

R&S® ZNB/ZNBT

Vector Network Analyzers

Getting Started



1316.0062.02 – 20

This manual describes the following vector network analyzer types:

- R&S® ZNB4, 2 test ports, order no. 1311.6010.22
- R&S® ZNB4, 4 test ports, order no. 1311.6010.24
- R&S® ZNB8, 2 test ports, order no. 1311.6010.42
- R&S® ZNB8, 4 test ports, order no. 1311.6010.44
- R&S® ZNB20, 2 test ports, order no. 1311.6010.62
- R&S® ZNB20, 4 test ports, order no. 1311.6010.64
- R&S® ZNB40, 2 test ports, order no. 1311.6010.72
- R&S® ZNBT8, 4 test ports (up to 24 ports optional), order no. 1318.7006.24

The software contained in this product makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgment" on the user documentation CD-ROM (included in delivery).

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

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Trade names are trademarks of the owners.

Throughout this guide R&S® is abbreviated as R&S.

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

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

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

Safety labels on products

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

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

Basic Safety Instructions

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

Signal words and their meaning

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



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



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



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



Indicates information considered important, but not hazard-related, e.g. messages relating to property damage.
In the product documentation, the word ATTENTION is used synonymously.

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

Basic Safety Instructions

Operating states and operating positions

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

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

Electrical safety

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

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

Basic Safety Instructions

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

Operation

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

Basic Safety Instructions

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

Repair and service

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

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

Batteries and rechargeable batteries/cells

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

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

Transport

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

Instrucciones de seguridad elementales

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 señalar 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.

Quality management and environmental management

Certified Quality System
ISO 9001

Certified Environmental System
ISO 14001

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde&Schwarz Produktes entschieden. Sie erhalten damit ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unserer Qualitäts- und Umweltmanagementsysteme entwickelt, gefertigt und geprüft. Rohde&Schwarz ist unter anderem nach den Managementsystemen ISO9001 und ISO 14001 zertifiziert.

Der Umwelt verpflichtet

- Energie-effiziente, RoHS-konforme Produkte
- Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
- ISO 14001-zertifiziertes Umweltmanagementsystem

Dear customer,

You have decided to buy a Rohde&Schwarz product. This product has been manufactured using the most advanced methods. It was developed, manufactured and tested in compliance with our quality management and environmental management systems. Rohde&Schwarz has been certified, for example, according to the ISO9001 and ISO 14001 management systems.

Environmental commitment

- Energy-efficient products
- Continuous improvement in environmental sustainability
- ISO 14001-certified environmental management system

Cher client,

Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests de ce produit ont été effectués selon nos systèmes de management de qualité et de management environnemental. La société Rohde&Schwarz a été homologuée, entre autres, conformément aux systèmes de management ISO9001 et ISO 14001.

Engagement écologique

- Produits à efficience énergétique
- Amélioration continue de la durabilité environnementale
- Système de management environnemental certifié selon ISO 14001



Customer Support

Technical support – where and when you need it

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

Up-to-date information and upgrades

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

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1 Documentation Map

The R&S ZNB/ZNBT documentation is delivered as a printed Getting Started guide and a documentation CD-ROM providing the complete user documentation. In addition, a help system is embedded in the instrument.

Getting Started Guide

The Getting Started guide describes everything that is needed to put the instrument into operation and helps you to get familiar with the R&S ZNB/ZNBT. It gives an introduction to the instrument's operating concept and provides simple measurement examples. A printed Getting Started guide is delivered with each R&S ZNB/ZNBT.

User Manual

The User Manual complements the Getting Started guide, providing a detailed description of the instrument's capabilities, examples and reference information for manual and remote control. The User Manual is available on the documentation CD-ROM; the most recent version is available for download on the R&S ZNB/ZNBT product pages on the R&S internet.

Help System

The help system is embedded in the instrument, offering quick, context-sensitive reference to the information needed for operation and programming. It comprises the complete information of the Getting Started guide and the User Manual.

You can use the help also if you control the instrument from an external monitor. Furthermore you can transfer the help to your PC and use it as a standalone help.

Documentation CD-ROM

The CD-ROM contains the complete user documentation for the R&S ZNB/ZNBT:

- the help system
- the Getting Started guide in printable form
- the User Manual in printable form
- brochures and data sheets in printable form
- the Service Manual in printable form
- links to various useful sites in the R&S Internet

2 Putting the Analyzer into Operation

This section describes the basic steps to be taken when setting up the analyzer for the first time.

Simple measurement examples are provided in [Chapter 5, "Performing Measurements"](#), on page 59; for a description of the operating concept refer to [Chapter 4, "Operating the Instrument"](#), on page 34. For all background and reference information concerning manual and remote control of the instrument refer to your analyzer's help system or user manual. A more detailed description of the hardware connectors and interfaces is also part of the help system or user manual.

WARNING

Risk of injury and instrument damage

The instrument must be used in an appropriate manner to prevent electric shock, fire, personal injury, or damage.

- Do not open the instrument casing.
- Read and observe the "Basic Safety Instructions" at the beginning of this manual, in addition to the safety instructions in the following sections. Notice that the data sheet may specify additional operating conditions.

NOTICE

Risk of instrument damage during operation

An unsuitable operating site or test setup can damage the instrument and connected devices. Ensure the following operating conditions before you switch on the instrument:

- All fan openings are unobstructed and the airflow perforations are unimpeded. The minimum distance from the wall is 10 cm.
- The instrument is dry and shows no sign of condensation.
- The instrument is positioned as described in the following sections.
- The ambient temperature does not exceed the range specified in the data sheet.
- Signal levels at the input connectors are all within the specified ranges.
- Signal outputs are correctly connected and are not overloaded.

2.1 Unpacking and Checking the Instrument

Check the equipment for completeness using the delivery note and the accessory lists for the various items. Should you notice any damage, immediately contact the carrier who delivered the instrument.

**Packing material**

Retain the original packing material. If the instrument needs to be transported or shipped at a later date, you can use the material to protect the control elements and connectors.

**CAUTION****Risk of injury and damage during transportation and shipment**

Insufficient protection against mechanical and electrostatic effects during transportation and shipment can damage the instrument.

- Always make sure that sufficient mechanical and electrostatic protection is provided.
- When shipping an instrument, the original packaging should be used. If you do not have the original packaging, use sufficient padding to prevent the instrument from moving around inside the box. Pack the instrument in antistatic wrap to protect it from electrostatic charging.
- Secure the instrument to prevent any movement and other mechanical effects during transportation.

The **carrying handles** at the front of the casing are designed to lift or carry the instrument. Do not apply an excessive external force to the handles.

As the R&S ZNBT is **very heavy** (over 35 kg fully equipped), it must always be carried by two people using both carrying handles to avoid personal injury or damage to the instrument.

Observe the information on transporting heavy instruments in the basic safety instructions included at the front of the printed manual and on the supplied CD ROM.

2.2 Positioning the Instrument

The network analyzer is designed for use under laboratory conditions, either on a bench top or in a rack. Notice the general ambient conditions at the operating site described under "[Risk of instrument damage during operation](#)" on page 8.

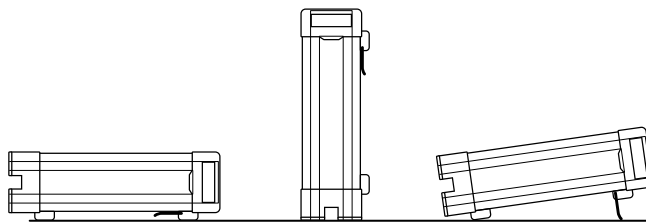
NOTICE**Risk of electrostatic discharge**

Electrostatic discharge (ESD) can cause damage to the electronic components of the DUT and the analyzer. ESD is most likely to occur when you connect or disconnect a device under test (DUT) or test fixture to the analyzer's test ports.

To prevent ESD, use a wrist strap and cord and connect yourself to the ground connector on the rear panel of the R&S ZNB/ZNBT. For additional information refer to the "Instructions for Electrostatic Discharge Protection" on the R&S ZNB/ZNBT documentation CD-ROM.

2.3 Bench Top Operation

If the analyzer is operated on a bench top, the surface should be flat. The instrument can be used in horizontal or vertical position, standing on its feet, or with the support feet on the bottom expanded.



2.4 Operation in a 19" Rack

The R&S ZNB/ZNBT can be mounted in 19" racks using the adapter R&S ZZA-KN5 (order number 1175.3040.00). Proceed according to the mounting instructions supplied with the rack adapter.

NOTICE**Risk of instrument damage in a rack**

An insufficient airflow can cause the instrument to overheat, which may disturb the operation and even cause damage.

Make sure that all fan openings are unobstructed, that the airflow perforations are unimpeded, and that the minimum distance from the wall is 10 cm.

2.5 EMI Suppression

Electromagnetic Interference (EMI) may affect the measurement results.

To suppress generated Electromagnetic Interference:

- Use suitable shielded cables of high quality. For example use double-shielded RF and LAN cables.
- Always terminate open cable ends.
- Note the EMC classification in the data sheet.

2.6 Connecting the Analyzer to the AC Supply

The network analyzer is automatically adapted to the AC supply voltage, which must be in the range of 100 V to 240 V at 50 Hz to 60 Hz. For the R&S ZNB 400 Hz is also supported. The mains connector is located in the upper part of the rear panel (see [Chapter 3.3, "Rear Panel R&S ZNB"](#), on page 29 or [Chapter 3.4, "Rear Panel R&S ZNBT"](#), on page 31).

- ▶ Connect the network analyzer to the AC power source using the AC power cable delivered with the instrument.

The maximum power consumption and the typical power consumption of the individual analyzer models are listed in the data sheet.

The R&S ZNBT is protected by a fuse located below the AC power switch; see [Chapter 7.2, "Replacing Fuses"](#), on page 71.

2.7 Starting the Analyzer and Shutting Down

The AC power switch is located in the upper part of the rear panel, together with the mains connector and the fuse drawer (R&S ZNBT only; see [Chapter 3.3, "Rear Panel R&S ZNB"](#), on page 29 or [Chapter 3.4, "Rear Panel R&S ZNBT"](#), on page 31).

To start the analyzer, proceed as follows:

1. Switch the AC power switch to position I (On).
After power-on, the analyzer automatically goes to standby or ready state, depending on the state of the standby toggle key at the front panel when the instrument was switched off last time.
2. If necessary, press the standby toggle key on the front panel to switch the instrument to ready state (R&S ZNB: green LED goes on; R&S ZNBT PWR LED turns from amber to green).

The analyzer automatically performs a system check, boots the Windows® operating system and then starts the network analyzer (VNA) application. If the last analyzer session was terminated regularly, the VNA application uses the last recall set with all instrument settings.

To shut down the analyzer, proceed as follows:

1. Press the standby key.
This will cause the instrument to save the current recall set, close the VNA application, shut down Windows®, and go to standby state. Of course you can also perform these steps manually, like in any Windows session.
2. If desired, set the AC power switch to position **O** (Off).

NOTICE

Risk of data loss

It is strongly recommended to switch the analyzer to standby state before disconnecting it from the AC supply. If you set the power switch to 0 while the VNA application is still running, you will lose the current settings. Moreover, loss of program data can not be excluded if the application is terminated improperly.



The AC power switch can be permanently on. It is recommendable, however, to switch it off if the instrument is not used for some time. When you switch the instrument back on, be sure to comply with the extended warm-up phase specified in the data sheet.

2.8 Standby and Ready State



R&S ZNB: The standby toggle key is located in the bottom left corner of the front panel. In standby state, the right, amber LED is on, in ready state, the left, green LED is on.



R&S ZNBT: The standby toggle key is located in the bottom right corner of the front panel. In standby state the PWR LED light is amber, in ready state it is green.

The standby power only supplies the power switch circuits and the optional oven quartz (option R&S ZNB-B4/R&S ZNBT8-B4, "OCXO Frequency Reference"). In this state it is safe to switch the AC power off and disconnect the instrument from the power supply. In ready state all modules are power-supplied. When switched to ready state, the analyzer initiates its startup procedure.

Observe the instructions for startup and shutdown in [Chapter 2.7, "Starting the Analyzer and Shutting Down"](#), on page 11.

2.9 Connecting External Accessories

The analyzer's standard PC interfaces (DVI-D, USB, LAN) can be used to connect a variety of accessories:

- An external monitor expands/displays the Windows® desktop, which is, by default, covered by the Vector Network Analyzer (VNA) application window in full-screen mode.

- External keyboard and mouse enable/simplify local control, in particular manual (GUI) operation of the VNA application.
- A printer can be used for example to create hard copies of the measurement diagrams and traces from within the VNA application.
- A LAN connection can be established in order to access the hard disk or control the analyzer from an external PC.



For the R&S ZNBT an external monitor and mouse are required for local operation. The R&S ZNB can be fully controlled by tapping the touchscreen and front panel keys.

2.9.1 Connecting a Monitor



A standard monitor can be connected to the MONITOR (DVI-D) connector of the R&S ZNB/ZNBT. No extra configuration is required.

NOTICE

Safety aspects

The monitor must be connected while the instrument is switched off (or in standby mode). Otherwise correct operation can not be guaranteed.

Select "DISPLAY > View Bar > Hard Key Panel" from the Menu bar of the VNA application to add the (virtual) "Hard Key Panel" to the analyzer screen.

2.9.2 Connecting a Keyboard

A keyboard can be connected to any of the USB connectors. After being auto-detected by the operating system it can safely be disconnected and reconnected even during measurements.



Keyboard configuration

The default input language is English – US. Select "Control Panel > Clock, Language, and Region > Region and Language > Keyboards and Languages" from the Windows® Start menu to configure the keyboard properties.

To access Windows®, press the Windows key on the front panel (R&S ZNB only) or on the external keyboard.

2.9.3 Connecting a Mouse

A USB mouse can be connected to any of the USB connectors. After being auto-detected by the operating system it can safely be disconnected and reconnected even during measurements.



Mouse configuration

Select "Control Panel > Hardware and Sound > Devices and Printers > Mouse" from the Windows® "Start" menu to configure the mouse properties.

To access Windows®, press the Windows key on the front panel (R&S ZNB only) or on the external keyboard.

2.9.4 Connecting a Printer

A printer can be connected to any of the USB connectors. After successful installation it can safely be disconnected and reconnected even during measurements. When printing a copy (PRINT), the analyzer checks whether a printer is connected and turned on and whether the appropriate printer driver is installed.



Printer driver installation

If required, printer driver installation is initiated using the operating system's "Add Printer Wizard". The wizard is self-explanatory. A printer driver needs to be installed only once, even though the printer may be temporarily removed from the analyzer.

A great variety of printer drivers is available on the analyzer. To obtain the complete list, select "Control Panel > Hardware and Sound > Devices and Printers" from the Windows® "Start" menu.

To access Windows®, press the Windows key on the front panel (R&S ZNB only) or on the external keyboard.

You can load updated and improved driver versions or new drivers from an installation disk, USB memory stick or another external storage medium. Alternatively, if the analyzer is integrated in a network, you can install driver data stored in a network directory. In either case, use the "Add Printer" wizard to complete the installation.



Printer configuration

Use the "Page Setup" dialog or the "Start > Control Panel > Devices and Printers" menu of Windows® to configure the printer properties and printing preferences.

2.9.5 Connecting a LAN Cable

A LAN cable can be connected to the LAN connector on the rear panel of the analyzer. To establish a LAN connection proceed as follows:

1. Refer to section [Chapter 2.12.1, "Assigning an IP Address"](#), on page 17 and learn how to avoid connection errors.
2. Connect a CAT6 or CAT7 RJ-45 (LAN, Ethernet) cable to the LAN port.

The LAN port of the analyzer is an auto-crossover Ethernet port. You can connect it to a network that is equipped with Ethernet hardware (hub, switch, router), but you can

also set up a direct connection to a computer or another test instrument. For both connection types, you can use either crossover or straight through (patch) cables.

The IP address information is shown in the "SETUP > Remote Settings" softtool panel and on the [Mini display](#) (R&S ZNBT only).

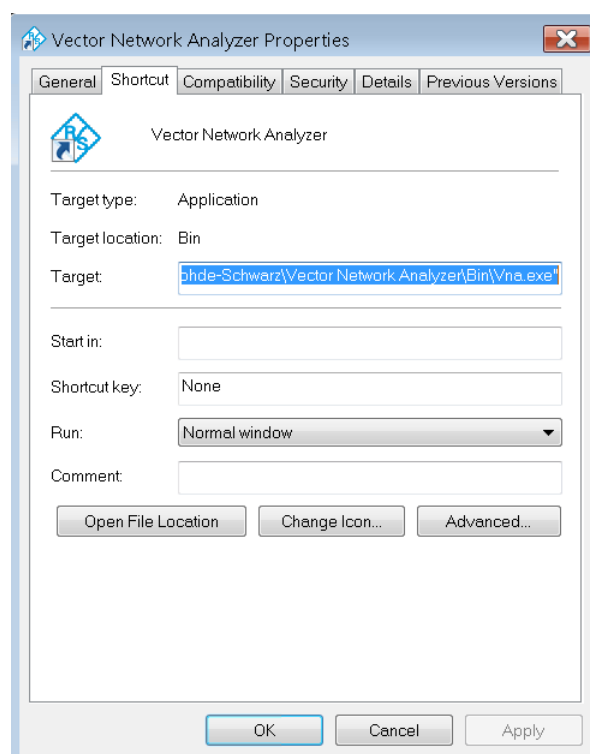
2.10 Minimizing the VNA application

With a minimized VNA application, you can access your analyzer's Windows® desktop or run other applications.

To exit the default full-screen mode of the VNA application, deselect "Display > View Bar > Title and Task Bar On". Then use the standard titlebar functions to minimize/maximize/close the application window

To automatically start the VNA application with a minimized window

1. Right-click the VNA shortcut icon on the desktop and open the "Properties" dialog.
2. In the "Shortcut" tab, select "Run: Minimized"



After a software update the VNA application is started with a maximized window again. Moreover, if a second VNA application is started after a first, minimized application, this will cause the first application to appear in the foreground.

2.11 Changing the Screen Resolution (R&S ZNBT)

In case the R&S ZNBT fails to properly adjust the display resolution when an external monitor is connected, proceed as follows:

1. Connect a USB keyboard and mouse as described in [Chapter 2.9, "Connecting External Accessories"](#), on page 12.
2. Hold the Ctrl key and press Esc to show the task bar
3. Click the rectangular button at the very right of the task bar to show the Windows desktop
4. Right click the Windows desktop and select "Screen resolution" from the context menu
5. In the Windows Screen Resolution" management
 - a) Change the "Multiple displays" setting to "Show desktop only on 2"; apply and confirm the modified settings ("Keep Changes")
 - b) Select Display 2 in the panel at the top
 - c) Change the display "Resolution" to the desired value by dragging the slider; click "OK" and confirm the modified settings ("Keep Changes")

2.12 Remote Operation in a LAN

A LAN connection is used to integrate the analyzer into a home/company network. This offers several applications, e.g.:

- Transfer data between a controller and the analyzer, e.g. in order run a remote control program.
- Control the measurement from a remote computer using Remote Desktop or a similar application.
- Use external network devices (e.g. printers).

NOTICE

Virus protection

An efficient virus protection is a prerequisite for secure operation in the network. Never connect your analyzer to an unprotected network because this may cause damage to the instrument software. For useful hints refer to the application note 1EF73_0E, which is available at:

http://www.rohde-schwarz.de/de/service_support/downloads/application_notes?type=20&downid=5699

The analyzer uses a user name and password as credentials for remote access; see note on "[User accounts and password protection](#)" on page 69 for details. To protect

the analyzer from unauthorized access, it is recommended to change the factory setting.



LXI compliance

The analyzer complies with LXI class C. LXI gives you direct access to the LAN settings described in the following sections; see "LXI Configuration" in your analyzer's help system.

2.12.1 Assigning an IP Address

Depending on the network capacities, the TCP/IP address information for the analyzer can be obtained in different ways.

- If the network supports dynamic TCP/IP configuration using the Dynamic Host Configuration Protocol (DHCP), all address information can be assigned automatically.
- If the network does not support DHCP, or if the analyzer is set to use alternate TCP/IP configuration, the addresses must be set manually.

By default, the analyzer is configured to use dynamic TCP/IP configuration and obtain all address information automatically. This means that it is safe to establish a physical connection to the LAN without any previous analyzer configuration.

NOTICE

Manual TCP/IP configuration

If your network does not support DHCP, or if you choose to disable dynamic TCP/IP configuration, you must assign valid address information **before** you connect the analyzer to the LAN. Contact your network administrator to obtain a valid IP address, because connection errors can affect the entire network.



Administrator account

You need administrator rights to change the TCP/IP configuration. See note on "[User accounts and password protection](#)" on page 69 for details.



The R&S ZNBT provides a miniature display in the upper right-hand corner of the front panel indicating the current IP address of the instrument. See [Chapter 3.2, "Front Panel R&S ZNBT"](#), on page 26.

To enter the TCP/IP address information manually

1. Obtain the IP address and subnet mask for the analyzer and the IP address for the local default gateway from your network administrator. If necessary, also obtain the name of your DNS domain and the IP addresses of the DNS and WINS servers on your network.

2. For the R&S ZNBT connect an external monitor, keyboard and mouse.
3. Press the Windows key in the SYSTEM keypad (R&S ZNB only) or on an external keyboard to access Windows®.
4. Open the "Control Panel > Network and Internet > Network and Sharing Center > Local Area Connection Status" dialog.
5. Select "Properties" and confirm the user account control message, depending on your current user account.
 - If your current account is an administrator account, select "Yes".
 - If your account is an account with standard user rights, enter the password of the administrator account and select "Yes".

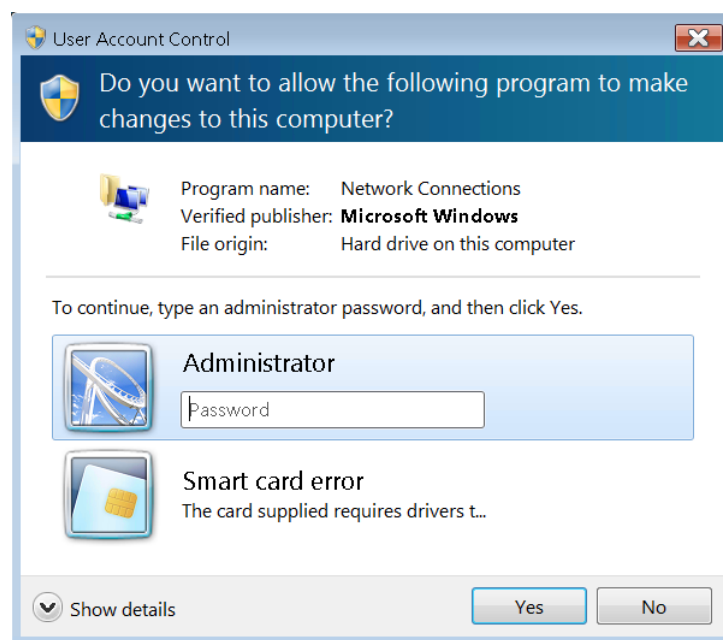
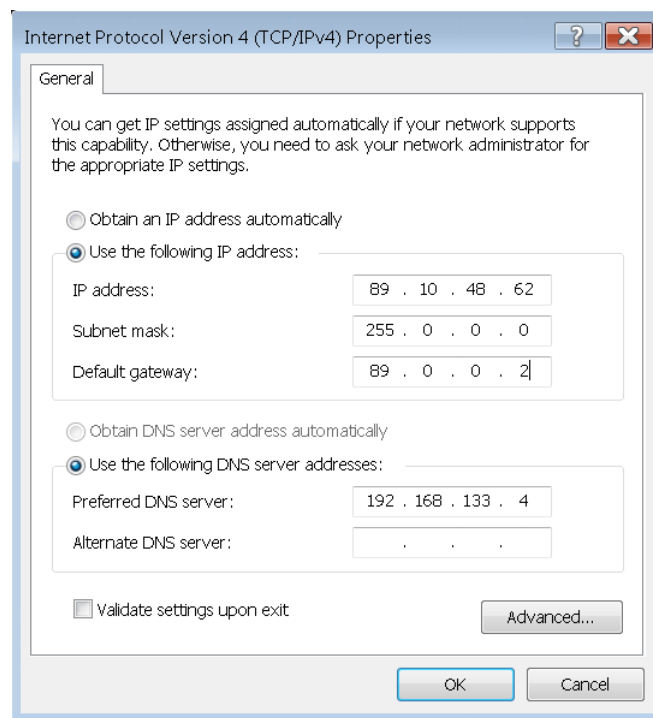


Figure 2-1: Windows 7 User Account Control dialog

6. In the "Local Area Connection Properties" dialog opened, select "Internet Protocol Version 4 (TCP/IPv4) > Properties" and enter the IP address information, e.g.:



2.12.2 Remote Desktop Connection

Remote Desktop is a Windows® application which you can use to access and control the analyzer from a remote computer through a LAN connection. While the measurement is running, the analyzer screen contents are displayed on the remote computer, and Remote Desktop provides access to all of the applications, files, and network resources of the analyzer.



At the R&S ZNB/ZNBT by default remote connections are enabled using a local group policy and remote access is granted to users instrument and administrator.

For detailed information about Remote Desktop and the connection refer to the Windows® Help ("Windows Start Menu > Help and Support").

To establish a remote desktop connection, proceed as follows:

1. Connect remote Windows PC and VNA to the LAN and make sure an IP connection can be established.
2. At the remote Windows PC select "Start > Programs > Accessories > Remote Desktop Connection", enter the VNA's computer name or IP address and select "Connect".

2.12.3 Windows® Firewall Settings

A firewall protects an instrument by preventing unauthorized users from gaining access to it through a network. In the default configuration of the R&S ZNB/ZNBT the firewall is enabled. A remote desktop connection does not require any changes in the firewall settings.



Administrator account

You need administrator rights to change the firewall settings. See note on "[User accounts and password protection](#)" on page 69 above for details.

Some actions require a different firewall configuration, e.g.:

- To transfer data with other hosts in the LAN, you have to allow "File and Printer Sharing".

To change the firewall settings proceed as follows:

1. Access the operating system by pressing the Windows® key on the external keyboard. Open the "Control Panel".
2. Select "System and Security > Windows Firewall".
 - Select "Change Settings > Allow a program or feature through Windows Firewall" to enable "File and Printer Sharing".
 - Select "Turn Windows Firewall on or off" to enable or disable the firewall.

You must confirm a user account control message to allow the desired changes (see [Figure 2-1](#)). For detailed information about the firewall refer to the Windows® Help.

NOTICE

Risks of changing the firewall settings

Disabling the firewall or allowing exceptions may make your instrument more vulnerable to viruses and intruders. It is recommend to restore the default firewall configuration after completing a task which requires modified settings.

3 Instrument Tour

This chapter gives an overview of the control elements and connectors of the R&S ZNB/ZNBT and gives all information that is necessary to put the instrument into operation and connect external devices.

3.1 Front Panel R&S ZNB

The front panel of a R&S ZNB consists of the touchscreen with the diagrams and soft-tool panels (left side), the hardkey area (right side) and the test port area below. Brief explanations on the controls and connectors, the hardkey area and the rear panel can be found on the next pages.



Two-port and four-port network analyzers

The figures and examples in this Getting Started guide show a two-port network analyzer. Everything described in this guide is also valid for four-port analyzers. The extended measurement functionality of the four-port instruments is described in the help system and in the user manual.

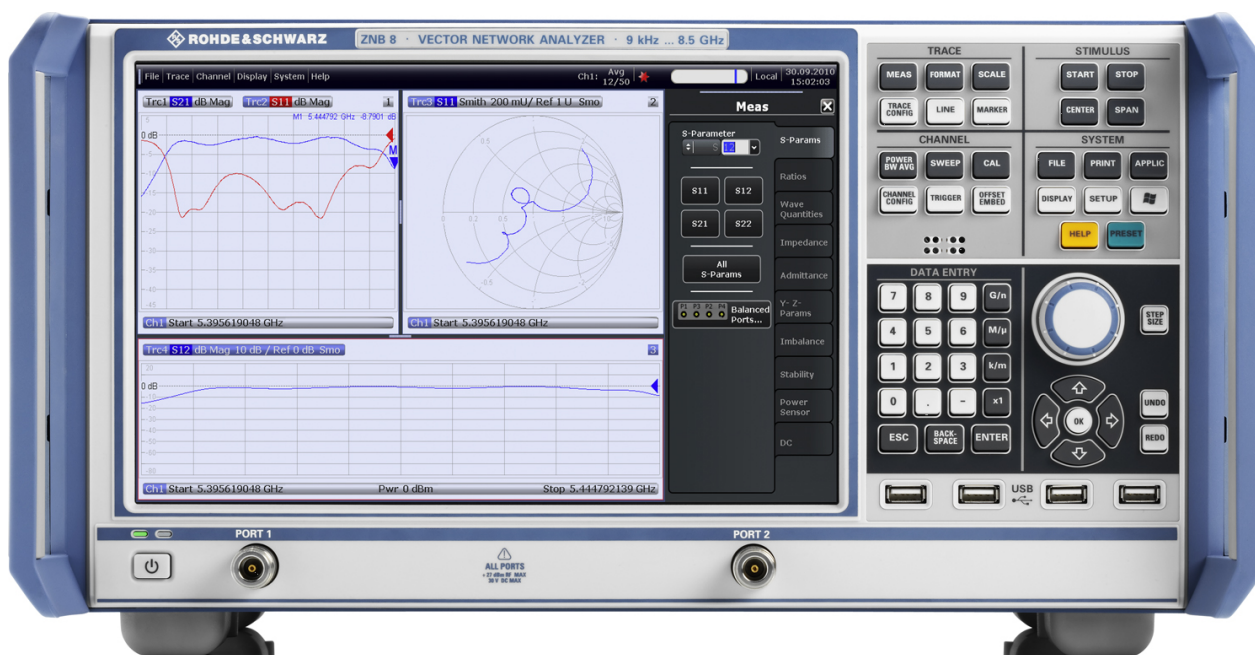


Figure 3-1: R&S ZNB8 with two ports

3.1.1 Touchscreen

The analyzer is equipped with a 12.1" XGA color touchscreen. The touchscreen presents all measurement results, mostly in the form of diagrams. Besides, all instrument

functions can be accessed and operated by tapping the control elements on the touchscreen. For an introduction to touchscreen operation, refer to [Chapter 4.1, "Manual Operation"](#), on page 34.

The following sections contain further useful information about manual control of the instrument.

- Refer to the other sections in chapter [Chapter 4, "Operating the Instrument"](#), on page 34 to learn how to handle traces and diagrams, and how to use menus, keys and softtools.
- Refer to chapter "Concepts and Features" in the user manual or help system to obtain information about the results in the diagram.
- Refer to section "Display Menu" in the user manual or help system to learn how to customize the screen.
- Refer to the data sheet for the technical specifications of the display.



Screen saver

The screen saver function of the operating system can be used to switch off the display if the analyzer receives no command for a selectable period of time. The display is switched on again if any front panel key is pressed.

To enable the screen saver, access the Windows® operating system (e.g. by pressing the Windows key in the SYSTEM keypad) and tap "Control Panel > Hardware and Sound > Power Options > Edit Plan Settings > Turn off the display".

3.1.2 Setup Keys

The keys in the TRACE, CHANNEL, STIMULUS, and SYSTEM keypads call up groups of related measurement settings. Each key corresponds to a softtool tab or a function of the graphical user interface.



The TRACE keys give access to all trace settings, to the limit check settings, and to the marker functions including marker search.

- The MEAS settings select the measured and displayed quantity.
- The FORMAT settings define how the measured data is presented in the diagram.
- The SCALE settings define how the active trace is displayed in the diagram selected via FORMAT.
- The TRACE CONFIG settings store traces to the memory and perform mathematical operations on traces.
- The LINES settings define limits for the measurement results, visualize them in the diagrams and activate/deactivate the limit check.
- The MARKER settings position markers on a trace, configure their properties and select the format of the numerical readout. Markers can also be used to locate specific points on the trace, define the sweep range, and scale the diagram.



The CHANNEL keys give access to the hardware-related (channel) settings.

- The POWER BW AVG settings define the power of the internal signal source, the IF bandwidth, and the sweep average.

- The SWEEP settings define the scope of measurement, including the sweep type and the number of measured sweeps.
- CAL provides all functions that are necessary to perform a system error correction (calibration).
- CHANNEL CONFIG provides functions for channel management.
- The TRIGGER settings control the start of the measurement sequence.
- OFFSET EMBED provides a selection of length offset parameters to shift the measurement plane.



The STIMULUS keys (START, STOP, CENTER, SPAN) define the sweep range, depending on the sweep type.



The SYSTEM keys provide general system settings.

- FILE provides standard Windows® functions used to create, save, recall or print recall sets, to copy the active screen and to shut down the application.
- The PRINT settings control an external printer that is used to print a hardcopy of the current recall set.
- APPLIC gives access to external software tools.
- DISPLAY gives access to all display settings and to the functions which activate, modify and arrange different diagrams.
- SETUP provides general system settings which are not restricted to a particular recall set.
- The Windows® key opens the startup menu of the Windows® operating system from where you can perform system configurations and call up additional software utilities.
- HELP opens the context-sensitive help system of the analyzer.
- PRESET performs a preset of the instrument settings.

3.1.3 Data Entry Keys



The keys in the DATA ENTRY keypad are used to enter numbers, units, and characters. The data entry keys are only enabled while the cursor is placed on a data input field in a dialog or in the Help navigation pane.

- The keys 0 to 9 enter the corresponding numbers.
- The function of the "." and "-" keys depends on the data type of the active input field:
 - In numeric input fields, the keys enter the decimal point and a negative sign for the entered numeric value. Multiple entries have no effect.
 - In character input fields, the keys enter a dot and a hyphen, respectively. Both entries can be repeated as often as desired.
- The function of the four unit keys depends on the data type of the active input field; see [Chapter 4.5, "Entering Data"](#), on page 51.

- In numeric input fields, the G/n, M/ μ , k/m or x1 keys multiply the entered value with factors of $10^{(-)9}$, $10^{(-)6}$, $10^{(-)3}$ or 1 and add the appropriate physical unit. x1 is equivalent to ENTER and confirms the previous entry.
- In character input fields, the G/n, M/ μ , k/m keys enter the letters G, M, K, respectively. x1 is equivalent to ENTER and confirms the previous entry.
- ESC is used to:
 - Cancel entries / close dialogs without activating the entries made (equivalent to the "Close" button).
 - Close the Help system.
- ENTER is used to:
 - Activate the selected active control element, e.g. a button in a dialog or a link in the "Contents" page of the Help system.
 - Confirm selections and entries made and close dialogs (equivalent to the "OK" button).
 - Compress or expand menus or the Help table of contents
- BACKSPACE deletes the last character before the cursor position or the selected character sequence or numeric value.

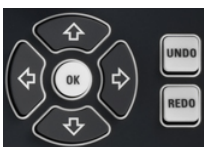
3.1.4 Rotary Knob



The rotary knob increases and decreases numerical values, scrolls within lists, activates controls and confirms entries. Turning or pressing the rotary knob is equivalent to the action of the "Cursor Up" and "Cursor Down" navigation keys or of the ENTER key in the DATA ENTRY keypad, respectively.

STEP SIZE opens an input box to select the steps (in units of the current physical parameter) between two consecutive numerical values. The step size is also valid for value changes using the "Cursor Up" and "Cursor Down" keys. See also [Chapter 4.5.2, "Using the Numeric Editor"](#), on page 52.

3.1.5 Navigation Keys



The keys in the NAVIGATION keypad are used to navigate within the touchscreen and the help system, to access and control active elements.

The "Cursor Up" and "Cursor Down" keys are used to:

- Scroll up and down in lists, e.g. among menu items, in a list of keywords, in the Help table of contents, or in the Help index
- Navigate between table rows in diagrams. Press "OK" to toggle between navigation mode and data entries.
- Increase and decrease numerical input values

"Cursor Up" (Down) become inactive as soon as the beginning of the list is reached. "Cursor Up" (Down) is equivalent to a rotation of the rotary knob to the right (left).

The "Cursor Left" and "Cursor Right" keys are used to:

- Move the cursor to the left or right within input fields

- Navigate between table columns in diagrams. Press "OK" to toggle between navigation mode and data entries.
- Compress or expand menus or the Help table of contents
- Move the highlighted item in the menu bar of the active application

ENT OK is equivalent to the action of the ENTER key in the DATA ENTRY keypad.

UNDO reverses the last action, if possible. REDO reverses the action of the UNDO button.

3.1.6 Standby Key



The standby toggle switch is located in the bottom left corner of the front panel.

The key serves two main purposes:

- Toggle between standby and ready state; see [Chapter 2.8, "Standby and Ready State"](#), on page 12.
- Shut down the instrument; see [Chapter 2.7, "Starting the Analyzer and Shutting Down"](#), on page 11.

3.1.7 Front Panel Connectors

The test ports and four USB connectors are located on the front panel of the R&S ZNB.

3.1.7.1 Test Ports



Numbered connectors:

- type N (7 mm, female) for R&S ZNB4 and R&S ZNB8
- PC (3.5 mm, male) for R&S ZNB20
- K (2.92 mm, male) for R&S ZNB40

The test ports serve as outputs for the RF stimulus signal and as inputs for the measured RF signals from the DUT (response signals).

- With a single test port, it is possible to generate a stimulus signal and measure the response signal in reflection. For a measurement example refer to [Chapter 5.2, "Reflection S-Parameter Measurement"](#), on page 67.
- With more than one test port it is possible to perform full two-port, 3-port, ... , or n-port measurements; see [Chapter 5.1, "Transmission S-Parameter Measurement"](#), on page 59.

In the standard R&S ZNB configuration, all test ports are supplied by a common source. Four-port instruments are available with an optional second source.

NOTICE**Maximum input levels**

The maximum input levels at all test ports according to the front panel labeling or the data sheet must not be exceeded.

In addition, the maximum input voltages of the other input connectors at the rear panel must not be exceeded.



It is recommended to use a torque wrench when screwing RF cables on the test port connectors.

3.1.7.2 USB Connectors

Four high speed Universal Serial Bus connectors of type A (master USB).



The USB ports can be used to connect

- external PC accessories such as mouse or other pointing devices, a keyboard, printer or external storage device (USB stick, CD-ROM drive etc.)
- external measurement equipment such as a calibration unit, power meter, signal generator or switch matrix



The length of passive connecting USB cables should not exceed 1 m. The maximum current per USB port is 500 mA. See also [Chapter 2.5, "EMI Suppression"](#), on page 10.

3.2 Front Panel R&S ZNBT

The largest part of R&S ZNBT front panel is reserved for the test ports, with an administrative area to the right. Brief explanations on the connectors and controls and the rear panel can be found on the next pages.

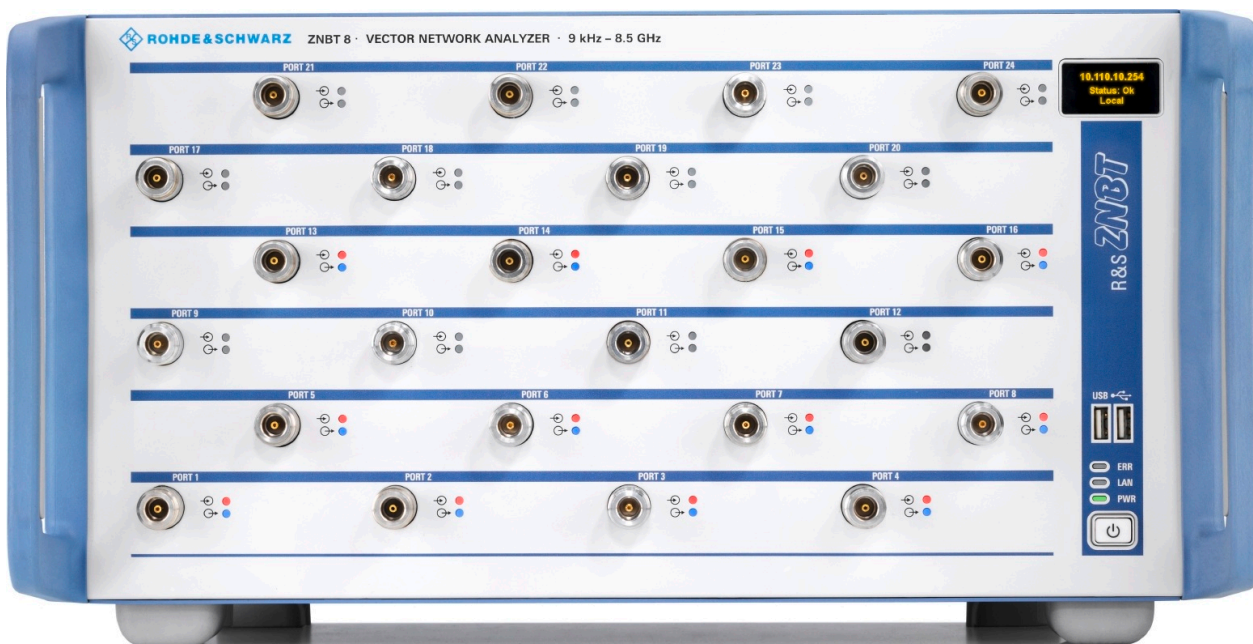


Figure 3-2: Front view of R&S ZNBT (fully equipped with the maximum 24 ports)

NOTICE

Instrument damage caused by cleaning agents

Cleaning agents contain substances that may damage the instrument. For example, cleaning agents that contain a solvent may damage the front panel labeling, plastic parts, or the display.

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

The outside of the instrument can be cleaned sufficiently using a soft, lint-free dust cloth.

Mini display



A miniature display is provided in the upper right-hand corner of the front panel to provide the following instrument information:

- IP address
- Operational "Status" or "Error <error code>"
 - "OK": no error
 - Info: general errors (e.g. related to external devices or remote control)
 - Warning: setting errors (e.g. generator power out of range)
 - Error <error code>: severe errors (e.g. FW boot errors, HW errors)
- Control mode:
 - "Local": manual interaction (e.g. via Remote Desktop)
 - "Remote": remote control (using a script) via a LAN or GPIB connection

LED controls



Above the standby toggle switch some LEDs indicate various status information:

- ERR: operation state; if an error occurs, the LED lights up red; for more information on errors and troubleshooting see the R&S ZNB/ZNBT User Manual
- LAN: LAN error occurred
- PWR: power state (ready/standby); see [Chapter 2.8, "Standby and Ready State"](#), on page 12

Standby key



The standby key is located at the lower right-hand corner of the front panel. It serves two main purposes:

- Toggle between standby and ready state; see [Chapter 2.8, "Standby and Ready State"](#), on page 12.
- Shut down the instrument; see [Chapter 2.7, "Starting the Analyzer and Shutting Down"](#), on page 11.

3.2.1 Front Panel Connectors

The test ports and two USB connectors are located on the front panel of the analyzer.

3.2.1.1 Test Ports



Numbered type N female connectors. Depending on the equipped options there are 4, 8, 12, 16, 20 or 24 test ports.

The test ports serve as outputs for the RF stimulus signal and as inputs for the measured RF signals from the DUT (response signals).

- With a single test port, it is possible to generate a stimulus signal and measure the response signal in reflection. For a measurement example refer to [Chapter 5.2, "Reflection S-Parameter Measurement"](#), on page 67.
- With more than one test port it is possible to perform full two-port, 3-port, ... , or n-port measurements; see [Chapter 5.1, "Transmission S-Parameter Measurement"](#), on page 59.

NOTICE

Maximum input levels

The maximum input levels at all test ports according to the front panel labeling or the data sheet must not be exceeded.

In addition, the maximum input voltages of the other input connectors at the rear panel must not be exceeded.



It is recommended that you use a torque wrench when screwing RF cables on the test port connectors.

Connector usage



Two LEDs next to each test port indicate the connector usage:

- on: connector is used as a source port
- on: connector is used as a receive port
- both LEDs on: connector is used as a bidirectional (source and receive) port

3.2.1.2 USB Connectors



Two high speed Universal Serial Bus connectors of type A (master USB) are provided on the front panel. They can be used to connect

- external PC accessories such as mouse or other pointing devices, a keyboard, printer or external storage device (USB stick, CD-ROM drive etc.)
- external measurement equipment such as a calibration unit, power meter, signal generator or switch matrix



The length of passive connecting USB cables should not exceed 1 m. The maximum current per USB port is 500 mA. See also [Chapter 2.5, "EMI Suppression"](#), on page 10.

3.3 Rear Panel R&S ZNB

This section gives an overview of the rear panel controls and connectors of the network analyzer.

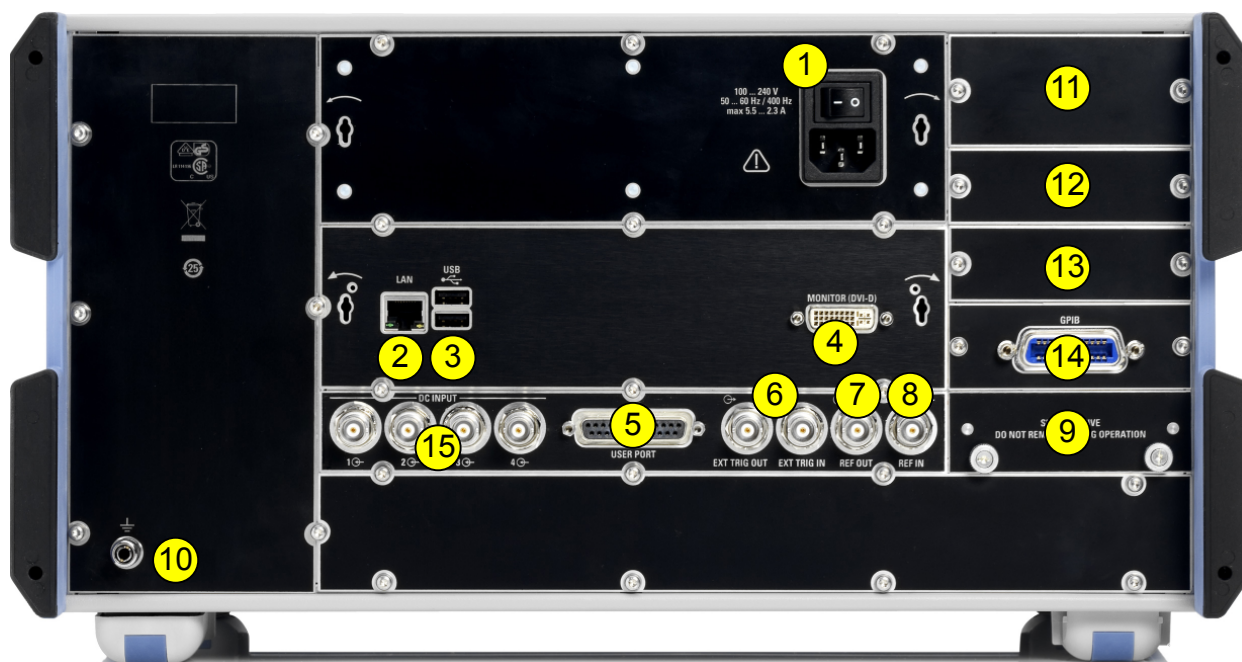


Figure 3-3: R&S ZNB rear view

Table 3-1: Rear panel connectors available on all instruments

Index	Label	Description
1	(Power I/O)	Power on / off switch, see Chapter 2.7, "Starting the Analyzer and Shutting Down" , on page 11
2	LAN	RJ-45 connector to integrate the instrument to a Local Area Network, primarily for remote control purposes; see Chapter 2.12.1, "Assigning an IP Address" , on page 17.
3	USB	The two additional USB connectors are equivalent to the USB connectors on the front panel; see Chapter 3.1.7.2, "USB Connectors" , on page 26.
4	MONITOR (DVI-D)	External monitor connector; see Chapter 2.9.1, "Connecting a Monitor" , on page 13.
5	(User port)	25-pin D-Sub connector used as an input and output for low-voltage (3.3 V) TTL control signals
6	EXT TRIG IN / EXT TRIG OUT	Two BNC connectors for 5 V TTL external trigger signals
7	REF OUT	BNC output for the internal reference frequency of the R&S ZNB. Use this connector to synchronize other instruments to the analyzer.
8	REF IN	BNC input for an external reference frequency. Use this connector to synchronize the R&S ZNB to another device.

Index	Label	Description
9	(System drive)	Contains the removable system hard disk of the R&S ZNB, containing all software (including the operating system and the VNA application) and data. No other hard disk is built in. Do not remove the disk during operation. Option R&S ZNB-B19 Var. 02 provides an additional removable HD (including firmware) for instruments with controller LPW10 (32 bit). Option R&S ZNB-B19 Var. 07 provides an additional removable HD (including firmware) for instruments with controller LPW11 (64 bit).
10	(Ground connector)	The ground connector provides the ground of the analyzer's supply voltage. Use this connector for ESD protection; see " Risk of electrostatic discharge " on page 10.

Table 3-2: Optional rear panel connectors

Index	Label	Description
11	Bias Tees or RFFE - GPIO Interface	This slot can be equipped with one of the following options: <ul style="list-style-type: none"> R&S ZNB-B1, "Bias Tees", providing two or four additional BNC inputs labeled BIAS 1 ... 4 (for two-port or four-port analyzers). The inputs can be used to apply an external DC voltage (bias) to the test ports. For fuse replacement refer to Chapter 7.2, "Replacing Fuses", on page 71. R&S ZN-B15 "RFFE - GPIO Interface", providing 2 independent RF Front-End (RFFE) interfaces according to the MIPI® Alliance "System Power Management Interface Specification" and 10 General Purpose Input/Output (GPIO) pins on a single 25 pin female connector
12	Device Control	Option R&S ZNB-B12 "Device Control" provides a PCIe and a Direct Control connector.
13	Handler I/O	Option R&S ZN-B14, Handler I/O (Universal Interface), providing a Centronics 36 input/output connector.
14	GPIB	Option R&S ZNB-B10 provides a GPIB bus connector according to standard IEEE 488 / IEC 625.
15	DC INPUT	Option R&S ZNB-B81 "DC Inputs" provides four BNC inputs for DC measurements (adjustable to different voltage ranges).

NOTICE**Input levels, EMC**

The maximum input levels and voltages of the input connectors at the front and rear panel must not be exceeded.

Use double shielded cables at the BNC rear panel connectors (EXT. TRIGGER OUT, EXT TRIGGER IN, REF OUT, REF IN) and match signals with 50 Ω in order to comply with EMC directives! See also [Chapter 2.5, "EMI Suppression"](#), on page 10.

3.4 Rear Panel R&S ZNBT

This section gives an overview of the rear panel controls and connectors of the R&S ZNBT.

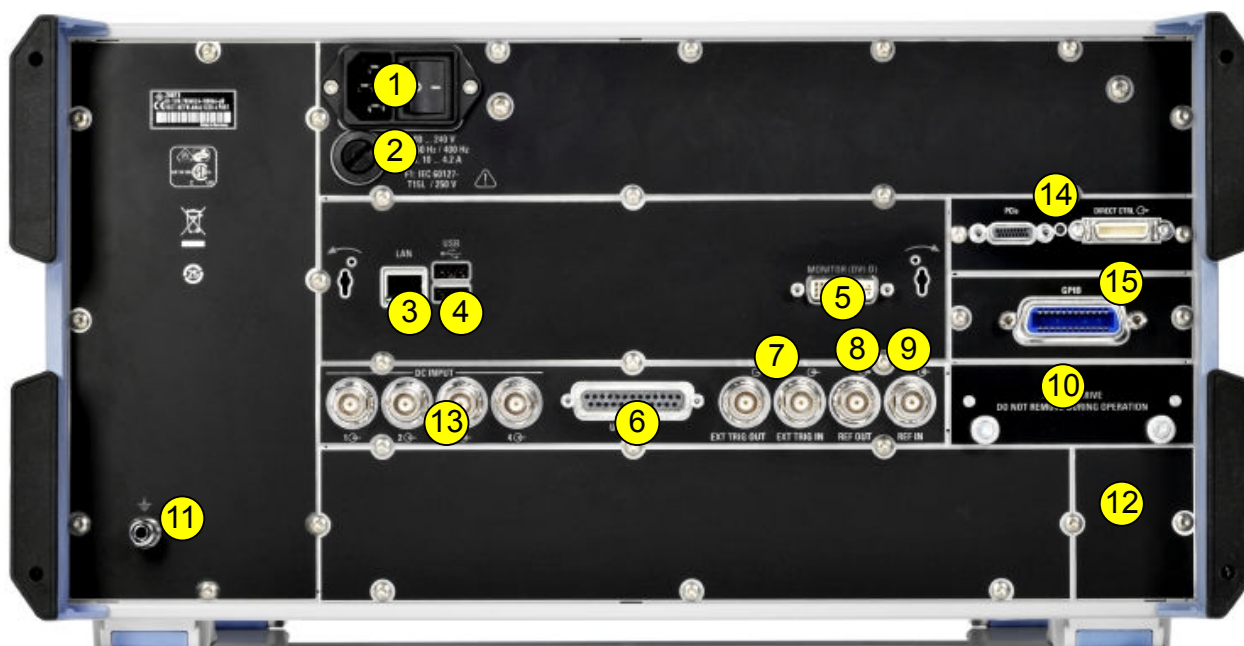


Figure 3-4: R&S ZNBT rear view

Table 3-3: Rear panel connectors available on all instruments

Index	Label	Description
1	(Power I/O)	Power on/off switch, see Chapter 2.7, "Starting the Analyzer and Shutting Down" , on page 11
2	(Fuse holder)	Fuse holder, see Chapter 7.2, "Replacing Fuses" , on page 71
3	LAN	RJ-45 connector to integrate the instrument to a Local Area Network, primarily for remote control purposes; see Chapter 2.12.1, "Assigning an IP Address" , on page 17.
4	USB	The two additional USB connectors are equivalent to the USB connectors on the front panel; see Chapter 3.2.1.2, "USB Connectors" , on page 29.
5	MONITOR (DVI-D)	External monitor connector; see Chapter 2.9.1, "Connecting a Monitor" , on page 13.
6	(User port)	25-pin D-Sub connector used as an input and output for low-voltage (3.3 V) TTL control signals
7	EXT TRIG IN / EXT TRIG OUT	Two BNC connectors for 5 V TTL external trigger signals
8	REF OUT	BNC output for the internal reference frequency of the R&S ZNBT. Use this connector to synchronize other instruments to the analyzer.
9	REF IN	BNC input for an external reference frequency. Use this connector to synchronize the R&S ZNBT to another device.
10	(System drive)	Contains the removable system hard disk of the R&S ZNBT, containing all software (including the operating system and the VNA application) and data. No other hard disk is built in. Do not remove the disk during operation.

Index	Label	Description
11	(Ground connector)	The ground connector provides the ground of the analyzer's supply voltage. Use this connector for ESD protection; see " Risk of electrostatic discharge " on page 10.
12	Digital I/O	Used to connect an external Handler I/O (option R&S ZNBT-Z14), providing a Centronics 36 input/output connector.

Table 3-4: Optional rear panel connectors

Index	Label	Description
13	DC INPUT	Option R&S ZNBT8-B81 "DC Inputs" provides four BNC inputs for DC measurements (adjustable to different voltage ranges).
14	Device Control	This slot can be equipped with option R&S ZNBT8 -B12, providing a PCIe and a Direct Control connector.
15	GPIB	Option R&S ZNBT8-B10 provides a GPIB bus connector according to standard IEEE 488 / IEC 625.

NOTICE

Input levels, EMC

The maximum input levels and voltages of the input connectors at the front and rear panel must not be exceeded.

Use double shielded cables at the BNC rear panel connectors (EXT. TRIGGER OUT, EXT TRIGGER IN, REF OUT, REF IN) and match signals with 50 Ω in order to comply with EMC directives! See also [Chapter 2.5, "EMI Suppression"](#), on page 10.

4 Operating the Instrument

The following sections describe how to solve basic tasks that you will frequently encounter when working with the instrument. In particular you can learn how to access instrument functions and control dialogs without a mouse and/or keyboard.

Manual and remote control of the instrument

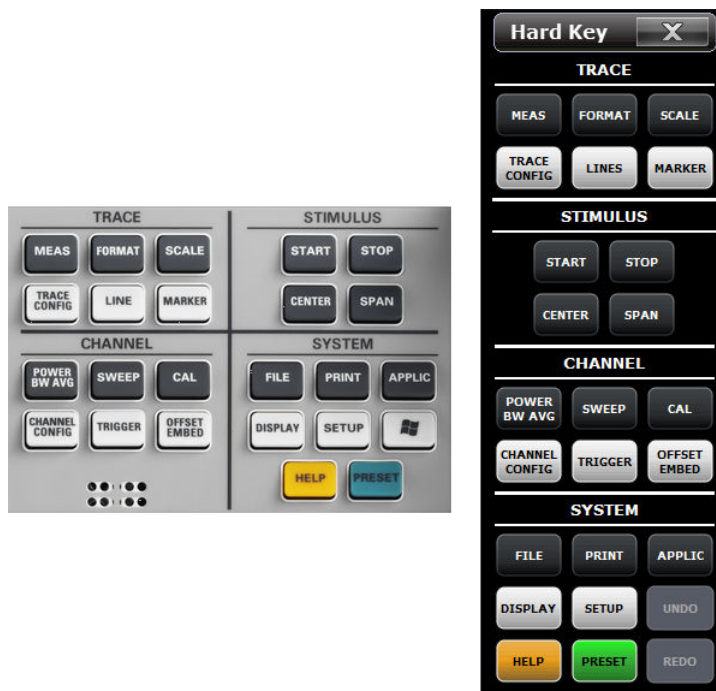
In contrast to the R&S ZNB, the R&S ZNBT is primarily intended to be remote-controlled via the GPIB or LAN interface (see chapter 'Remote Control' in the user manual). However, all instruments can be controlled manually, either using touchscreen and frontpanel keys (R&S ZNB only), an external monitor in combination with a mouse (see also [Chapter 2.9, "Connecting External Accessories"](#), on page 12) or via Remote Desktop (see also [Chapter 2.12, "Remote Operation in a LAN"](#), on page 16).

Manual and remote control of the R&S ZNB/ZNBT are described in separate chapters of the user manual. Background information is provided in the reference chapter for manual control, together with the dialogs that may be displayed on an external monitor. To avoid redundancy, the reference chapter for remote control focusses on program syntax and parameter ranges but contains only a short description of the command functions.

Manual operation is particularly useful for getting to know the instrument and for trouble shooting. The following sections describe how to access the instrument functions and control dialogs at the graphical user interface.

4.1 Manual Operation

The analyzer functions are arranged in tabbed softtool panels and dialogs. The keys on the front panel (R&S ZNB only) or the on-screen "Hard Key Panel" open the most frequently used panels. This provides quick access to the instrument settings, avoiding complicated menu structures and long operating sequences. The control elements in the softtool panels can be accessed in different alternative ways.



Customizing the screen

The contents of the screen and the size and position of many display and control elements are not fixed. You can display or hide most elements. You can also drag and drop traces, info fields, and even the softtool panel to your preferred position; see [Chapter 4.4.4, "Using Drag and Drop"](#), on page 50.

For example, you can show/hide the on-screen Hard Key Panel by selecting/deselecting "Display > View Bar > Hard Key Panel On" in the main menu.

The following table shows possible touchscreen operations (R&S ZNB only) with the corresponding mouse operations.

Touchscreen	Mouse	Typical task
Tap control element for a short time	Click control element (left mouse button)	Select button or softtool tab
Tap for an extended time (tap and hold)	Click (right button)	Open context menu
Tap twice (double-tap)	Double-click (left button)	Open on-screen keyboard

Using (Virtual) Hard Keys

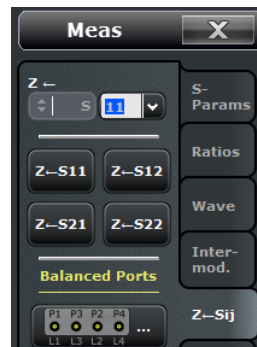
To access an instrument function

1. Press a (virtual) key, e.g. the MEAS key in the TRACE panel.

The corresponding softtool panel expands at the current docking position.



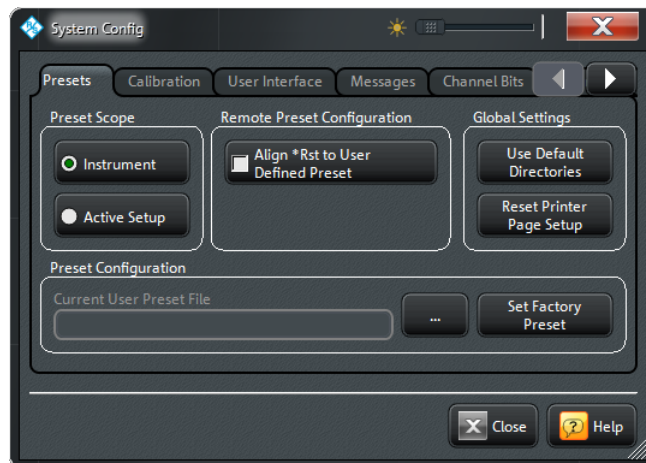
2. Activate the desired softtool tab, e.g. "Z←Sij".



3. Select a control element, e.g. "Z←S11".

The diagram immediately shows the result of your setting. In the present example, the active trace shows the converted impedance parameter Z_{11} .

A control element with three dots (e.g. "SYSTEM > SETUP > System Config...") opens a dialog, containing a group of related settings, a wizard or additional information.

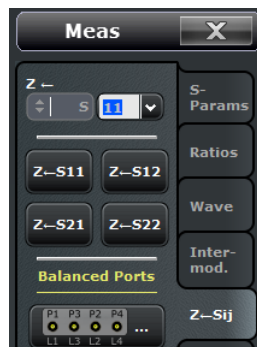


Using the menu bar

The menu bar at the bottom of the application screen provides an alternative access to **all** instrument functions. To repeat the "Z←S11" setting described above,

- ▶ Select "Trace > Meas > Z←Sij > Z←S11".

The diagram immediately shows the result of your setting. At the same time, the related softtool tab is opened.



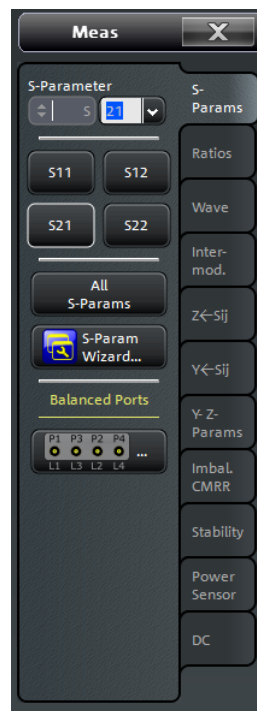
Using context menus

Context menus are another alternative for quick access to instrument settings. To repeat the "Z←S11" setting described above,

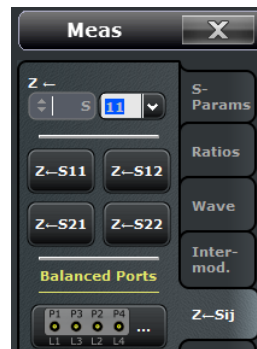
1. Touch and hold (R&S ZNB only) or right-click the measured quantity section in the trace list for a couple of seconds until the context menu appears.



2. Select "S-Parameter" to open the "Meas > S-Params" softtool tab.



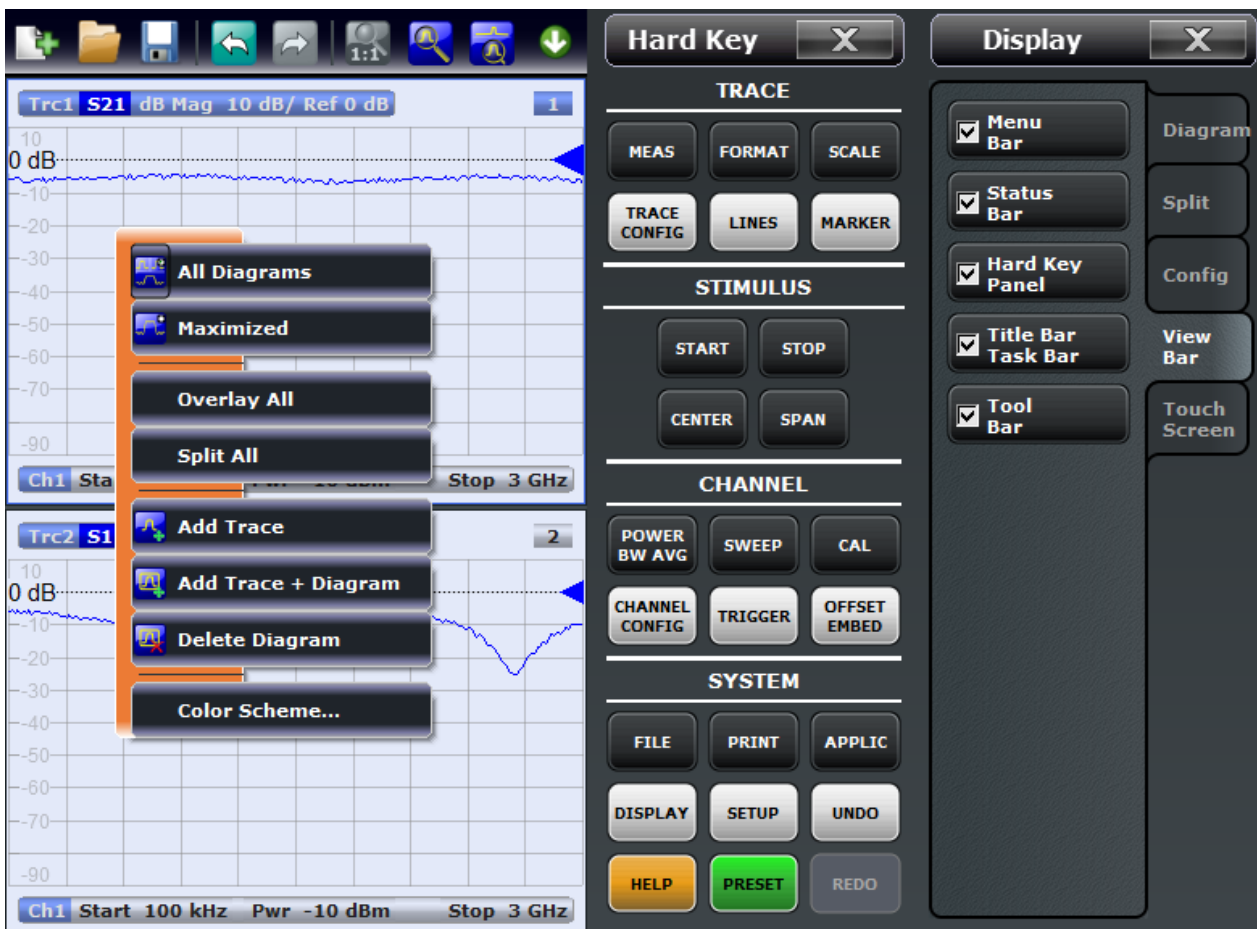
3. Select "Z←Sij > Z←S11".



4.2 Control Elements of the Screen

The main window of the analyzer provides all control elements for the measurements and contains the diagrams for the results. There are several alternative ways for accessing an instrument function:

- Using the icons in the toolbar above the diagram area (for frequent actions)
- Using the control elements of the softtool panel (recommended, provides all settings)
- Using the menus and submenus of the menu bar (alternative to the previous method)
- Using the hardkey panel (preselection of the most important softtool panels)



These methods are described in more detail in the following sections.

4.2.1 Title Bar

The main application window of the vector network analyzer application provides a title bar, in analogy to every Windows® application. The title bar contains the name of the application and the standard minimize, maximize, and close buttons. The appearance depends on the "Control Panel" settings of the operating system.



You can display or hide the title bar using "SYSTEM > DISPLAY > View Bar" or "APPLIC > External Tools". The title bar is displayed together with the taskbar across the bottom of the screen which you can use to change between the VNA application and external tools.

4.2.2 Toolbar

The toolbar above the diagram area contains the most frequently used control elements of the user interface. All controls are also accessible from the R&S ZNB/ZNBT's softtool panels.



The toolbar is divided into five icon groups, separated by vertical lines.

- The leftmost group comprises recall set actions ("SYSTEM > FILE > Recall Sets"): add a new recall set ("New..."), open a recall set file ("Open Recall..."), save the active recall set to a file ("Save...")
- The second group comprises the undo and redo actions that are also accessible via the SYSTEM > UNDO and SYSTEM > REDO front panel keys.
- The icons in the middle group control the graphical zoom function ("TRACE > SCALE > Zoom"): "Zoom Reset", "Zoom Select", and "Overview Select".
- The icons in the fourth group allow to add a new trace and (possibly) a new diagram ("TRACE > TRACE CONFIG > Trace"), add a marker ("TRACE > Marker > Markers"), and delete a marker, trace, or diagram.
- The icon in the rightmost group allows to restart the sweep ("CHANNEL > SWEEP > Sweep Control > Restart Sweep")



You can hide the toolbar using "SYSTEM > DISPLAY > View Bar".

4.2.3 Softtool Panel

Softtool panels display groups of related settings. They can be opened via keys on the front panel (R&S ZNB only) or the on-screen "Hard Key" panel, or via menu bar and context menu items. Selecting a control element in the softtool panels activates a setting. You can also enter values and open dialogs with extended settings.

A softtool panel consists of a title (e.g. "Display") with a close/re-open icon and the control element area below. The title remains displayed when the softtool panel is closed, which allows you to re-open closed softtools at any time. Most softtool panels are subdivided into different tabs (e.g. "Diagram", "Split", "Config", "View Bar").



Softtool panels may contain different types of control elements:

- A button with a double arrow (e.g. "Color Scheme" in the example above) opens a list of alternative settings.
- A button with three dots (e.g. "User Define..." in the example above) opens a dialog which provides several related settings.
- A button with a checkmark (e.g. "Frequency Info" in the example above) enables or disables.
- A button with a light background (e.g. "Font Size" in the example above) is an input fields for numbers or characters.
- A labeled button with no additional symbols directly initiates an action.

4.2.4 Menu Bar

All analyzer functions are arranged in drop-down menus. The menu bar is located across the bottom of the diagram:



As in any Windows® application, menus can be controlled with the touchscreen (R&S ZNB only) or a mouse. A short tap (left mouse click) expands a menu or sub-menu. If a menu command has no submenu assigned, a short tap (left mouse click) opens a dialog or directly activates the menu command. When a (sub)menu is selected, the R&S ZNB/ZNBT displays the corresponding softtool panel.

Overview of menu functions

- The "File" menu provides standard Windows® functions that can be used to create, save, recall or print recall sets, to copy the current screen or to shut down the application.

- The "Trace" menu provides all trace settings, the limit check settings, and the marker functions including marker search.
- The "Channel" menu provides all channel settings and activates, modifies or stores different channels.
- The "Display" menu provides all display settings and the functions for activating, modifying and arranging different diagrams.
- The "Applications" menu gives access to applications and tools that extend the functionality of the analyzer firmware.
- The "System" menu provides functions that can be used to return to a defined instrument state, reverse operations, access service functions and define various system-related settings.
- The "Help" menu provides assistance with the network analyzer and its operation.



You can hide the menu bar using "SYSTEM > DISPLAY > View Bar".

4.2.5 Menu Structure

All menus show an analogous structure.



- A menu command with a right arrow expands a submenu with further related settings.
Example: "Marker" expands a submenu with marker-related properties.
- A menu command with three dots appended calls up a dialog providing several related settings.
Example: "Search Range" opens a dialog to define the search range for the marker search.
- A menu command with no arrow or dots initiates an immediate action.
Example: "Max" sets the active marker to the maximum of the active trace.

4.2.6 Hardkey Emulation

The keys of the hardkey panel (see "SYSTEM > DISPLAY > View Bar") open a particular tab of the softtool panel providing related control elements.



The keys in the TRACE, CHANNEL, STIMULUS, and SYSTEM keypads call up groups of related measurement settings. Each key corresponds to a softtool tab or a function of the graphical user interface.

The TRACE keys give access to all trace settings, to the limit check settings, and to the marker functions including marker search.

- The MEAS settings select the measured and displayed quantity.
- The FORMAT settings define how the measured data is presented in the diagram.
- The SCALE settings define how the active trace is displayed in the diagram selected via FORMAT.
- The TRACE CONFIG settings store traces to the memory and perform mathematical operations on traces.
- The LINES settings define limits for the measurement results, visualize them in the diagrams and activate/deactivate the limit check.
- The MARKER settings position markers on a trace, configure their properties and select the format of the numerical readout. Markers can also be used to locate specific points on the trace, define the sweep range, and scale the diagram.

The CHANNEL keys give access to the hardware-related (channel) settings.

- The POWER BW AVG settings define the power of the internal signal source, the IF bandwidth, and the sweep average.
- The SWEEP settings define the scope of measurement, including the sweep type and the number of measured sweeps.

- CAL provides all functions that are necessary to perform a system error correction (calibration).
- CHANNEL CONFIG provides functions for channel management.
- The TRIGGER settings control the start of the measurement sequence.
- OFFSET EMBED provides a selection of length offset parameters to shift the measurement plane.

The STIMULUS keys (START, STOP, CENTER, SPAN) define the sweep range, depending on the sweep type.

The SYSTEM keys provide general system settings.

- FILE provides standard Windows® functions used to create, save, recall or print recall sets, to copy the active screen and to shut down the application.
- The PRINT settings control an external printer that is used to print a hardcopy of the current recall set.
- APPLIC gives access to external software tools.
- DISPLAY gives access to all display settings and to the functions which activate, modify and arrange different diagrams.
- SETUP provides general system settings which are not restricted to a particular recall set.
- The Windows® key opens the startup menu of the Windows® operating system from where you can perform system configurations and call up additional software utilities.
- HELP opens the context-sensitive help system of the analyzer.
- PRESET performs a preset of the instrument settings.

4.2.7 Status Bar

The status bar shows

- the active channel and drive port (P1, P2 ...)
- the statistics for the sweep average (if sweep average is on, otherwise "Avg None")
- the progress of the sweep
The progress bar also shows when the R&S ZNB/ZNBT prepares a sweep with new channel settings
- the External Reference symbol (if an external reference clock is used for synchronization)
- the Redefined S-parameters symbol (if the physical ports have been redefined)
- the LXI status symbol (if enabled; see "SYSTEM > SETUP > Remote Settings")
A green LXI status symbol indicates that a LAN connection has been established; a red symbol indicates that no LAN cable is connected.
- the switch matrix status symbol, if a switch matrix is connected to the analyzer (See the R&S ZNB/ZNBT User Manual)
- the current date and time



Figure 4-1: R&S ZNB/ZNBT with redefined physical ports



Figure 4-2: R&S ZNB/ZNBT with switch matrix



The progress bar slowly oscillates from left to right and back if the sweep is too fast to be monitored, e.g. because the number of sweep points is low. You can hide the status bar using "SYSTEM > DISPLAY > View Bar".

4.3 Working with Dialogs

Dialogs provide groups of related settings and allow to make selections and enter data in an organized way. The settings are visualized, if possible. An example is shown below.



All dialogs are operated in a similar way.

- To open a dialog, select a softtool button with three dots behind its labeling (e.g. "Start Cal (Manual) ...").
- Use the "Transparency" function to obtain a transparent dialog which you can control while viewing the underlying traces and display elements.

- Drag and drop the hatched triangle in the lower right corner of the dialog to modify its size.
- Some dialogs are subdivided into tabs, containing groups of related settings. Activate a tab to access the settings.
- Select "OK" to activate the current settings and close the dialog, "Cancel" to discard all changes.



The Help system provides useful information about each dialog's specific settings. Tap "Help" to open the Help.

4.4 Handling Diagrams, Traces, and Markers

The analyzer displays measurement results as traces in rectangular diagrams. Markers are used to read specific numerical values and to search for points or regions on a trace. The following section will make you familiar with some of the graphical tools the R&S ZNB/ZNBT provides for trace and marker handling.



For further reference

Refer to chapter "Concepts and Features" in the R&S ZNB/ZNBT Help or in the User Manual to learn more about traces, channels, and screen elements.

4.4.1 Adding New Traces and Diagrams

A new trace is needed if you want to measure and display an additional quantity.

Typical scenario: The transmission coefficient S_{21} is measured as described in [Chapter 5.1, "Transmission S-Parameter Measurement"](#), on page 59. A trace is added to display the reflection coefficient S_{11} for comparison.



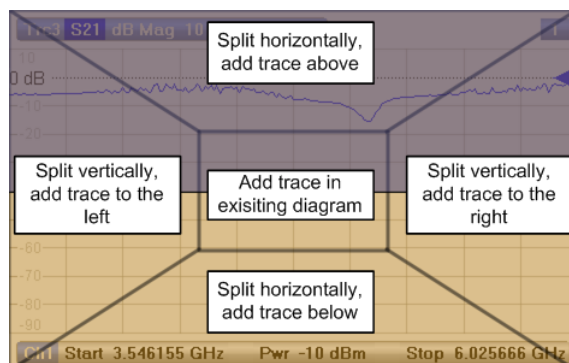
To create a new trace,

1. Drag the "New Trace" icon from the toolbar above the diagram area into a diagram.

The diagram changes its color scheme and contents as shown below. A rectangle with diagonal lines divides the diagram into different sectors.



2. Select the sector, depending on whether you want to display the new trace in the existing diagram, or whether you want to add a new diagram.



3. In the dialog box that is opened when you release the "New Trace" icon, select an S-parameter to display.
For a four-port analyzer:



The R&S ZNB/ZNBT generates a new trace for the selected S-parameter.



Alternative control elements

The "TRACE > Trace Config" softtool tab provides more functions for trace handling. The "DISPLAY > Display > Diagram" softtool tab provides functions for efficient diagram handling.

To add a trace for an arbitrary measured quantity (e.g. a ratio, wave, impedance, or admittance parameter), you can open the tabs of the "TRACE > Meas" softtool and simply drag and drop the corresponding softkeys into a diagram area.

4.4.2 Adding New Markers

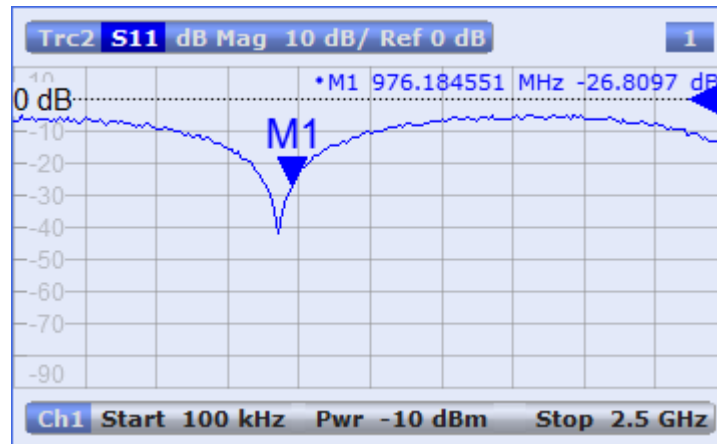
A marker is needed e.g. if you want to read a particular numerical trace value.



To add a new marker,

- Drag and drop the "New Marker" icon in the toolbar above the diagram area to the desired position.

The marker appears on the active trace. The marker info field displays the stimulus value (x-axis value) and response value (y-axis value) at the marker position. The response value varies as the analyzer continues performing sweeps.



Alternatively, any marker offered in "TRACE > Marker > Markers" softtool tab can be positioned on the active trace by Drag&Drop.



Active trace, alternative control elements

The trace line of the active trace in the upper part of the diagram is highlighted. If the diagram contains several traces, first activate the the target trace, then add the marker. The "TRACE > Marker > Markers" softtool tab provides more functions for marker handling.

4.4.3 Deleting Display Elements



Markers, traces, diagram areas, and other display elements are most conveniently deleted using the "Delete" icon in the toolbar above the diagram area.

- To delete a single marker, drag it into vertical direction to release it from the trace and drop it onto the "Delete" icon.
To delete a set of markers, drag and drop their marker info field onto the "Delete" icon. You can delete all types of marker info fields, including e.g. the info fields for a band-filter search.
Deleting a marker and its info field also disables the associated marker function.
- To delete a trace, drag and drop its trace line onto the "Delete" icon.
- To delete a channel, drag and drop all associated traces onto the "Delete" icon.
- To hide the limit lines and disable the limit check, drag and drop the PASS / FAIL message onto the "Delete" icon. The limit line itself is not deleted; you can re-use it any time.
- To delete a diagram area, drag and drop the diagram number label in the upper right corner onto the "Delete" icon.

The context menu of some display elements (e.g. markers) also provides the "Delete" function.



Undo function

If you happen to delete a display element unintentionally, you can simply restore it using the UNDO key or the "Undo" icon in the toolbar.

4.4.4 Using Drag and Drop

You can drag and drop many of the R&S ZNB/ZNBT's control and display elements in order to change their size and position. The drag and drop functionality is often more convenient to use than the equivalent buttons of the softtool panels. The following table gives an overview.

Table 4-1: Drag and drop functionality for various screen elements

Screen element	Action	Drag and drop...
Diagram	Create	"New Trace" icon --> existing diagram; see Chapter 4.4.1, "Adding New Traces and Diagrams" , on page 47
	Re-size	Frame (shaded bar in-between adjacent diagrams)
	Delete	Diagram number label ---> "Delete" icon; see Chapter 4.4.3, "Deleting Display Elements" , on page 49
Trace	Create	"New Trace" or "New Ch + Tr" icon --> existing diagram; see Chapter 4.4.1, "Adding New Traces and Diagrams" , on page 47
	Move vertically	Reference line marker (right diagram edge)
	Move into other or new diagram	Trace line
	Delete	Trace line --> "Delete" icon; see Chapter 4.4.3, "Deleting Display Elements" , on page 49
	Reset / suspend graphic zoom	"Graphic Zoom" element in additional trace line --> "Delete" icon; see Chapter 4.6.1, "Using the Graphic Zoom" , on page 54
Marker	Create	"New Marker" icon --> existing diagram; see Chapter 4.4.2, "Adding New Markers" , on page 48
	Move horizontally	Marker symbol
	Delete	Marker or marker info field --> "Delete" icon; see Chapter 4.4.3, "Deleting Display Elements" , on page 49
Marker info field	Add / delete	See marker above (the info field is always tied to a marker)
	Move within diagram	Marker info field (move to one of several pre-defined positions)
Softtool area	Move	Softtool area (move to the right or left edge of the screen)

4.5 Entering Data

The analyzer provides dialogs with various types of input fields where you can enter numeric values and character data. Data entry with a mouse and an external keyboard is a standard procedure known from other Windows® applications. However, there are various other ways to enter data.

4.5.1 Using Front Panel Keys

On a R&S ZNB you can use the keys in the DATA ENTRY keypad to enter numbers, units, and characters.



To enter a numeric value

1. Select a numeric data input field to activate it.
2. Press the DATA ENTRY keys.
 - Use "0" to "9" to enter the corresponding numbers.
 - Use "." and "-" to enter a decimal point or change the sign of the value.
 - Use "G/n", "M/μ", "k/m", or "x1" to multiply the entered value with factors of $10^{(-)9}$, $10^{(-)6}$, $10^{(-)3}$ or 1 and add the appropriate physical unit.

To enter a character string

1. Tap a character data input field to activate it.
2. Press the DATA ENTRY keys as if you were writing a short message on your mobile phone.
 - Press "0" to "9" once to enter the corresponding numbers.
 - Use "." or "-" to enter a dot or a hyphen.
 - Use "G/n", "M/μ", or "k/m" to enter the letters G, M or K (case-insensitive).
 - Use the BACKSPACE key to correct wrong entries, deleting the character to the left of the current cursor position.

- Press ENTER to complete an entry.
 - Press ESC CANCEL to discard the entries made.
3. To enter letters other than G, M or K, you can also use one of the methods described in the following sections:
 - [Chapter 4.5.3, "Using the Analyzer's On-Screen Keyboard"](#), on page 53
 - [Chapter 4.5.4, "Using the Windows® On-Screen Keyboard"](#), on page 53

4.5.2 Using the Numeric Editor

The "Numeric Editor" is a tool for convenient entry and modification of numeric values. It is available for all numeric input fields in the "Vector Network Analyzer" (VNA) application.

Operation with touchscreen or mouse:

1. Double-tap or double-click a numeric input field in a dialog or softtool panel to open the numeric editor.



2. Use the buttons in the numeric keypad to compose the numeric input value.
3. If desired, select a "Stepsize" and use the cursor up/down buttons to increment/decrement the current value. If a marker is active, you can also set the numeric value to the current marker value ("Set to Marker").
4. After completing the input string select "Enter" to apply your selection and close the numeric editor.



STEP SIZE key

If a numeric input field is active, the STEP SIZE front panel key to the right of the rotary knob opens a dialog box containing the "Step Size" panel of the numeric editor. Use this box for efficient operation of the rotary knob.

4.5.3 Using the Analyzer's On-Screen Keyboard

The on-screen "Keyboard" allows you to enter characters, in particular letters, without an external keyboard. It is available for all character input fields in the "Vector Network Analyzer" (VNA) application.



Operation with touchscreen:

1. Double-tap to activate a character data input field in a dialog or in a softtool panel and open the on-screen keyboard.
2. Tap the buttons to select the characters for the input string.
3. After completing the input string tap "Enter" to apply your selection and close the keyboard.

Operation with a mouse:

1. Double-click a character data input field to open the on-screen keyboard.
2. Click a sequence of characters and "Enter" to apply your selection and close the keyboard.

4.5.4 Using the Windows® On-Screen Keyboard

The Windows® on-screen keyboard allows you to enter characters, in particular letters, even if an input field cannot call up the analyzer's own on-screen keyboard. Examples are input fields in standard Windows® dialogs.



To call up the on-screen keyboard,

1. Use the "SYSTEM > APPLIC" key to open the "Applic" softtool.
2. In the "External Tools" tab select "Screen Keyboard".

4.6 Scaling Diagrams

The analyzer provides many alternative tools for customizing the diagrams and for setting the sweep range. Choose the method that is most convenient for you.

4.6.1 Using the Graphic Zoom

The graphic zoom function magnifies a rectangular portion of the diagram (zoom window) to fill the entire diagram area. The sweep points are not affected.



To activate the graphic zoom,

- Activate the "Zoom Select" toggle button in the toolbar above the diagram area. The icon changes its color as shown on the left side.
- In the active diagram area, select an appropriate rectangular area.



The zoomed view shows the selected area, scaled in both horizontal and vertical direction. In general, the zoom window covers only part of the sweep range; the distance between the displayed sweep points increases. The reduced sweep range is displayed in the additional trace lines at the bottom of the diagram.



If you activate the "Overview Select" toggle button and then proceed as described for "Zoom Select", the upper part of the diagram shows a small version of the original diagram for comparison. You can move the zoomed part of the trace by moving the selected rectangular area in the overview.



Use the "Zoom Reset" icon to restore the original diagram. Alternatively, you can drag and drop the "Zoom" label in the additional channel line onto the "Delete" button.



Alternative settings

The "TRACE > Scale > Zoom" softtool panel provides numeric input fields where you can refine the displayed zoom range. To zoom the stimulus range and change the sweep point spacing so that the number of displayed sweep points is maintained, use "STIMULUS > Stimulus > Zoom Stimulus".

4.6.2 Setting the Sweep Range

The sweep range for all channels is displayed in the channel list across the bottom of the diagram:

Ch1	Start 100 kHz	Pwr -10 dBm	Bw 10 kHz	Stop 3 GHz
Ch2	Start 100 kHz	Pwr -10 dBm	Bw 10 kHz	Stop 3 GHz
Ch3	Freq 1 GHz	Pwr -10 dBm	Bw 10 kHz	Stop 1 s
Ch4	Start 100 kHz	Pwr -10 dBm	Bw 10 kHz	Stop 3 GHz
Trc4	Start -1 ns	Time Domain		Stop 4 ns

To change the sweep range, use one of the following methods:

- Press either the START and STOP keys or the CENTER and SPAN keys in the STIMULUS keypad.

- Tap and hold (with a mouse: right-click) the start or stop value in the channel list for some seconds and select "Start Frequency", "Stop Frequency", "Center Frequency", "Frequency Span" from the context menu.
- Select "Start Frequency", "Stop Frequency", "Center Frequency", "Span Frequency" from the "Channel > Stimulus" menu.
- Use the "Set by Marker" functions ("TRACE > MARKER > Set by Marker"; see [Chapter 4.6.6, "Set by Marker"](#), on page 57).

4.6.3 Reference Value and Position

The analyzer provides three parameters for changing the scale of the vertical (response) axis:

- Changing the "Ref Value" or "Ref Position" shifts the trace in vertical direction and adjusts the labels of the vertical axis. "Ref Value" also works for radial diagrams.
- Changing the "Scale/Div" modifies the value of the vertical or radial diagram divisions and thus the entire range of response values displayed.

The "Scale/Div" and the "Ref Value" are indicated in the scale section of the trace list. In the example below, a "Scale/Div" of 10 dB and a "Ref Value" of 0 dB is used.

Trc1 S21 dB Mag 10 dB / Ref 0 dB Math

To change one of the parameters use one of the following methods:

- Select "TRACE > SCALE > Scale Values" to access the settings in the softtool tab.
- Tap and hold (with a mouse: right-click) the scale section in the trace list for some seconds and select the settings from the context menu.
- Select the settings from the "Trace > Scale > Scale Values" menu.
- Use the "Set by Marker" functions ("TRACE > MARKER > Marker Funct"; see [Chapter 4.6.6, "Set by Marker"](#), on page 57).

4.6.4 Auto Scale

The "Auto Scale" function adjusts the scale divisions and the reference value so that the entire trace fits into the diagram. To access "Auto Scale", use one of the following methods:

- Select "TRACE > SCALE > Scale Values" to access the "Auto Scale..." settings in the softtool tab.
- Tap and hold (with a mouse: right-click) the scale section in the trace list and select "Auto Scale Trace" from the context menu.
- Select "Auto Scale..." from the "Trace > Scale > Scale Values" menu.

4.6.5 Circular Diagrams

The radial scale of a circular ("Polar", "Smith" or "Inverted Smith") diagram can be changed with a single linear parameter, the "Ref Value". The reference value defines the radius of the outer circumference.

- Increasing the "Ref Value" scales down the polar diagram.
- Decreasing the "Ref Value" magnifies the polar diagram.

The "Ref Value" is indicated in the scale section of the trace list.

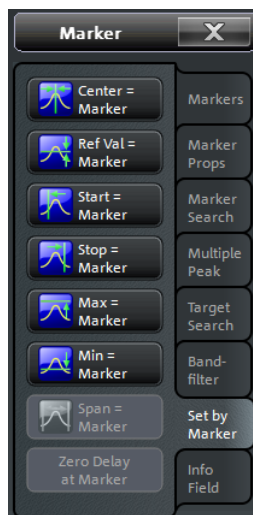
Trc1 S21 Polar 400 mU/ Ref 2 U

To change the "Ref Value" use one of the following methods:

- Select "TRACE > SCALE > Scale Values" to access the parameter in the softtool tab.
- Tap and hold (with a mouse: right-click) the scale section in the trace list and select the parameter from the context menu.
Tap and hold the scale section in the trace list for some seconds (with a mouse: right-click) and select "Ref Value..." from the context menu.
- Select the parameter from the "Trace > Scale > Scale Values" menu.
- Use the "Set by Marker" functions; see [Chapter 4.6.6, "Set by Marker"](#), on page 57.

4.6.6 Set by Marker

The "Set by Marker" functions are a convenient tool for scaling (in particular: magnifying) diagrams without entering explicit numeric values. You simply place a marker to a trace point and use the marker values to change the sweep range or move the trace relative to the vertical axis. The touchscreen or a mouse makes it easier to activate (touch/click) or move (drag and drop) markers.



To set the sweep range use one of the following methods.

Define "Start" and "Stop" values:

1. Create two normal markers, e.g. the markers Mkr 1 (M1) and Mkr 2 (M2), and place them to the desired start and stop values of the sweep range.
2. Activate "M1" and tap "TRACE > MARKER > Set by Marker > Start = Marker".
3. Activate "M2" and tap "TRACE > MARKER > Set by Marker > Stop = Marker".

Use a definite "Span:"

1. Create a marker and set it to delta mode.
The analyzer automatically creates a reference marker in addition to the delta marker.
2. Place the reference marker to the desired start value of the sweep range.
3. Set the value of the delta marker equal to the desired (positive or negative) span.
4. Activate the delta marker and tap "TRACE > MARKER > Set by Marker > Span = Marker".

To move the trace relative to the vertical axis proceed as follows:

1. Create a normal marker, e.g. the marker Mkr 1 (M1), and place it to a particular trace point. E.g. you can use the "Marker Search" functions to locate a maximum or minimum on the trace.
2. Select "TRACE > MARKER > Set by Marker > Max = Marker" to move the trace towards the upper diagram edge, leaving the values of the vertical divisions ("Scale/Div") and the overall vertical scale unchanged. Analogously, select "Min = Marker" to move the trace towards the lower diagram edge, or select "Ref Val = Marker" to move the trace towards the "Ref Value".



You can also use marker values in the "Numeric Editor" dialog; see [Chapter 4.5.2, "Using the Numeric Editor"](#), on page 52.

4.6.7 Enlarging a Diagram

The analyzer provides different tools for customizing the contents and size of the diagrams:

- Double-Tapping (or double-clicking) a diagram maximizes the diagram to occupy the whole diagram area.
- The "Menu Bar", "Status Bar", "Hard Key Panel", and the "Title Bar" are optional display elements which you can hide in order to gain space for the diagrams ("SYSTEM > DISPLAY > View Bar").
- "SYSTEM > DISPLAY > Config" softtool tab provides optional display elements for the interior of the diagrams.

Use the context menu of the diagram, the SYSTEM > DISPLAY key or the "Display" menu to access the display settings.

5 Performing Measurements

The following chapter describes a sample session with a R&S ZNB/ZNBT network analyzer and explains how to solve basic tasks that you will frequently encounter when working with the instrument.

CAUTION

Safety considerations

Before starting any measurement on your network analyzer, please note the instructions given in [Chapter 2, "Putting the Analyzer into Operation"](#), on page 8.



Use the "S-Parameter Wizard" accessible via "TRACE > MEAS > S-Params > S-Param Wizard ..." to perform a standard S-parameter measurement in a straightforward way. The wizard provides a series of dialogs where you can select the test setup, screen configuration and measurement parameters, configure the essential channel settings and perform a guided calibration.

Measurement stages in the wizard

The individual dialogs of the "S-parameter Wizard" correspond to the typical stages of any measurement:

1. Select the test setup
2. Define port impedances
3. Select the measurement parameters and the diagrams
4. Define the sweep range
5. Adjust the receiver and source settings (measurement bandwidth, source power)
6. Perform a calibration

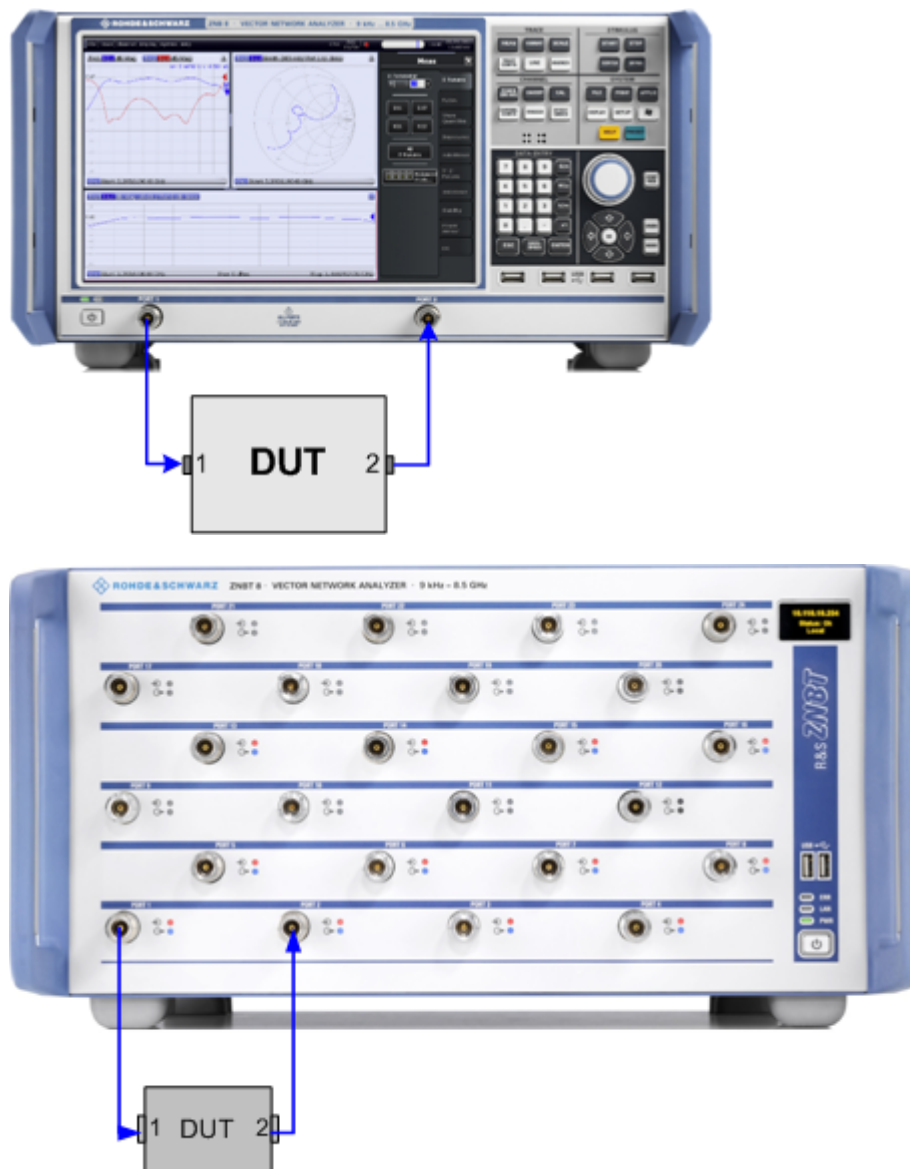
5.1 Transmission S-Parameter Measurement

In a transmission measurement, the analyzer transmits a stimulus signal to the input port of the device under test (DUT) and measures the transmitted wave at the DUT's output port. The trace settings allow you to select the measured quantities and display formats, depending on what you want to learn from the data. A minimum of two analyzer test ports are required for transmission measurements.

In the following example, the analyzer is set up for a two-port transmission measurement. A frequency sweep range is selected, the instrument is calibrated and the measurement result is analyzed using various display formats.

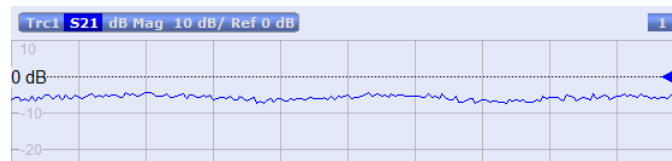
5.1.1 Connecting the Instrument for Transmission Measurements

In order to prepare a transmission measurement, you have to connect your DUT (which for simplicity we assume to have appropriate connectors) in-between a pair of analyzer test ports. It is recommended that you preset the R&S ZNB/ZNBT in order to start from a well-defined instrument state.



1. Connect the DUT between test ports 1 and 2 of the network analyzer as shown above.
2. Proceed as described in [Chapter 2.7, "Starting the Analyzer and Shutting Down"](#), on page 11, to switch on the instrument and start the VNA application.
3. Use the SYSTEM > PRESET key to perform a factory preset of the analyzer.

The analyzer is now set to its default state. The default measured quantity is the transmission S-parameter S_{21} .



Select TRACE > TRACE CONFIG and use the control elements in the "Traces" softtool panel if you wish to create a new trace or a new diagram.

5.1.2 Selecting the Sweep Range and Other Parameters

After a system preset the display shows a diagram with a dB magnitude scale, and the S-parameter S_{21} is selected as a measured quantity. This S-parameter is the forward transmission coefficient of the DUT, defined as the ratio of the transmitted wave at the DUT's output port (port no. 2) to the incident wave at the DUT's input port (port no. 1).

The R&S ZNB/ZNBT automatically adjusts its internal source and receiver to the selected measured quantities: For an S_{21} measurement, a stimulus signal (termed a_1) is transmitted at the analyzer port no. 1; the transmitted wave (termed b_2) is measured at port 2. The stimulus signal from the analyzer port no. 2 is not needed except for some calibration types.

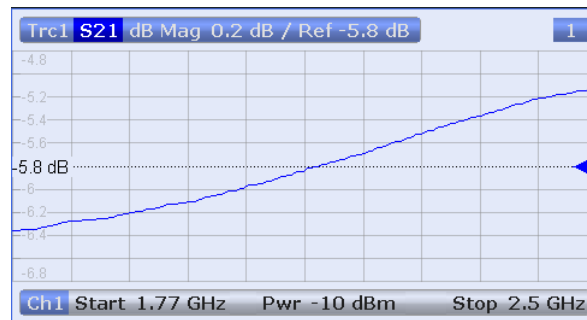
The default sweep range is from 100 kHz to the maximum frequency of the analyzer, except for the R&S ZNB40, which starts at 10 MHz. To gain some more insight into the transmission characteristics of your DUT you can select a smaller sweep range.

1. Select STIMULUS > START and, in the "Start Frequency" input field of the opened softtool panel, enter the lowest frequency you want to measure (e.g. 1.77 GHz). For convenient numeric entry, open the "Numeric Editor" dialog (see [Chapter 4.5.2, "Using the Numeric Editor"](#), on page 52).

Tip: If you use the DATA ENTRY keys at the front panel for data entry (R&S ZNB only), simply type 1.77 and terminate the entry with the G/n key.

Refer to [Chapter 4.5, "Entering Data"](#), on page 51 to learn more about entering numeric values and characters.

2. In the "Stop Frequency" input field enter the highest frequency you want to measure (e.g. 2.5 GHz).
3. Select "TRACE > SCALE > Scale Values" and activate the "Auto Scale Trace" function. The analyzer adjusts the scale of the diagram to fit in the entire S_{21} trace, leaving an appropriate display margin.



Tip: Refer to [Chapter 4.6, "Scaling Diagrams"](#), on page 54 to learn more about the different methods and tools for diagram scaling.

5.1.3 Calibrating the Instrument

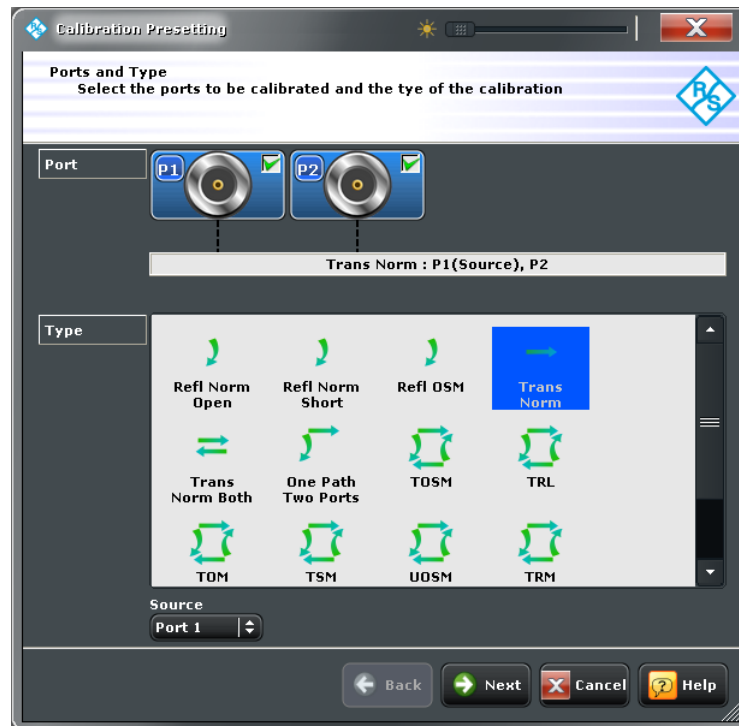
Calibration (system error correction) is the process of eliminating systematic, reproducible errors from the measurement results. E.g. in the current test setup, the connecting cables between the analyzer ports and the DUT introduce an attenuation of the waves on their way from the analyzer port 1 to the input of the DUT and from the DUT output to the analyzer port 2. The length of the cables also introduces a phase shift of the waves. Both effects impair the accuracy of the S-parameter measurement.

The analyzer provides a wide range of sophisticated calibration methods for all types of measurements. Which calibration method should be selected depends on the expected system errors, the accuracy requirements of the measurement, on the test setup and on the types of calibration standards available.

The following example requires a calibration kit with a male Through standard with known transmission characteristics for the related test port connector type and gender. With a single Through, it is possible to perform a transmission normalization, compensating for a frequency-dependent attenuation and phase shift in the signal paths.

Due to the R&S ZNB/ZNBT's calibration wizard, calibration is a straightforward, menu-guided process.

1. Replace the DUT by the Through standard of your calibration kit.
2. Select "CHANNEL > CAL > Start Cal (Manual)" to open the "Calibration Presetting" dialog.
3. Select the port combination Port 1 (P1) and Port 2 (P2) and the calibration type "Trans Norm". Ensure that port 1 is defined as the source port.

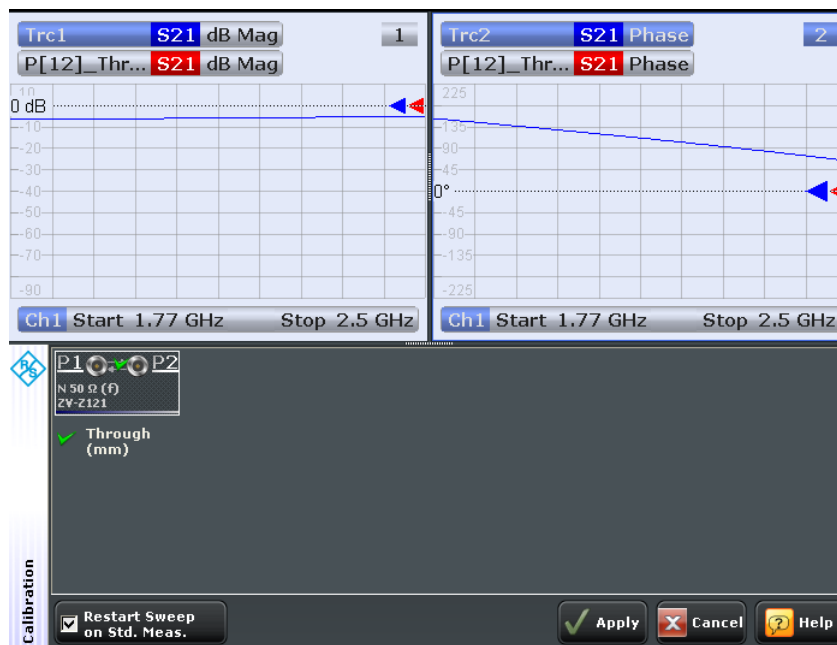


Tip: For a R&S ZNBT with more than 4 ports the graphical port representation is replaced by a generic port list. The selection logic is unchanged.

4. Select "Next" to proceed to the next page of the "Calibration Presetting" wizard.
5. Select the test port connector type and gender (here: N 50 Ω , Female, corresponding to a male Through standard) and the calibration kit (here: "ZV-Z121"), then click "Start".



6. The "Calibration" dock widget indicates the calibration standards to be measured. Select "Through (mm)" to initiate the measurement of the connected Through standard.



The analyzer performs a calibration sweep for the measured quantity S_{21} . The magnitude and phase of the result is displayed in two diagrams, together with the expected typical result for a through standard (red traces, hidden by the blue ones in our example). The similarity of the red and the blue traces indicates that the Through standard has been properly connected. After the R&S ZNB/ZNBT has completed the calibration sweep and calculated the correction data, the "Apply" button is available.

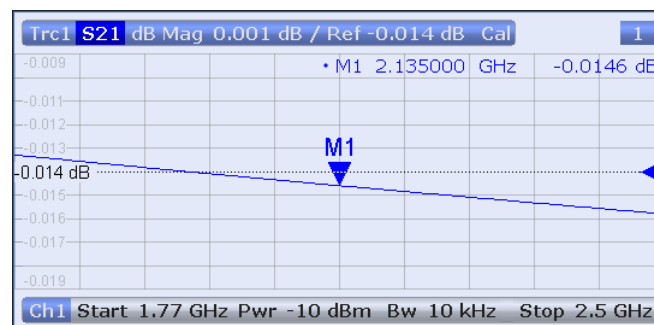
7. Select "Apply" to close the wizard and apply the system error correction to the current channel. A "Cal" label appears in the trace list.
8. Remove the Through standard and connect the DUT again.

5.1.4 Evaluating Data

The analyzer provides various tools to optimize the display and analyze the measurement data. For instance, you can use markers to determine maxima and minima on the trace, and change the display format to obtain information about the group delay of the transmitted wave.

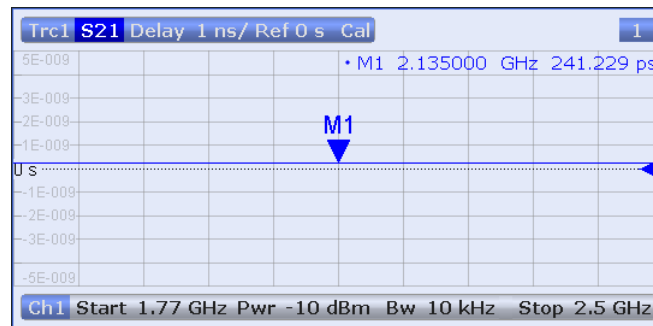
1. Select "TRACE > MARKER > Mkr 1". This places "Marker 1" to its default position (center of the sweep range).

A marker symbol (triangle) appears on the trace. The stimulus value (frequency) and response value (magnitude of the transmission coefficient converted to a dB value) at the marker position is displayed in the marker info field in the upper right corner of the diagram.



2. Select the "Marker Search" softtool tab and activate "Min" search. The marker jumps to the absolute minimum of the curve in the entire sweep range. The marker info field shows the coordinates of the new marker position.
3. Select "TRACE > FORMAT" and choose the "Delay" of the transmission coefficient as displayed quantity.

The group delay represents the propagation time of the wave through the DUT; it is displayed in a Cartesian diagram. The marker info field shows the frequency and group delay at the marker position.



Refer to section "Display Formats and Diagram Types" in the help system or in the user manual to learn more about the diagram properties.

5.1.5 Saving and Printing Data

The analyzer provides standard functions for saving measurement settings and for saving or printing the results. You can use these functions as if you were working on a standard PC. Moreover you can export your trace data to an ASCII file and reuse it in a later session or in an external application.



Data transfer is made easier if external accessories are connected to the analyzer or if the instrument is integrated into a LAN. Refer to [Chapter 2.9, "Connecting External Accessories"](#), on page 12, and [Chapter 2.12, "Remote Operation in a LAN"](#), on page 16 to obtain information about the necessary steps.

1. Select "SYSTEM > FILE" to open the "File" softtool.
2. In the "Trace Data" tab of the "File" softtool select "Export > ASCII" to open the "Export Data - ASCII Files" dialog
3. In the "Export Data - ASCII Files" dialog, select a file location ("Look in:"), enter a file name and select "Save".
The active trace data is written to an ASCII file and the dialog closes.
4. In the "Print" tab of the "File" softtool select "Print" to create a hardcopy of your diagram or "To Clipboard" to copy the diagram to the Windows clipboard
5. Select "SYSTEM > FILE > Recall Sets > Save..." to open the "Save" dialog for recall sets.
6. In the "Save" dialog, select a file location ("Look in:"), enter a name for the recall set file and select "Save".
The active recall set containing your instrument settings is stored to a file and can be used again in a later session.

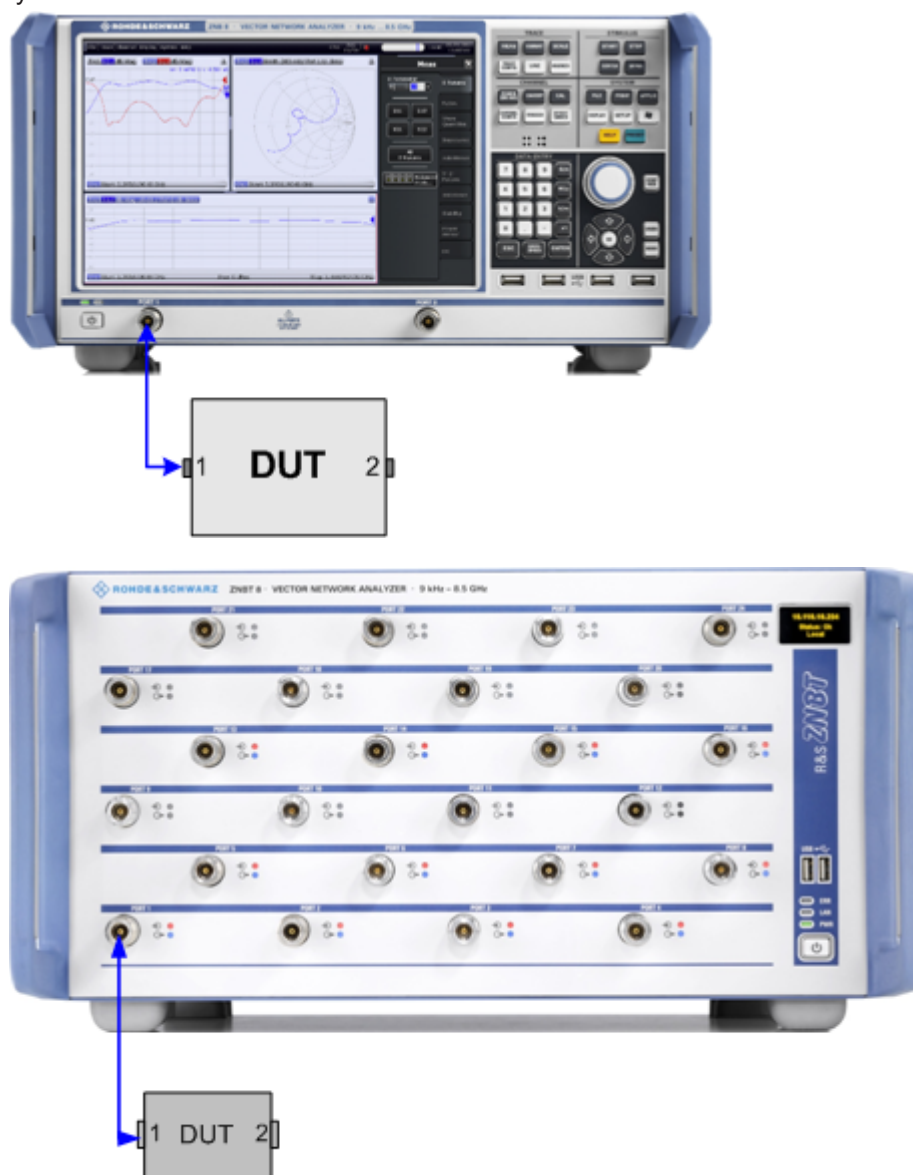
Proceed as described in [Chapter 2.7, "Starting the Analyzer and Shutting Down"](#), on page 11 to shut down your analyzer.

5.2 Reflection S-Parameter Measurement

In a reflection measurement, the analyzer transmits a stimulus signal to the input port of the device under test (DUT) and measures the reflected wave. A number of trace formats allow you to express and display the results, depending on what you want to learn from the data. Only one analyzer test port is required for reflection measurements.

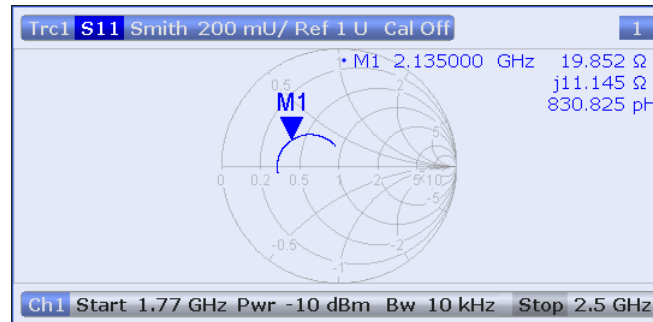
In principle a reflection measurement involves the same steps as a transmission measurement. Note the following differences:

- The basic test setup for reflection measurements involves a single DUT and analyzer port. For instance, you can connect the input of your DUT to port 1 of the analyzer as shown below.



You can also use the basic transmission test setup, e.g. if you want to measure reflection and transmission parameters in parallel.

- The analyzer provides special calibration types for reflection measurements. Use the calibration wizard and select an appropriate type. The full n-port calibration types (TOSM, UOSM, TNA ...) will correct the system errors for all transmission and reflection S-parameters.
- Some of the trace formats are particularly suited for reflection measurements. E.g. you can display the measured reflection coefficient S_{11} in a Smith chart in order to obtain the complex input impedance at port no. 1.



6 Administrative Tasks

This chapter describes various topics which you may need only occasionally or in case that you desire a special instrument configuration.

6.1 Windows Operating System

The analyzer is equipped with a Windows® 7 operating system which has been configured according to the instrument's features and needs. Changes in the system configuration can be necessary in order to:

- Establish a LAN connection
- Customize the properties of the external accessories connected to the analyzer
- Call up additional software tools

NOTICE

Modifications of the operating system

The operating system is adapted to the network analyzer. To avoid impairment of instrument functions, only change the settings described in this manual. Existing software must be modified only with update software released by Rohde & Schwarz. Likewise, only programs authorized by Rohde & Schwarz for use on the instrument must be executed.

The "Start" menu of the operating system is accessed by pressing the Windows key in the SYSTEM keypad or on an external keyboard. All necessary settings can be accessed from the "Start" menu, in particular from the "Control Panel".



User accounts and password protection

The analyzer uses a user name and password as credentials for remote access. Two user accounts with different levels of access are available on the instrument:

- "instrument" is the default account with standard rights to change system settings. Use this account for normal operation of the analyzer.
- "Administrator" is the account for administering the operating system. This account is required e.g. if you wish to install programs on the analyzer.

In the factory configuration, "894129" is preset as a password for both users. To protect the analyzer from unauthorized access, it is recommended to change the factory setting ("Control Panel > User Accounts > Change your password").

To switch from one user account to the other, use Windows ""Logoff" and "Logon". On the R&S ZNB/ZNBT the "Switch User" functionality is disabled.



6.2 Firmware Update

Upgrade versions of the analyzer firmware are supplied as single setup files *.msi.



Administrator account

You need administrator rights to install a new firmware version. See note on "[User accounts and password protection](#)" on page 69 for details.

To perform a firmware update,

1. Copy the setup file to any storage medium accessible from the analyzer. This may be the internal hard disk, an external storage medium (USB memory stick, external CD-ROM drive) or a network connection (LAN, GPIB bus).
2. In the Windows® Explorer, tap the setup file twice (or double-click with a mouse) and follow the instructions of the setup wizard.

Setup files can be stored and installed again. The default drive name of the internal hard disk is C:. External storage devices are automatically mapped to the next free drive, i.e. D:, E: etc.



Factory calibration

A firmware update does not affect the factory calibration.

NOTICE

External accessories

Calibration units must be disconnected during a firmware update.

7 Maintenance

The R&S ZNB/ZNBT vector network analyzer does not require any special maintenance.

For our support center address and a list of useful R&S contact addresses refer to the documentation CD-ROM or the "Contact" page at the beginning of the Help system.

7.1 Storing and Packing the Instrument

The vector network analyzer can be stored at the temperature range quoted in the data sheet. When it is stored for a longer period of time the unit should be protected against dust.

The original packing should be used when the unit is to be transported or dispatched; please also observe the notes in [Chapter 2.1, "Unpacking and Checking the Instrument"](#), on page 8.

7.2 Replacing Fuses

The R&S ZNBT is protected by a time lag fuse (T15L250V, stock no. 3589.7478.00). The fuse is screwed in below the AC power switch on the rear panel.

For the R&S ZNB the optional "Bias Tee" inputs at the rear panel (labeled PORT BIAS <no>) are each protected by a fuse (0.250 A, F IEC60127-2/2, stock no. 0020.7246.00).

WARNING

Shock hazard

Before replacing a fuse, make sure that the instrument is switched off and disconnected from all power supplies.

Always use fuses supplied by Rohde & Schwarz as spare parts, or fuses of the same type and rating.

To replace the mains fuse (R&S ZNBT only)

1. Unscrew the fuse holder from the rear panel and pull the fuse holder out of the slot.
2. Pull the fuse out of the fuse holder and replace it by a new one.
3. Stick the fuse holder back into the slot in the rear panel and screw it tight.

To replace the DC input fuses

- ▶ Open the fuse holder by slightly turning the lid counterclockwise.

8 Obtaining Technical Support

The instrument generates error messages which in most cases will be sufficient for you to detect the cause of an error and find a remedy. Error message types are described in the R&S ZNB/ZNBT User Manual; refer to section "Error Messages and Troubleshooting".

In addition, our customer support centers are there to assist you in solving any problems that you may encounter with your network analyzer. We will find solutions more quickly and efficiently if you provide us with the information listed below. Simply open the relevant dialogs in the "Info" dialog, select "Save...", and send us the file.

- **Setup Info:** The instrument setup information ("Info > Setup Info") contains your instrument settings. You can also send us the VNA recall set file (*.znx) that you generate after the fault occurs ("File > Recall Sets > Save...").
- **Option Info:** The option info ("Info > Option Info") informs us about the status of all software and hardware options of your analyzer.
- **Hardware Info:** The hardware info ("Info > Hardware Info") shows us the installed options and hardware assemblies.
- **Error Log:** The error log ("Info > Error Log") contains a chronological record of errors.
- **Exception Dumps:** In case of an exception the R&S ZNB/ZNBT automatically generates a dump file for debugging purposes.
The level of detail of the dumps can be set from the "Advanced" tab of the "System Config" dialog.
The latest 5 exception dumps can be retrieved using the "Save Report" function of the "Info" dialog.
- **Save Report:** The system report command ("Info > Save Report") collects the setup, option, and hardware information as well as the error log and the current selftest results and writes everything to a *.zip file. The *.zip file also contains the current eeprom data and a screenshot of the VNA display. It is written to the report directory `C:\Users\Public\Documents\Vna\Report`. The file name contains the current date and time, e.g. `report_20110125_1658.zip`. "Save Report" provides the most comprehensive information, comprising all other "Info" files.

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