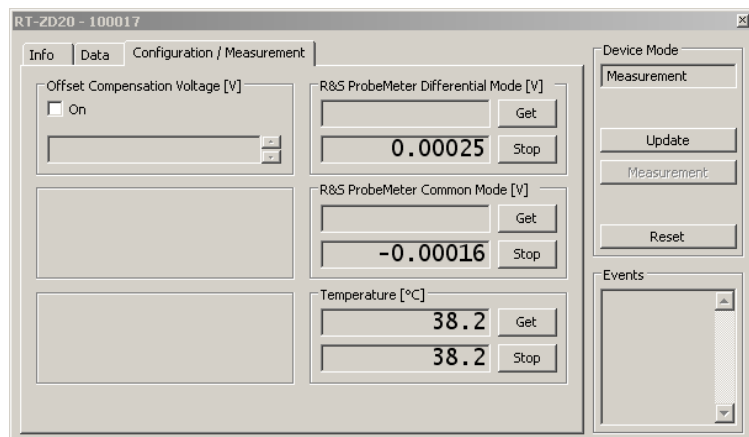


Figure 1-18: RT-Z Device Manager, Measurement tab

DC voltage source settings: – Function: Source voltage
– Sense Mode: 2-wire
– Output ON

Measurement: ► Set the voltages and the associated measurement range on the DC voltage source
► Read off the measured voltage in the R&S ProbeMeter field in the R&S RT-Z device manager and enter the value in Table 8.

DC voltage source		R&S ProbeMeter Differential Mode	
Range	Setting		Measured voltage
1 V	1 V	V_{dm1p}	
1 V	–1 V	V_{dm1n}	
6 V	2 V	V_{dm2p}	
6 V	–2 V	V_{dm2n}	
40 V	5 V	V_{dm5p}	
40 V	–5 V	V_{dm5n}	

Table 8: R&S ProbeMeter voltage

Evaluation for performance test report:

The corresponding input voltages $V_{Sourcexy}$ are not the voltages set on the DC voltage source, but the voltages determined in section 1.3.4 "DC Voltage Source Calibration". They are entered in Table 3.

$V_{PM,DM,xp}$ ($x = 1, 2, 5$) for positive V_{in} :

$$V_{PM,DM,xp} = V_{dmxp} - V_{Sourcexp}$$

$V_{PM,DM,xn}$ ($x = 1, 2, 5$) for negative V_{in} :

$$V_{PM,DM,xn} = V_{dmxn} - V_{Sourcexn}$$

- Enter the calculated values in the performance test report in section 1.8 under **R&S ProbeMeter**.

Test setup, 0 V:

- Switch off the output voltages on the DC voltage source.
- Set jumpers as described in chapter 1.6.2 jumper setting

Evaluation for performance test report:

- Read off the measured voltage $V_{PM,DM,0}$ in the R&S ProbeMeter Differential Mode field in the R&S RT-Z device manager and enter the value in the performance test report in section 1.8 under **R&S ProbeMeter**.

1.7.2 Measurement error, common mode & common mode rejection

Test equipment:

- See chapter 1.6.1 "Attenuation Error"

Test setup:

- See chapter 1.6.3 "Common mode rejection, DC"

R&S RT-Z device manager software settings:

- Start R&S RT-Z device manager and select the Configuration / Measurement tab. With the button "Get" the actual reading can be frozen in the associated field.

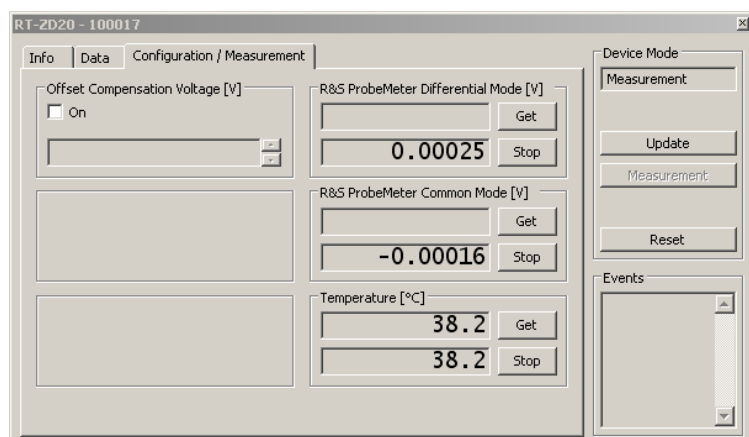


Figure 1-19: RT-Z device manager, Measurement tab

DC voltage source settings:

- Function: Source voltage
- Sense Mode: 2-wire
- Output ON

- Measurement:**
- ▶ Set the voltages and the associated measurement range on the DC voltage source
 - ▶ Read off the measured voltage in the R&S ProbeMeter field in the R&S RT-Z device manager and enter the value in Table 8.

DC voltage source		R&S ProbeMeter Differential Mode		R&S ProbeMeter Common Mode	
Range	Setting		Measured voltage		Measured voltage
1 V	1 V	-		V_{cm1p}	
1 V	-1 V	-		V_{cm1n}	
6 V	2 V	-		V_{cm2p}	
6 V	-2 V	-		V_{cm2n}	
40 V	5 V	V_{dm5p}		V_{cm5p}	
40 V	-5 V	V_{dm5n}		V_{cm5n}	
*) 40 V	8 V	-		V_{cm8p}	
*) 40 V	-8 V	-		V_{cm8n}	

Table 9: R&S ProbeMeter voltage

*) These voltages are only relevant for probes with serial number > 200 000

Evaluation for performance test report:

The corresponding input voltages $V_{Sourcexy}$ are not the voltages set on the DC voltage source, but the voltages determined in section 1.3.4 "DC Voltage Source Calibration". They are entered in Table 3.

$V_{PM,CM,xp}$ (x = 1, 2, 5, 8) for positive V_{in} :

$$V_{PM,CM,xp} = V_{cmxp} - V_{Sourcexp}$$

$V_{PM,CM,xn}$ (x = 1, 2, 5, 8) for negative V_{in} :

$$V_{PM,CM,xn} = V_{cmxn} - V_{Sourcexn}$$

- ▶ Enter the calculated values in the performance test report in section 1.8 under **R&S ProbeMeter**.

Evaluation for performance test report:

The common mode rejection is:

$$CMRR_{DC} = 20 * \log \left| \frac{V_{cm5p} - V_{cm5n}}{V_{dm5p} - V_{dm5n}} \right|$$

- ▶ Enter the calculated values in the performance test report in section 1.8 under **R&S ProbeMeter**.

Test setup, 0 V:

- ▶ Switch off the output voltages on the DC voltage source.
- ▶ Set jumpers as described in chapter 1.6.2 jumper setting

Measurement, evaluation for performance test report:

- ▶ Read off the measured voltage $V_{PM,CM,0}$ in the R&S ProbeMeter Common Mode field in the R&S RT-Z device manager and enter the value in the performance test report in section 1.8 under **R&S ProbeMeter**.

1.8 R&S RT-ZD10/20/30/40 Performance Test Report

ROHDE&SCHWARZ	R&S RT-ZD10 Diff. Voltage Probe	1410.4715.02
	R&S RT-ZD20 Diff. Voltage Probe	1410.4409.02
	R&S RT-ZD30 Diff. Voltage Probe	1410.4609.02
	R&S RT-ZD40 Diff. Voltage Probe	1410.5205.02
Serial number:		
Date:		
Person responsible:		
Signature:		

Measured	Ref.	Specified min. value	Determined value	Specified max. value	MU
Rise time	Page 19				
R&S RT-ZD10					
Rise time P-side		-		350.00 ps	
Rise time N-side		-		350.00 ps	
R&S RT-ZD20					
Rise time P-side		-		250.00 ps	
Rise time N-side		-		250.00 ps	
R&S RT-ZD30					
Rise time P-side		-		135.00 ps	
Rise time N-side		-		135.00 ps	
R&S RT-ZD40					
Rise time P-side		-		90.00 ps	
Rise time N-side		-		90.00 ps	

Measured	Ref.	Specified min. value	Determined value	Specified max. value	MU
DC characteristics					
Attenuation Error	Page 24				
–5.00 V	ϵ_{5n}	–0.500 %		0.500 %	
–2.00 V	ϵ_{2n}	–0.500 %		0.500 %	
–1.00 V	ϵ_{1n}	–0.500 %		0.500 %	
1.00 V	ϵ_{1p}	–0.500 %		0.500 %	
2.00 V	ϵ_{2p}	–0.500 %		0.500 %	
5.00 V	ϵ_{5p}	–0.500 %		0.500 %	
Zero Error	Page 28				
Zero error referenced to probe input	V_{Zero}	–3.000 mV		3.000 mV	
CMRR	Page 33				
Common mode rejection DC	$CMRR_{DC}$	50 dB		–	
R&S ProbeMeter					
Measurement Error, Differential Mode	Page 32				
–5.00 V	$V_{PM,DM,5n}$	–7.000 mV		7.000 mV	
–2.00 V	$V_{PM,DM,2n}$	–4.000 mV		4.000 mV	
–1.00 V	$V_{PM,DM,1n}$	–3.000 mV		3.000 mV	
0.00 V	$V_{PM,DM,0}$	–2.000 mV		2.000 mV	
1.00 V	$V_{PM,DM,1p}$	–3.000 mV		3.000 mV	
2.00 V	$V_{PM,DM,2p}$	–4.000 mV		4.000 mV	
5.00 V	$V_{PM,DM,5p}$	–7.000 mV		7.000 mV	

Measured	Ref.	Specified min. value	Determined value	Specified max. value	MU
Measurement Error, Common Mode	Page 33				
*) -8.00 V	$V_{PM,CM,8n}$	-10.000 mV		10.000 mV	
-5.00 V	$V_{PM,CM,5n}$	-7.000 mV		7.000 mV	
-2.00 V	$V_{PM,CM,2n}$	-4.000 mV		4.000 mV	
-1.00 V	$V_{PM,CM,1n}$	-3.000 mV		3.000 mV	
0.00 V	$V_{PM,CM,0}$	-2.000 mV		2.000 mV	
1.00 V	$V_{PM,CM,1p}$	-3.000 mV		3.000 mV	
2.00 V	$V_{PM,CM,2p}$	-4.000 mV		4.000 mV	
5.00 V	$V_{PM,CM,5p}$	-7.000 mV		7.000 mV	
*) 8.00 V	$V_{PM,CM,8p}$	-10.000 mV		10.000 mV	
Common mode rejection	$CMRR_{PM}$	50 dB			
Correction Parameters	Ref	Name	Determined value	Calibration data-set	Unit
Probe Output	Page 13				
Zero voltage		V_{RFC}		fVrfc	mV
Attenuation		A_{RFC}		fArfc	-

*) only for probes with serial number > 200 000

2 Adjustment

The R&S RT-ZD10/20/30/40 probes are delivered with valid factory calibration and adjustment. If the probe performance test fails, please see chapter "[Repair](#)" for troubleshooting or replacement of the probe.

3 Repair

This chapter describes the use of the service tools as well as the installation and operation of the R&S RT-Z device manager software. The chapter also contains an additional evaluation test for detailed error analysis.

The probe cannot be repaired. If the probe does not meet specifications or is damaged, it has to be replaced.

3.1 Functional Description

The probe consists of the probe head for connection to the DUT, the probe box for connection to the oscilloscope, and the probe cable.

3.1.1 Probe Head

The small and lightweight probe head is designed for easy handling and high-performance measurements. The probe head is used for connecting the probe and the DUT. Different accessories for the signal sockets and the ground socket allow the probe head to be connected to a wide range of DUTs.

Probe head

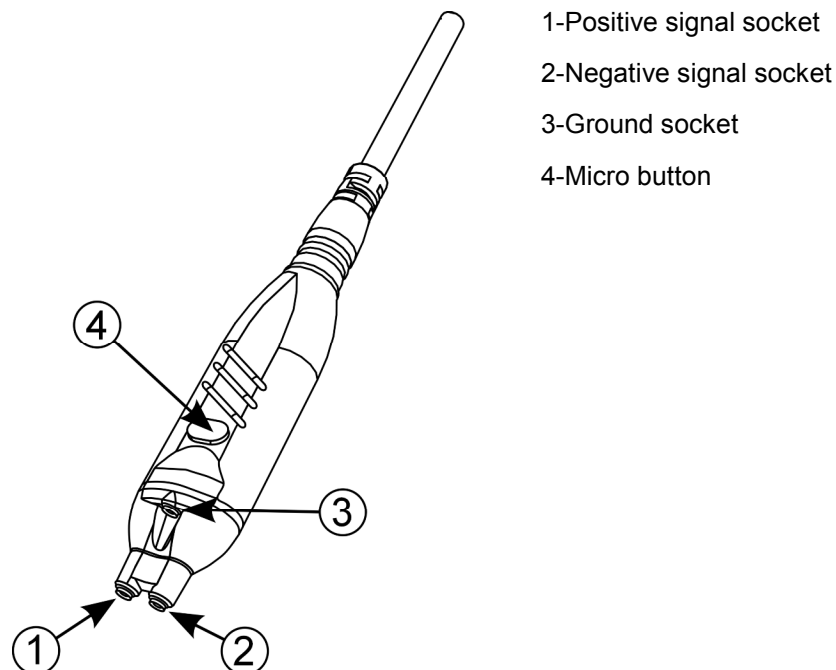
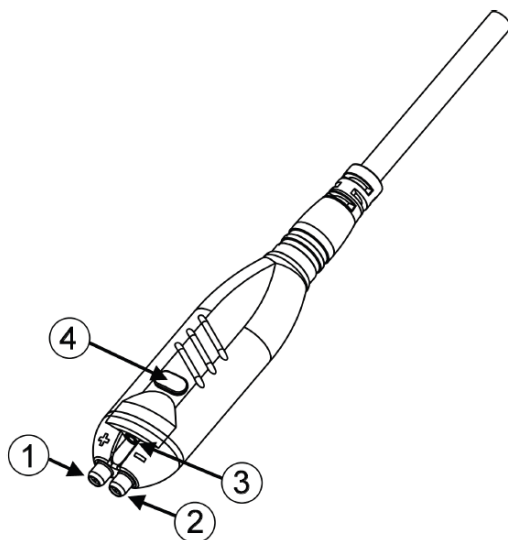


Figure 3-1: Probe head RT-ZD10/20/30

Probe head



- (1) Positive signal socket
- (2) Negative signal socket
- (3) Ground socket
- (4) Micro button

The accessories supplied for the probe head sockets are listed in chapter 5.4.

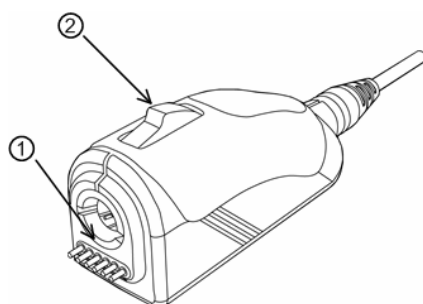
The ground socket is compatible with 0.64 mm (25 mil) square pins and 0.6 mm to 0.8 mm (24 mil to 35 mil) round pins.

The signal sockets have a spacing of 4 mm (160 mil).

Figure 3-2: Probe head RT-ZD40

3.1.2 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 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 that future probes can operate on any base unit that features a Rohde & Schwarz probe interface.



- 1. Rohde & Schwarz probe interface with BNC-compatible 7 mm (276 mil) connector and six pogo pins
- 2. Release knob

Figure 3-3: Probe box

3.2 Service Tools

Using the R&S RT-ZK2 service kit and the R&S RT-Z device manager software, the probe can be put into operation even without the R&S RTO base unit.

This is necessary for adapting the probe to external measuring equipment and for checking compliance with the specifications provided in the data sheet. Due to the narrowly specified data sheet values, the R&S RTO base unit cannot be used to check the specifications.

3.2.1 R&S RT-ZK2 Service Kit (1410.5305.02)

Item	Quantity	Description	Test equipment item no.
1	1	Probe tip adapter 2	9a
2	1	Probe box adapter	9b
3	2	SMA(m) to BNC(m) adapter	9c
4	3	BNC(f) to dual banana adapter	9d
5	1	N(f) to BNC(f) adapter	9e
6	1	BNC termination (m) 50 Ω	9f
7	1	BNC T connector	9g
8	1	BNC (m/m) cable 50 cm	9h
9	1	USB A/B cable 50 cm	9i
10	1	CD incl. service manual and R&S RT-Z device manager software	9j
11	2	Browser adapter (RT-ZD10/20/30)	9k
12	1	Adapter square pin (RT-ZD10/20/30)	9l
13	2	Socket adapter, variable spacing (RT-ZD40)	9m
14	2	Browser adapter, spring loaded (RT-ZD40)	9n

Table 10: Content of service kit RT-ZK2

3.2.2 R&S RT-Z Device Manager Software

The supplied CD (item 9j) contains the R&S RT-Z device manager software. For information on updating the software, refer to the release notes or contact your Rohde & Schwarz Service Center.

The R&S RT-Z device manager software is necessary to perform the following:

- Read back device information
- Read back the correction parameters which are needed for evaluating the performance test
- Firmware update of the probe
- Selftest
- Read the R&S ProbeMeter voltage
- Set the offset compensation voltage

3.2.2.1 Hardware Requirements

- Computer with Windows XP operating system
- USB port
- 4 Mbyte of free hard disk space

NOTICE

Device Manager Software update

The latest Device Manager Software RT-Z has to be used at all times.

The latest Software is supplied on the product CD or can be downloaded from the R&S Firmware Software database.

3.2.2.2 Software Installation

1. To install the R&S RT-Z device manager software, run the Setup.exe file. The self-extractor program will start and guide you through the installation.



Figure 3-4: Installation wizard start window

2. When you are prompted for the installation path, leave the default path "C:\Program Files\Rohde-Schwarz\rsrtzdm" unchanged.

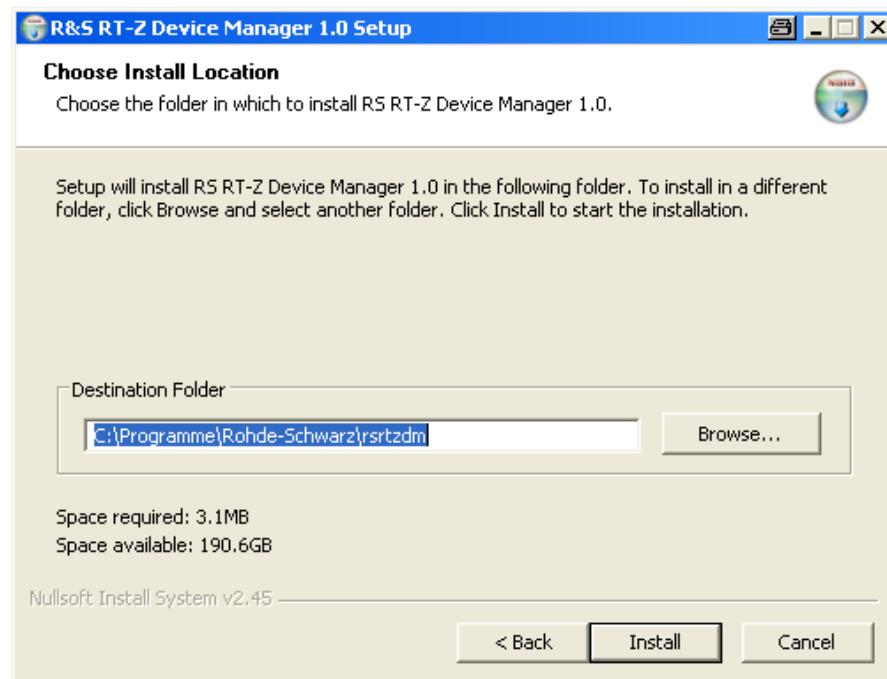


Figure 3-5: Installation location

3. After you have set the installation location, the program will install all required program routines as well as all required drivers for the probe. The installation status can be seen on the progress bar (see Figure 3-6).

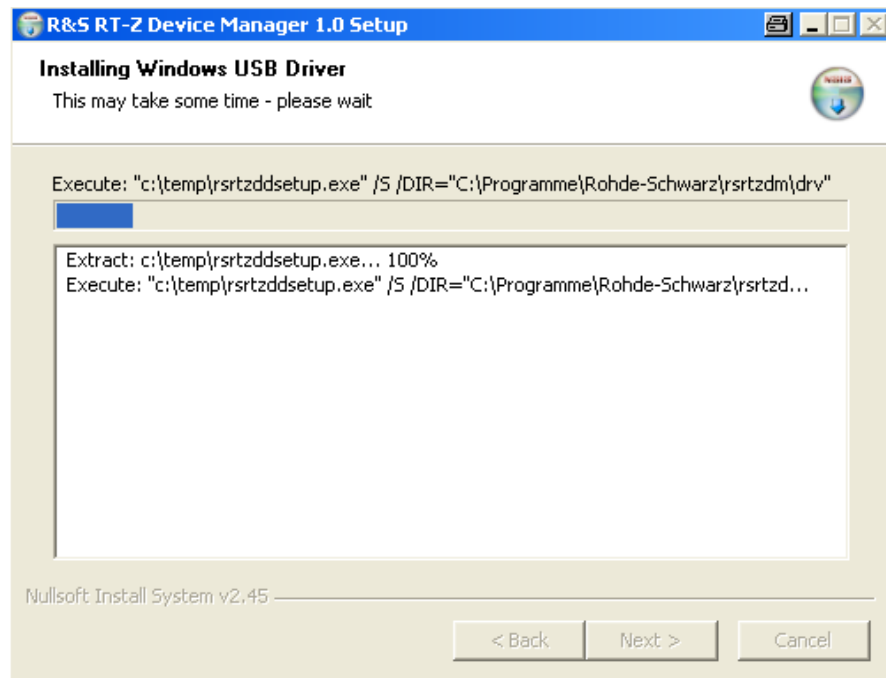


Figure 3-6: Installation progress

4. After all routines have been installed, you need to complete the installation and click Finish.



Figure 3-7: Installation completion

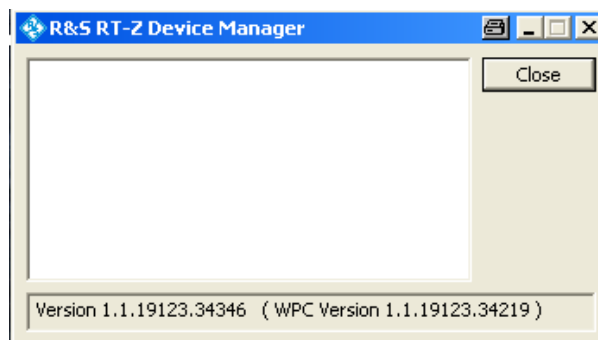
3.2.2.3 Starting the Application

The installation wizard creates a subdirectory on your Windows start menu. To start the software application, click the R&S RT-Z Device Manager menu item.

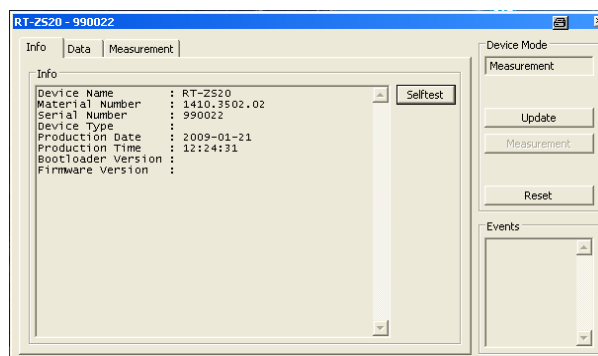
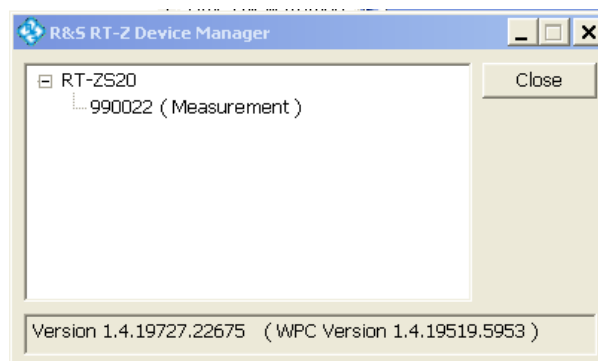


Figure 3-8: Program start menu

If no probe is connected or recognized on the computer via USB, R&S RT-Z device manager will start up with the following application window.



As soon as the probe has been recognized, the application starts with the startup screen displaying the DUT serial number.



3.3 Troubleshooting

3.3.1 Functional Check

Perform the functional check using an R&S RTO base unit as described in the R&S RT-ZD10/20/30/40 operating manuals. This test enables you to check the quality of the interplay between the probe and the base unit. This test checks the DC offset, DC accuracy and offset compensation function.

3.3.2 Selftest

The selftest checks all the required supply voltages of the probe and runs automatically in the background every time the probe is connected to the base unit. Using the R&S RT-Z device manager software, you can read out the status report of the selftest and check it for errors.

Required test equipment & test setup:

See chapter 1.3.1 "Configuring the Probe Box Adapter".

Starting the selftest:

1. Select the "Info" tab in R&S RT-Z device manager.
2. Start the selftest by pressing the "Selftest" button.

Evaluation of the results:

- Check the evaluation statement. "PASS" should be indicated for all parameters.

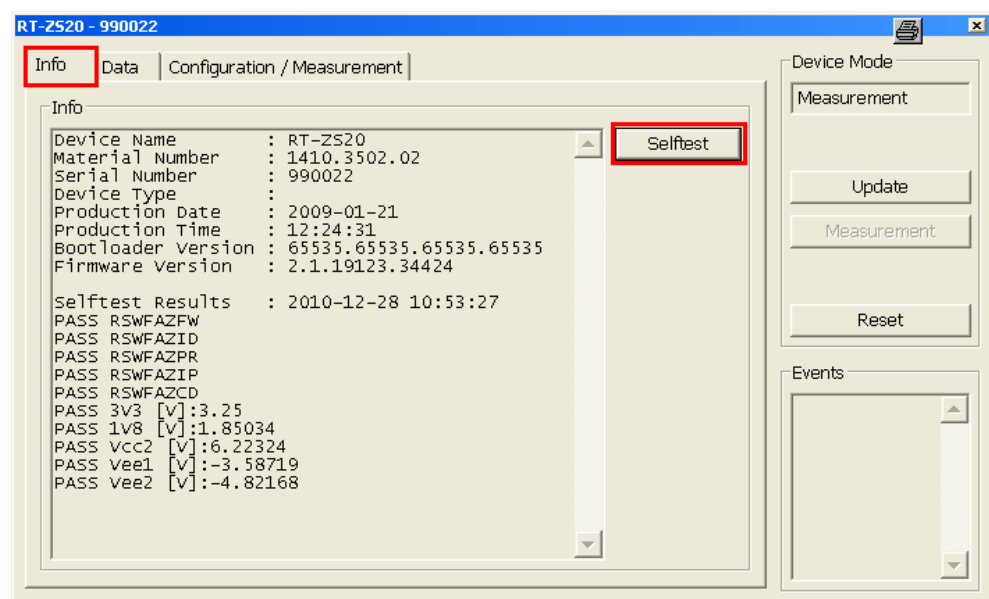


Figure 3-9: Selftest status report

3.3.3 Micro Button

The functionality of the micro button must be tested.

Required test equipment & test setup:

See chapter 1.3.1 "Configuring the Probe Box Adapter".

Testing the micro button:

1. Select the "Data" tab in R&S RT-Z device manager.
2. Press and release the micro button and check the event window for results.

Evaluation of the results:

- ▶ Micro button pressed: Check event window for "Key down".
- ▶ Micro button released: Check event window for "Key up".

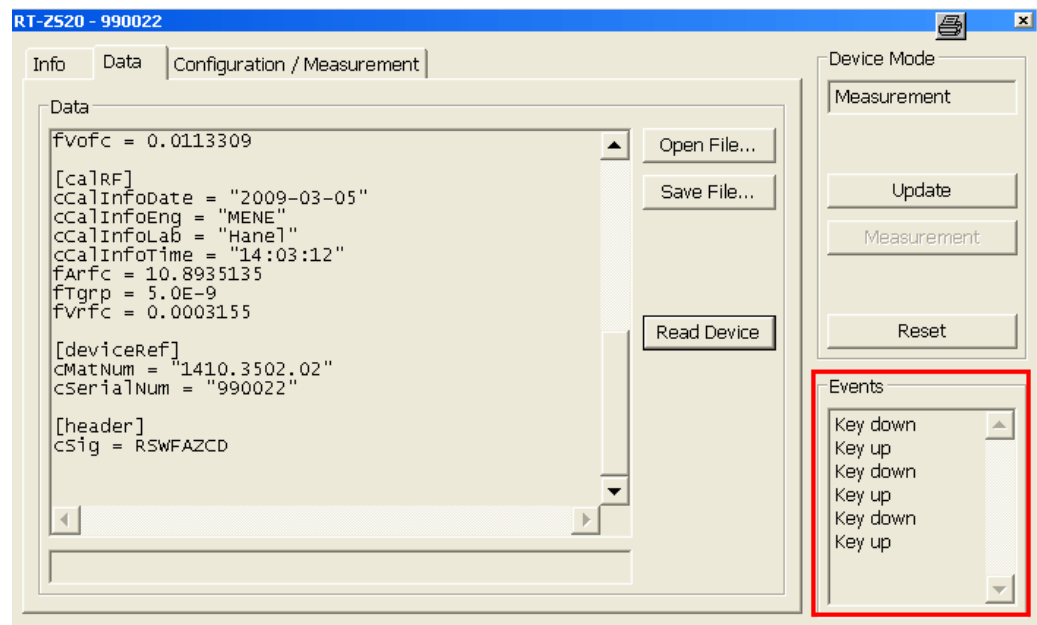


Figure 3-10: Event window for micro button test

3.3.4 Replacing the pogo pins

The pogo pins connect the probe box to the R&S oscilloscope for power supply and digital communication. To replace the pogo pins the probe box needs to be disassembled.

3.3.4.1 Opening the Probe Box

To open the probe box a flat screw driver size 2 or a plastic adjustment tool is necessary:

1. Slide of the protective sleeve in the direction shown at Figure 3-11.
2. Remove the circlip with a screw driver.

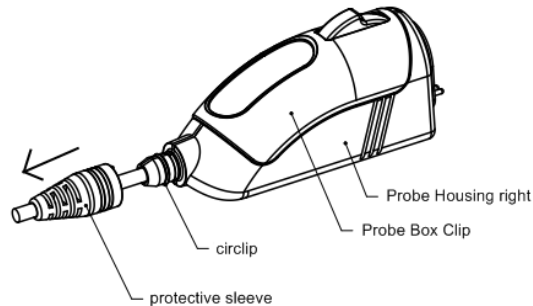


Figure 3-11: Removing sleeve and circlip

3. Remove probe box clip using a screw driver. Gently bent up the clip on the position shown on Figure 3-12. Repeat this on the other side and remove the probe box clip.



Figure 3-12: Removing probe box clip

4. Remove the right probe housing. Turn the probe around and press a screwdriver into the opening for the locking hook. Start on the front side as shown in Figure 3-13. Once the locking hook is disengaged repeat the procedure on the other end.



Figure 3-13: Removing the probe housing

5. Open the probe housing

3.3.4.2 Replacing the Pogo Pins

Now you have access to the probe box components.

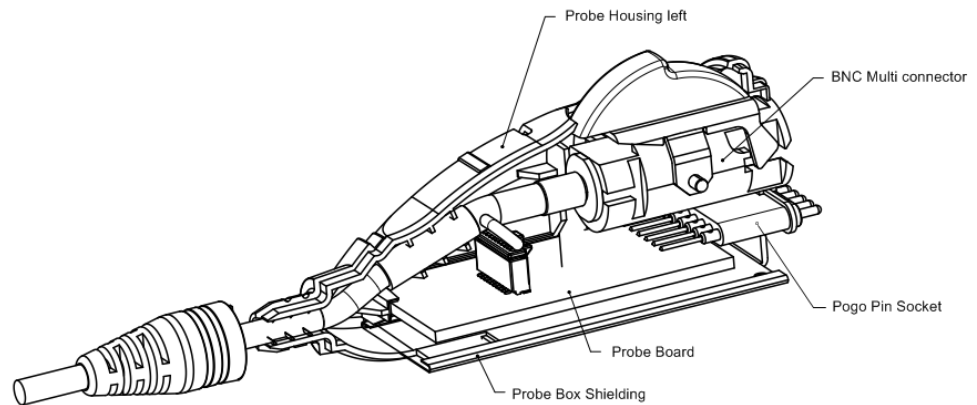


Figure 3-14: Opened probe box

1. Extract the probe board along with the pogo pin connector from the fixture.
2. Remove the pogo pin connector from the probe board socket as shown in Figure 3-15.
3. Mount the new pogo pin connector on the probe board socket

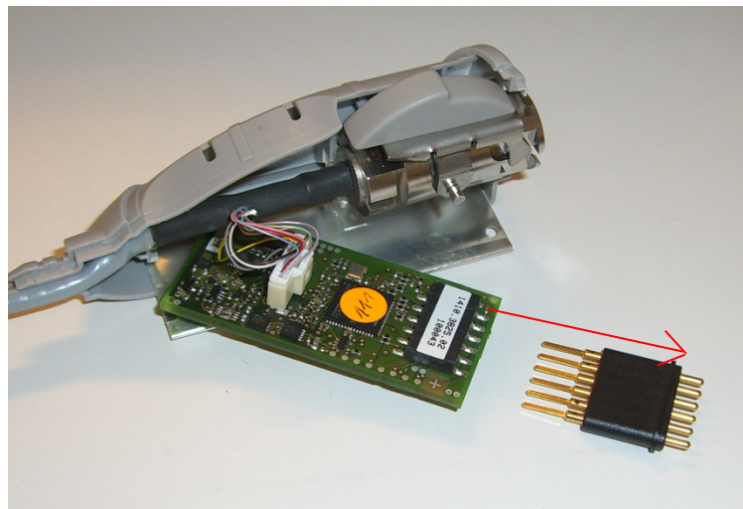


Figure 3-15: Replacing the pogo pin connector

3.3.4.3 Closing the Probe Box

Ensure all components fit in the right position within the left housing before the right housing shell is mounted.

1. Insert the probe board with the pogo pin connector as shown in Figure 3-16.

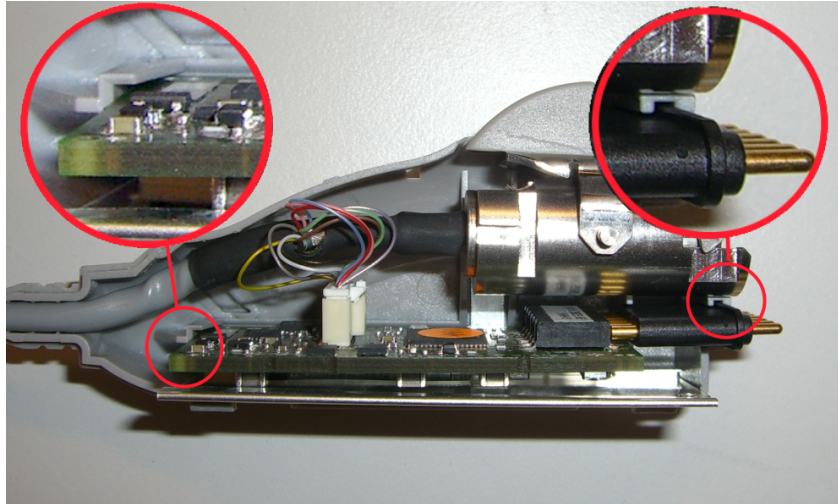


Figure 3-16: Assembling the probe box

2. Snap in the right housing. Ensure the locking hooks will click into place and lock correctly.

Note: When mounting the right housing make sure that no cables are damaged.

3. Mount the probe box clip.
4. Move the circlip on the first slot as shown in Figure 3-17.
5. Mount the protective sleeve. The noses of the protective sleeve are inserted in the groove of the probe box housing.

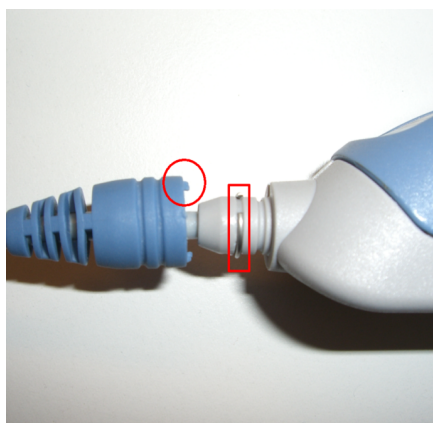


Figure 3-17: Assembling circlip and sleeve

4 Software Update / Installing Options

This chapter contains information on updating the software of the R&S RT-ZD probes.

4.1 Installing a new R&S RT-ZD10/20/30/40 Firmware

For information on updating software refer to the release notes. The most recent version is provided at www.rohde-schwarz.com.

Required test equipment & test setup:

See chapter 1.3.1 "Configuring the Probe Box Adapter".

Preparation for the firmware update:

- ▶ Download the update file.
- ▶ Extract the contents of the ZIP file to a temporary folder, e.g. C:\My temp.

Updating the R&S RT-ZD10/20/30/40 firmware:

1. Initiate the update process by clicking the "Update" button.

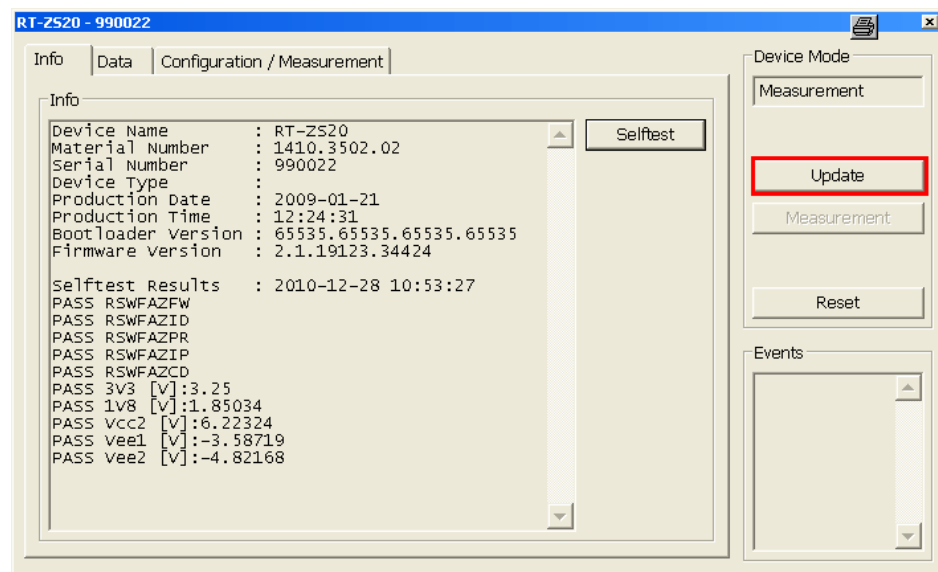


Figure 4-1: R&S RT-Z device manager software

2. The "Device Mode" of the software application will change to "Update" mode (a). The "Configuration / Measurement" tab will change to "Update" (b) as shown in Figure 4-2.
3. Select the "Update" tab and click "Open file ..." (c) to load the firmware file for updating the probe software.

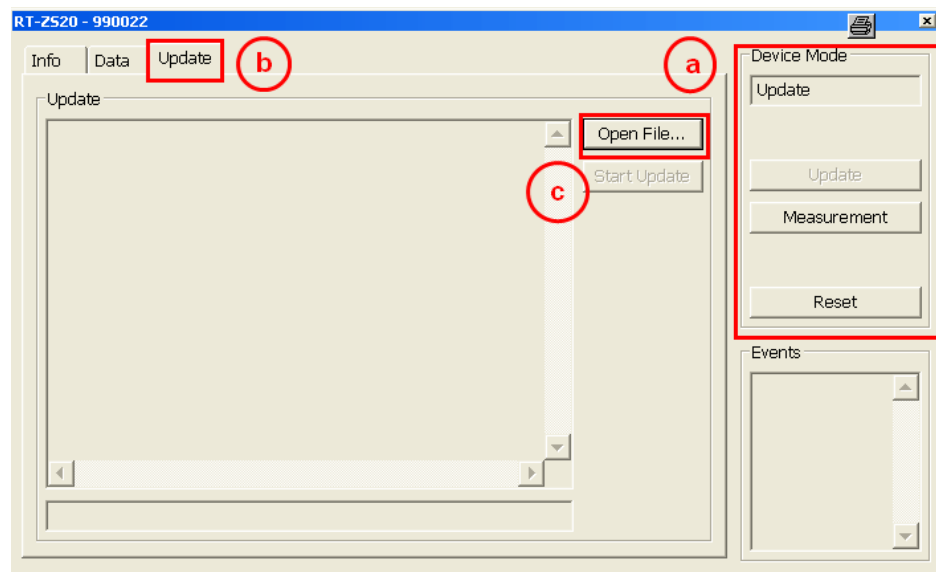


Figure 4-2: R&S RT-Z device manager software update mode

4. Navigate to the directory where the DUT firmware is hosted (e.g. C:\My temp) and select the update file wfaz_fw_2_1_19123_34424.img.

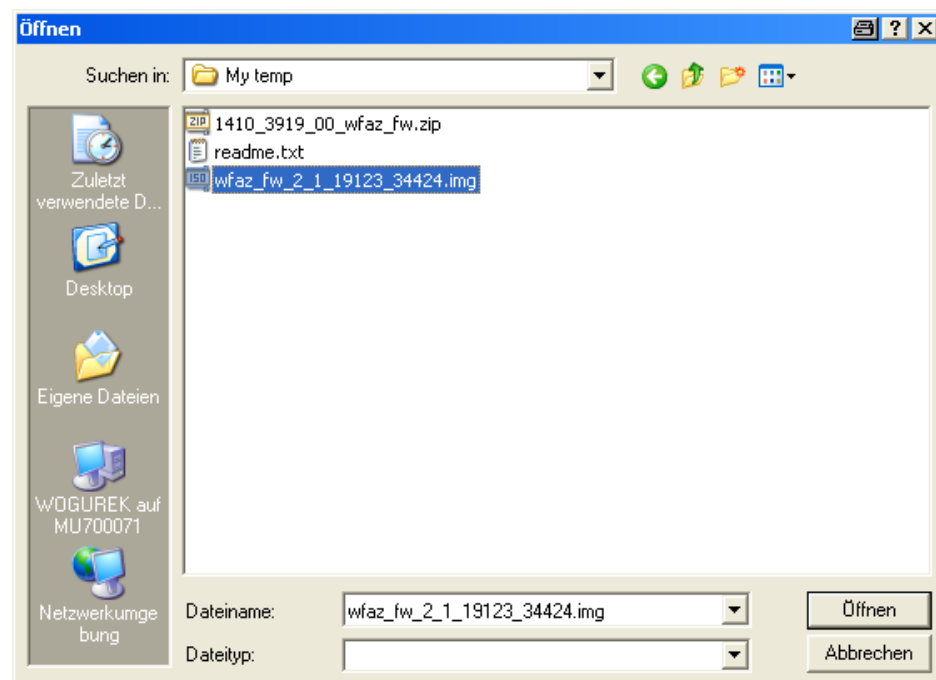


Figure 4-3: Update firmware location

5. To update the probe firmware, click the “Start Update” button and watch the progress bar until the “update succeeded” message is displayed.

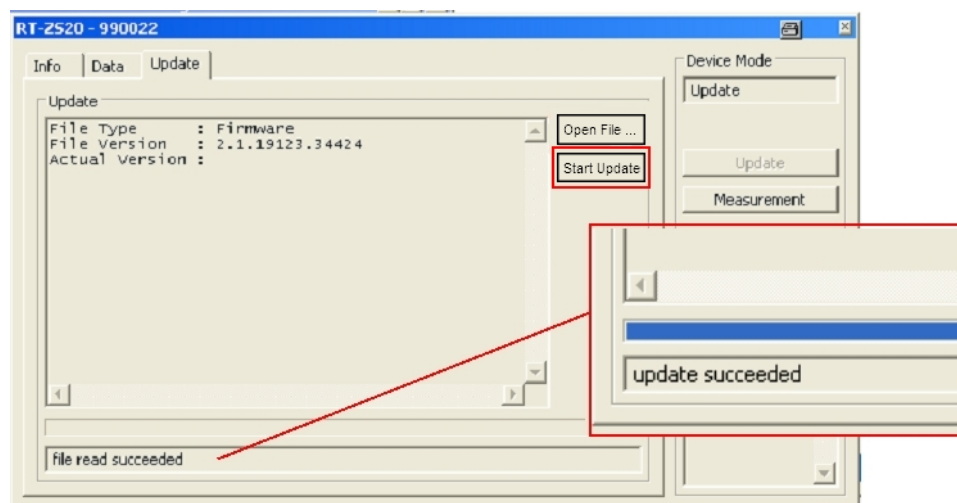


Figure 4-4: Firmware update progress status

5 Documents

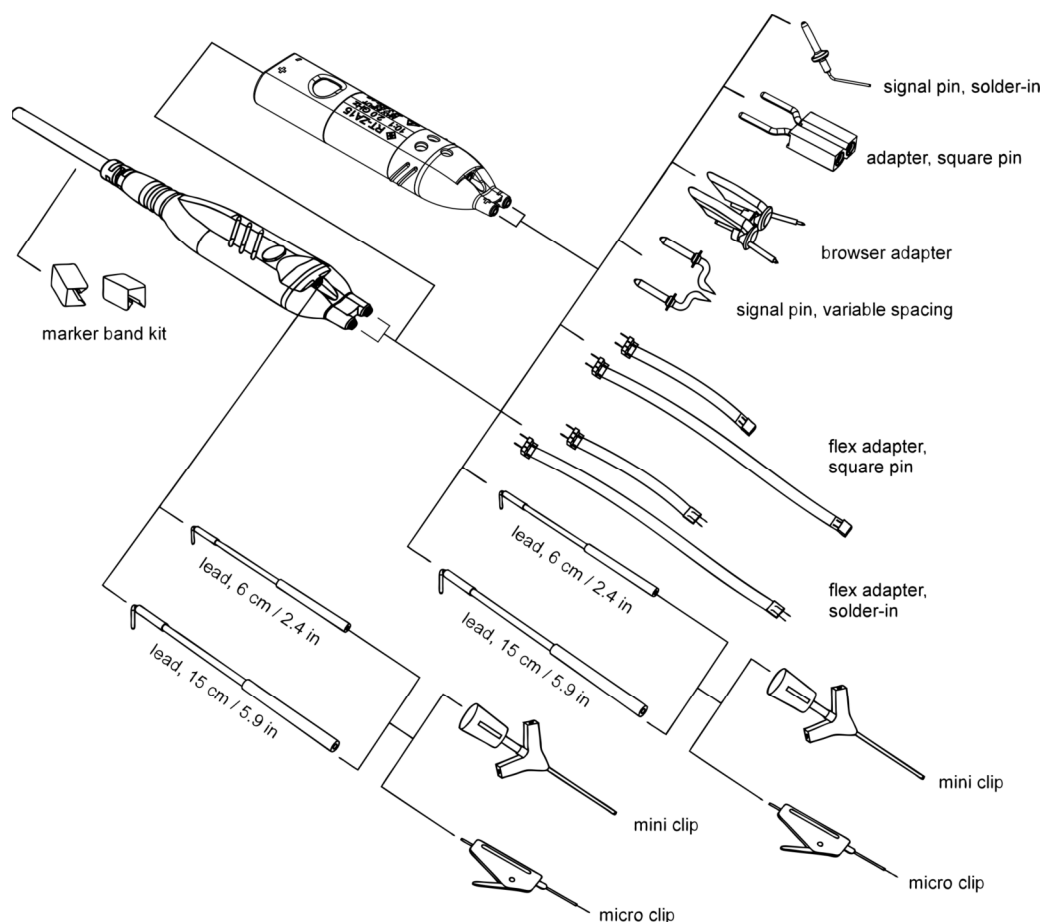
This chapter provides information on ordering spare parts and contains the spare parts list.

5.1 Spare Parts RT-ZD

Pos	Item	Description	Part Number
1	RT-ZD10	Active Probe 1,0 GHz	1410.4715.02
2	RT-ZD20	Active Probe 1,5 GHz	1410.4409.02
3	RT-ZD30	Active Probe 3,0 GHz	1410.4609.02
4	RT-ZD40	Active Probe 4,5 GHz	1410.5205.02
5	Pogo Pin	Pogo Pin Connector, 6 pins	3584.6396.00
6	RT-ZK2	RT-ZK2 Service Kit	1410.5305.02
7	ESD Wrist Strap	ESD Wrist Strap	0008.9959.00
8	ESD Grounding Cable	ESD Grounding Cable	1043.4962.00

Table 1: Spare Parts

5.2 Accessories RT-ZD10/20/30



5.3 Accessory List RT-ZD10/20/30

Pos	Item	Description	Part Number
1		Signal pin, solder-in	1417.0538.00
2		Signal pin, variable spacing	1417.0550.00
3		Browser adapter	1417.0509.00

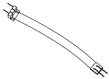
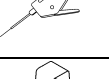
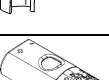
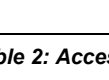
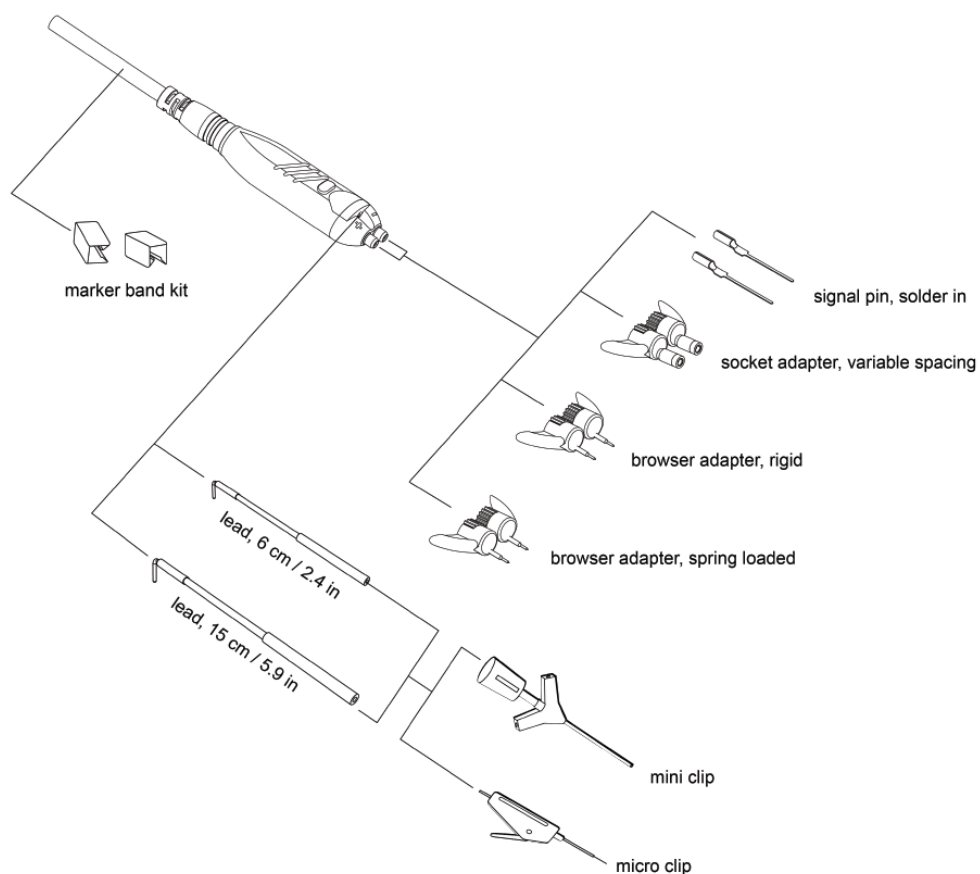
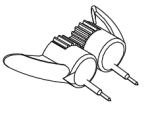
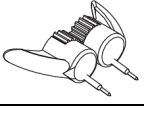
Pos	Item	Description	Part Number
4		Adapter, square pin	1417.0573.00
5		Flex adapter, solder-in, 4 cm / 1.6 in	1417.0596.00
6		Flex adapter, square pin, 4 cm / 1.6 in	1417.0580.00
7		Lead, 6 cm / 2.4 in	1416.0128.00
8		Lead, 15 cm / 5.9 in	1416.0134.00
9		Mini clip	1416.0105.00
10		Micro clip	1416.0111.00
11		Marker band kit	1416.0205.00
12		RT-ZA15 External attenuator	1410.4744.02
13		Adjustment tool	1416.0057.00

Table 2: Accessories RT-ZD10/20/30

5.4 Accessories RT-ZD40



5.5 Accessory List RT-ZD40

Pos	Item	Description	Part Number
1		Browser adapter, spring loaded	1417.0680.00
2		Browser adapter, rigid	1417.0673.00

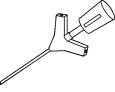
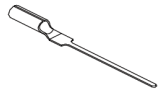
Pos	Item	Description	Part Number
3		Socket adapter, variable spacing	1417.0667.00
4		Lead, 6 cm / 2.4 in	1416.0128.00
5		Lead, 15 cm / 5.9 in	1416.0134.00
6		Mini clip	1416.0105.00
7		Micro clip	1416.0111.00
8		Marker band kit	1416.0205.00
9		Signal pin, solder-in	1417.0838.00

Table 3: Accessories RT-ZD40