

R&S® ZVA-Z90E / -Z110E Converters WR12 / WR10 with Electronic Attenuators Quick Start Guide



1307.7197.62 - 06

This Quick Start Guide describes the following converter types:

- R&S® ZVA-Z90E, Converter WR12, stock no. 1307.7600.02
- R&S® ZVA-Z110E, Converter WR10, stock no. 1307.7000.40

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Mühlhofstr. 15, 81671 München, Germany

Phone: +49 89 41 29 - 0

Fax: +49 89 41 29 12 164

Email: info@rohde-schwarz.com

Internet: www.rohde-schwarz.com

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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)

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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.

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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.

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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.

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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 ISO 9001 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.

Europe, Africa, Middle East

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

North America

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

Latin America

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

Asia/Pacific

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

China

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



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1 Safety Instructions

This frequency converter has been designed 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.

NOTICE

Risk of instrument damage

To prevent instrument damage make sure to read through and observe the following safety instructions.

ESD protective measures

To protect the frequency converter against damage due to Electrostatic Discharge (ESD) use the wrist strap and grounding cord supplied with the network analyzer and connect yourself to the GND connector at the front panel of the analyzer. For details refer to the Quick Start Guide of your analyzer.

Input powers RF IN and LO IN

The RF input power at the connectors RF IN and LO IN must not exceed the maximum values quoted in the data sheet. The maximum values are below the maximum RF source power of the network analyzer. The frequency converter mode ensures compatible source powers.

Before you connect your converter to the network analyzer, always activate the frequency converter mode using the Frequency Converter dialog (see [chapter 3.3, "Activating the Frequency Converter Mode"](#), on page 20) and select the proper converter type and connecting diagram.

Protection of waveguide flanges

The waveguide flanges of the converter and of the test port adapters must be protected against mechanical damage. Furthermore the waveguides must be shielded from dust.

Protect the waveguide flange of the converter by leaving a test port adapter mounted. When the converter is not in use attach one of the included protective caps to the adapter. Also attach protective caps to the second test port adapter. Avoid scratching the contact surfaces of the waveguide flanges.

Avoid heavy shocks

Heavy shocks can damage inner parts of the instrument. Shock-proof packing should therefore be used for storing or dispatching the frequency converter.

Opening the instrument

Do not open the instrument. The converter must be repaired at the manufacturer's servicing department.

2 Preparing for Use

This chapter gives an overview of the controls and connectors of the frequency converter and provides all information that is required to put the converter into operation and connect external devices.

Chapter 3 provides an introduction to the operation of the frequency converter. For a list of (additional) required equipment see [chapter 3.1, "Required Equipment"](#), on page 19.

2.1 Test Port Adapter (Waveguide Flange)

The test port with a mounted test port adapter is located at the front of the instrument. The device under test (DUT) has to be connected to the test port adapter.



Fig. 2-1: Front of the instrument R&S ZVA-Z110E (the other model is similar in design)

The precision waveguide flange of the test port adapter is equipped with two alignment pins and two holes receiving the alignment pins of the DUT (see [figure 2-2](#)). Two additional holes in the middle allow to insert additional alignment pins (delivered with the instrument). Additional pins should be used if the flange of the DUT also has holes for receiving these pins and the accuracy of the connection shall be enhanced.

The R&S ZVA-Z110E converter is delivered with a standard adapter plus an alternative adapter. The two adapters differ in the size of the holes receiving the alignment pins of the flange of the DUT. The standard test port adapter has holes with a diameter of 1.565 mm at both ends. The alternative adapter has holes with a diameter of 1.605 mm at the DUT side. The DUT side is marked by the label "HP/A", indicating that this side is HP/Agilent compatible (i.e. supports thicker pins).

The R&S ZVA-Z90E converter is delivered with the HP/A compatible adapter.

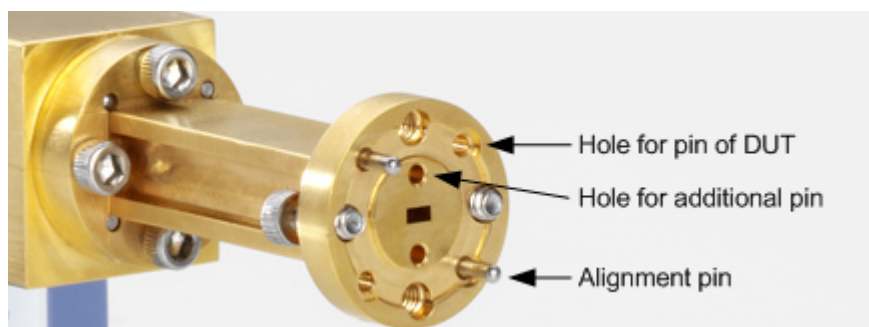


Fig. 2-2: Test port adapter of R&S ZVA-Z110E

NOTICE

Risk of damaging waveguide flanges

The waveguide flanges of the converter and of the test port adapters must be protected against mechanical damage. Furthermore the waveguides must be shielded from dust.

Protect the waveguide flange of the converter by leaving a test port adapter mounted. When the converter is not in use attach one of the included protective caps to the adapter. Also attach protective caps to the second test port adapter. Avoid scratching the contact surfaces of the waveguide flanges.

2.2 DC OUT Connector



The DC OUT TO DIPLEXER connector below the test port adapter provides the DC supply voltage for the diplexers of an R&S ZVA110 network analyzer. It is available on R&S ZVA-Z110E converters where it replaces the front panel label.

NOTICE

Risk of instrument damage

The supply voltage of the DC OUT connector is exclusively intended for the diplexer modules of a network analyzer with external test sets. Never connect any other devices.

2.3 Rear Panel

The rear panel of the frequency converter provides the connectors and control elements described below:

- [Standby Switch](#)

- Power Supply Connector
- Fuse Holder
- RF Connectors – Input
- RF Connectors – Output
- Control Connector



Fig. 2-3: Rear view of the frequency converter

2.3.1 Standby Switch

The standby toggle switch connects (ready state) or disconnects (standby state) the internal modules of the frequency converter from the power supply.

A green light-emitting diode (LED) next to the switch indicates that the instrument is in ready state. An orange LED further to the right indicates that the instrument is in standby state. These LEDs are only lit when the converter is properly connected to the power supply and the fuse of the instrument is intact.



Fig. 2-4: Standby switch and LEDs

2.3.2 Power Supply Connector



To supply the frequency converter with power, connect the external DC power supply to the "9 V / MAX. 1.1 A" DC input (labeled "9 V / MAX. 1.6 A" on R&S ZVA-Z500 converters). For details see [chapter 2.4.7, "Connecting the Converter to the DC Supply"](#), on page 16.

Always switch the instrument to standby state before removing the power supply.

NOTICE

Risk of instrument damage

The input voltage and current must not exceed the maximum values according to the rear panel labeling or the data sheet.

Notice that the external DC power supply units of R&S ZVA-Z500 converters support higher output powers. Always use the DC power supply delivered with your frequency converter.

2.3.3 Fuse Holder



The power supply connector at the rear panel is protected by a fuse of type IEC60127 T1 L/H (IEC60127 T1.8 L/H on R&S ZVA-Z500 converters). For fuse replacement see [chapter 2.4.10, "Replacing Fuses"](#), on page 17.

2.3.4 RF Connectors – Input



Two 3.5 mm input connectors:

- RF IN (RF source signal input)
- LO IN (local oscillator signal input)

For correct cabling please refer to [chapter 2.4.6, "Connecting RF Cables"](#), on page 13.

NOTICE**Risk of instrument damage**

The RF input power at the connectors RF IN and LO IN must not exceed the maximum values quoted in the data sheet. The maximum values are below the maximum RF source power of the network analyzer. The frequency converter mode ensures compatible source powers.

Before you connect your converter to the network analyzer, always activate the frequency converter mode using the Frequency Converter dialog (see [chapter 3.3, "Activating the Frequency Converter Mode"](#), on page 20) and select the proper converter type and connecting diagram.

2.3.5 RF Connectors – Output



Two SMA connectors:

- MEAS OUT (measurement signal output)
- REF OUT (reference signal output)

For correct cabling please refer to [chapter 2.4.6, "Connecting RF Cables"](#), on page 13.

2.3.6 Control Connector



The three-pin control connector receives the control signal for the source power of the frequency converter.

For correct connection read [chapter 2.4.5, "Connecting the Control Cable"](#), on page 13.

2.4 Putting the Converter into Operation

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

NOTICE**Risk of instrument damage**

Before turning on the converter, please make sure that the following conditions are fulfilled:

- Converter covers are in place and all fasteners are tightened.
- Ventilation openings are unobstructed.
- The converter is dry and shows no condensation.

Non-observance may cause damage to the converter!

2.4.1 Unpacking the Unit and Checking the Shipment

When you receive the converter, please take the following steps:

1. Unpack the converter and the other contents of the wooden shipping box.
2. Check the shipment against the list of accessories to ensure that all items are included.
3. Remove the protective cap from the test port adapter at the front of the instrument and carefully inspect the frequency converter to make sure that it was not damaged during shipment.

Should the converter be damaged, immediately notify the forwarder who shipped the converter to you and keep the container and packing material.

Equipment returned or sent in for repair should be packed in the original wooden box.

NOTICE**Risk of damaging waveguide flanges**

The waveguide flanges of the converter and of the test port adapters must be protected against mechanical damage. Furthermore the waveguides must be shielded from dust.

Protect the waveguide flange of the converter by leaving a test port adapter mounted. When the converter is not in use attach one of the included protective caps to the adapter. Also attach protective caps to the second test port adapter.

The wooden box should also be kept and used for storage of the instrument and the accessories.

2.4.2 Setting up the Converter

The frequency converter is designed for use under laboratory conditions on a bench top. The surface of the bench top should be flat. The converter must be used in horizontal position.

The general ambient conditions required at the operating site are as follows:

- The ambient temperature must be in the ranges specified for operation and for compliance with specifications (see data sheet).
- All ventilation openings must be unobstructed.

NOTICE

Risk of instrument and DUT damage

To avoid damage of electronic components of the DUT and the frequency converter, the operating site must be protected against electrostatic discharge (ESD).

To prevent ESD damage use the wrist strap and grounding cord supplied with the network analyzer and connect yourself to the GND connector at the front panel of the analyzer. For details refer to the Quick Start Guide of your analyzer.

2.4.3 Adjusting the Feet of the Instrument

The instrument can be used with three or four feet attached to the bottom side. It is recommended to use three feet: two in the front and one in the middle of the rear. In most cases a suitable start setup for instrument alignment is as follows: Screw the front feet into the instrument as far as possible and use the rear foot to align the instrument parallel to the surface of the bench top. When you mount a DUT to two instruments (see [chapter 2.4.9, "Mounting a DUT"](#), on page 17) use the feet for further alignment.



Fig. 2-5: Setup with three feet (left) and four feet (right)

2.4.4 Selecting and Mounting a Test Port Adapter

For the R&S ZVA-Z110E two test port adapters are available (see [chapter 2.1, "Test Port Adapter \(Waveguide Flange\)"](#), on page 6). Select the appropriate adapter depending on the DUTs to be measured:

- Standard adapter:
Use this adapter if you want to measure DUTs with thin pins only.
- HP/Agilent compatible adapter:
Use this adapter if you want to measure DUTs with thick pins.

DUTs with thin pins can also be connected to the HP/A adapter (useful if you have both types of DUT). But the connection of DUTs with small pins is more accurate if the standard adapter is used. The reduced alignment condition can typically be compensated using two additional pins above and below the waveguide cross-section.

Mount the selected adapter to the waveguide flange of the instrument using the delivered screws and the included hex ball driver. A tight and accurate connection is very important to ensure precise calibration and measurement results.

2.4.5 Connecting the Control Cable

The source power of the frequency converter is controlled from the R&S ZVA vector network analyzer. Connect the 3-pin control connector at the rear panel of the converter to the output connector of option R&S ZVA-B8 (EXTATT CTRL) at the top right of the R&S ZVA front panel using the control cable supplied with the converter.



The numbers below the EXTATT CTRL connectors denote the controlled analyzer ports. Control connector numbers and analyzer port numbers must always be the same.

For an upgrade of your network analyzer with option R&S ZVA-B8, contact your Rohde & Schwarz service representative.



Option R&S ZVA-B8 replaces the 3.5" disk drive of the analyzer. If you keep cal kit data or other network analyzer data files on a 3.5" disk, you may want to save them to another storage medium, e.g. a USB memory stick before you have the disk drive replaced.

2.4.6 Connecting RF Cables

The connectors RF IN, LO IN, MEAS OUT and REF OUT have to be connected to the NWA; LO IN can alternatively be connected to an external generator.

NOTICE**Risk of connector and cable damage**

Tightening the cables too strongly may damage cables and connectors. Loose tightening may result in inaccurate measurement results.

Therefore always use an appropriate torque wrench, suitable for the type of connector. Rohde & Schwarz offers an optional 5/16" torque wrench that fits for SMA, 3.5 mm, 2.92 mm and 1.85 mm connectors (order number 1328.8534.35). Similar wrenches are available for other sizes of spanner, too. See ordering information in R&S ZVA-Z110E data sheet or product brochure.

Connecting the input connectors (RF IN, LO IN)

The type of cable required for connecting the input connectors depends on the type of the network analyzer / external generator. Since the converter inputs are fitted with 3.5 mm female connectors, the cable should ideally have male connectors of the same type (e.g. R&S ZV-Z193, order number 1306.4520.xx). Alternatively, 2.92 mm or SMA male connectors are possible. These are mechanically compatible with 3.5 mm connectors while providing tolerable electrical mismatch (e.g. R&S ZV-Z195, order number 1306.4536.xx).

For a complete test setup for a 2-port transmission measurement - as shown in [figure 2-6](#) - a cable length of about 1 m is recommended. For a setup with only one converter shorter cables may be sufficient. Always use cables with low attenuation and excellent phase stability.

Depending on the NWA model, additional 1.85 mm to 2.92 mm adapters may be required to connect the cables.

1. Connect port 1 or port 2 of the analyzer to RF IN of the converter.
2. Connect port 3 or port 4 of the analyzer to LO IN of the converter.
For NWAs with 4 sources (R&S ZVA24 var. 28, R&S ZVA40 var. 48 or R&S ZVA67), connect LO IN to **port 4 only**. For these NWA models, or in case an external generator is used, a power splitter is required for a two-port converter setup. If the outputs of the splitter are so close that two cables cannot be mounted in parallel, additional angled adapters are required. This setup is shown in [figure 2-7](#) below.

If a power splitter is used and the phases of S_{21} and S_{12} deviate or drift by equal magnitude, but opposite sign, check the phase stability of the LO paths of both converters.

The required adapters and splitters are offered as complementary adaption kits (see "[Adaption Kits R&S ZCAK](#)" on page 16).

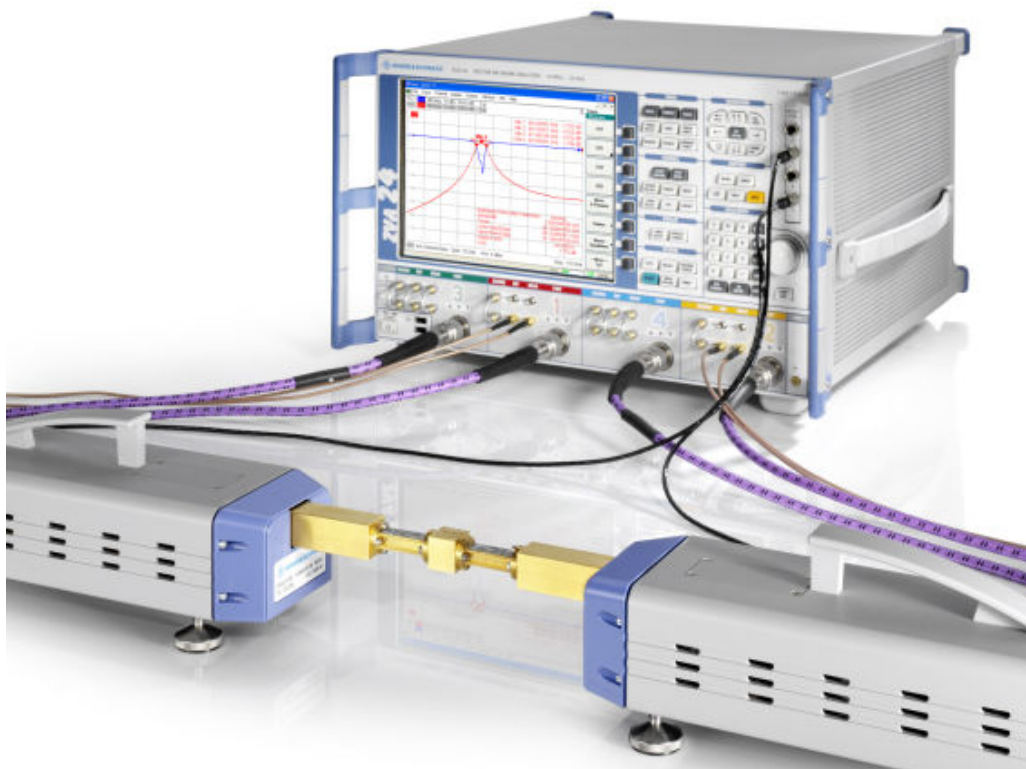


Fig. 2-6: Test setup: 2-port transmission measurement for a NWA with two sources

Connecting the output connectors (MEAS OUT, REF OUT)

Suitable cables for connecting the output connectors to the network analyzer are included in the converter shipment. The connectors of these cables are labeled accordingly.

R&S ZVA50 and R&S ZVA67 require additional 1.85 mm to 2.92 mm adapters to connect the cables. These adapters are offered as complementary adaption kits (see ["Adaption Kits R&S ZCAK"](#) on page 16).

1. Connect MEAS OUT of the converter to the NWA. Use the MEAS IN connector of the NWA port that provides the RF source signal.
2. Connect REF OUT of the converter to the REF IN connector of the same NWA port.

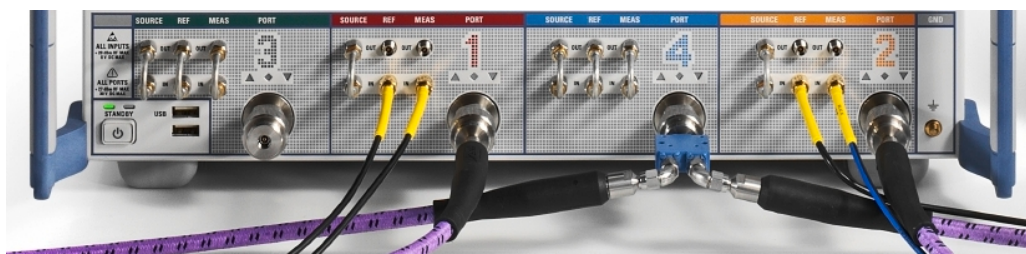


Fig. 2-7: Test setup: 2-port transmission measurement for a NWA with four sources

Adaption Kits R&S ZCAK

As explained in the previous sections, depending on the NWA model, additional adaptors, power splitters and angled adapters may be required to connect the cables. Rohde & Schwarz offers three different adaption kits R&S ZCAK to meet the requirements of different NWAs:

- For the R&S ZVA24 var. 28 and the R&S ZVA40 var. 48 (NWAs with four sources), Rohde & Schwarz offers the adaption kit R&S ZCAK Var. 24 (order number 1323.7746.24).
It includes a power splitter and two right angled SMA (m-m) adapters.
- For the R&S ZVA50, Rohde & Schwarz offers the adaption kit R&S ZCAK Var. 50 (order number 1323.7746.50).
It includes four 1.85 mm (f) to 2.92 mm (m) adapters and four 1.85 mm (m) to 2.92 mm (f) adapters.
- For the R&S ZVA67, Rohde & Schwarz offers the adaption kit R&S ZCAK Var. 67 (order number 1323.7746.67).
It includes a power splitter and two right angled SMA (m-m) adapters, three 1.85 mm (f) to 2.92 mm (m) adapters and four 1.85 mm (m) to 2.92 mm (f) adapters.

2.4.7 Connecting the Converter to the DC Supply

An external DC power supply and several plug adapters are provided with the instrument. Select the appropriate adapter and attach it to the power supply. To remove a mounted adapter press the small button next to the adapter and push the adapter away from the button.

Connect the power supply to the "9 V / MAX. 1.1 A" DC input on the rear panel (see [chapter 2.3.2, "Power Supply Connector"](#), on page 9) and to a power outlet. The power supply supports input AC voltages between 100 V and 240 V and frequencies between 47 Hz and 63 Hz.

A lit LED next to the standby switch indicates that the power supply operates appropriately. If neither of the two LEDs is lit, check the fuse of the instrument (see [chapter 2.4.10, "Replacing Fuses"](#), on page 17).

NOTICE

R&S ZVA-Z500 converters

The external DC power supply units of R&S ZVA-Z500 converters support higher output powers; the DC input connector at the rear panel is labeled "9 V / MAX 1.6 A". Always use the DC power supply delivered with your frequency converter.

2.4.8 Switching on the Instrument

The standby toggle switch is located at the rear panel (see [chapter 2.3.1, "Standby Switch"](#), on page 8). To switch the instrument to ready state, press the key. The green LED next to the switch must be lit now.

After switching the instrument to the ready state a warm-up time of one hour is required to ensure accurate measurements. The instrument is only warmed-up in ready state, not in standby state.

2.4.9 Mounting a DUT

The DUT has to be mounted to the test port adapter at the front of the converter. Use the included screws and hex ball driver. For higher precision, a torque-controlled hex ball driver R&S ZV-Z1000 is available as an accessory (order number 1314.5467.02). Rohde & Schwarz also offers a special angled hex ball driver R&S ZCAW (order number 1175.1960.00) that can advantageously be applied in the tight space between rear side of the test port adapter flange and converter front side (see [figure 2-8](#)).

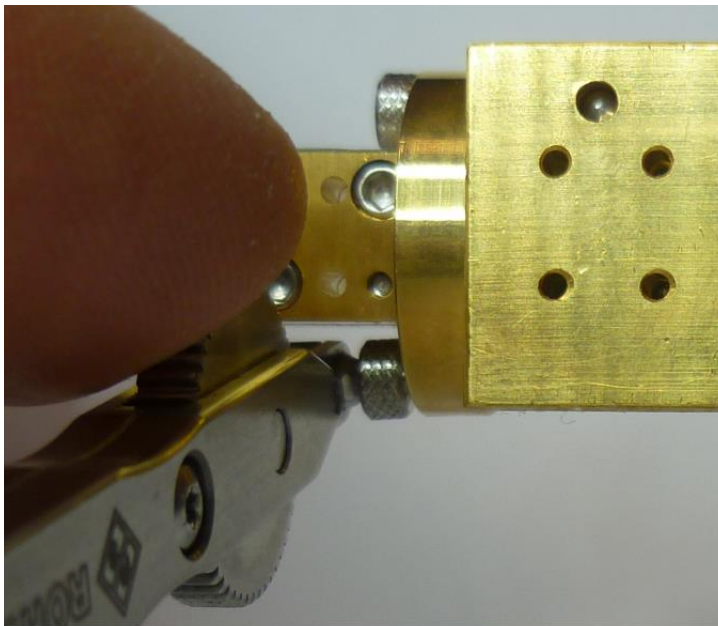


Fig. 2-8: Angled hex ball driver R&S ZCAW (accessory)

A tight and accurate connection is very important to ensure precise calibration and measurement results. Depending on the type of waveguide flange of the DUT it may be required to exchange the test port adapter (see [chapter 2.4.4, "Selecting and Mounting a Test Port Adapter"](#), on page 13).

For a test setup involving two frequency converters connected to one DUT, converters and DUT have to be aligned accurately, using the adjustable instrument feet. A bubble level may help for proper alignment.

2.4.10 Replacing Fuses

The power supply connector at the rear panel is protected by a fuse of type IEC60127 T1 L/H (IEC60127 T1.8 L/H on R&S ZVA-Z500 converters). To replace the fuse open

the fuse holder by slightly turning the lid counter-clockwise, preferably using a small coin. A replacement fuse is provided with the instrument.

2.5 Maintenance

The frequency converter does not require any special maintenance. Make sure that the air vents are not obstructed. The outside of the instrument is suitably cleaned using a soft, line-free dust cloth.

NOTICE

Risk of instrument damage

Cleaning agents contain substances that may damage the instrument, e.g. solvent-containing cleaning agents may damage the front panel labeling or plastic parts.

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

For our support center address and a list of useful R&S contact addresses refer to the pages at the beginning of this document.

2.6 Storing and Packing

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

When the instrument is to be transported or dispatched, the original packing should be used, particularly the protective cap and the wooden box (see also [chapter 2.4.1, "Unpacking the Unit and Checking the Shipment"](#), on page 11).

3 Basic Operation

This chapter describes the use of an R&S ZVA vector network analyzer and two R&S ZVA-Z110E frequency converters for 2-port transmission measurements.

Measurements using other converter types are performed in an analogous way.

3.1 Required Equipment

Measurements with frequency converters can be carried out with the following equipment:

- Network analyzer (NWA) R&S ZVA with an upper frequency limit of 20 GHz or higher (R&S ZVA 24, R&S ZVA40 ...).
The required firmware version depends on the frequency converter model:
 - R&S ZVA-Z110E: at least version V2.61
 - R&S ZVA-Z90E: at least version V2.70
- Two NWA ports per frequency converter port.
Alternatively: One NWA port per frequency converter plus a common external generator for the LO signals. The R&S SMF100A signal generator with suitable options is recommended.
- N frequency converters for an N-port measurement
- Option R&S ZVA<n>-B16, "Direct Generator/Receiver Access" at each port
- Option R&S ZVA-K8, "Converter Control"
- Option R&S ZVA-B8 to establish the control connection between the NWA and the frequency converters
- a suitable set of calibration standards

3.2 Measurement Principle

The frequency converters use frequency multipliers to transform the RF source signal from one of the network analyzer ports into a high-frequency stimulus signal. A second signal (Local Oscillator, LO) is used for down-conversion of the reference and measurement channels. The LO signal can be provided either by a second analyzer port or by an external generator.

The measurement involves the following steps:

1. Selection of the converter and test setup, activation of the converter mode
2. Entry of power coefficients (when a converter is used for the first time or assigned to a new analyzer port).
3. Connection of the frequency converters
4. Power and frequency settings

5. Power calibration using an appropriate external waveguide power meter
6. Calibration using a suitable waveguide calibration kit
7. Connection of the DUT and measurement

3.3 Activating the Frequency Converter Mode

To activate the converter mode for a setup without external generator,

1. Click "System > System Config ..." and open the "Frequency Converter" tab of the "System Configuration" dialog.
2. Select correct "Type": R&S ZVA-Z90E or R&S ZVA-Z110E.
3. If you use your frequency converter for the first time, click "Coefficients" to enter the power coefficients; see [chapter 3.4, "Entering Power Coefficients"](#), on page 21.
4. Select a test setup with an analyzer port as external source, click "Apply" to activate the frequency converter mode and "Close".



Analyzer settings with active frequency converter

In frequency converter mode, the frequency and level settings of the network analyzer are automatically set to be compatible with the selected frequency converters. "Low Phase Noise" is enabled, Automatic Level Control (ALC) is disabled. The frequency and levels of all ports are displayed in the "Port Configuration" dialog ("Channel > Mode > Port Config ...").

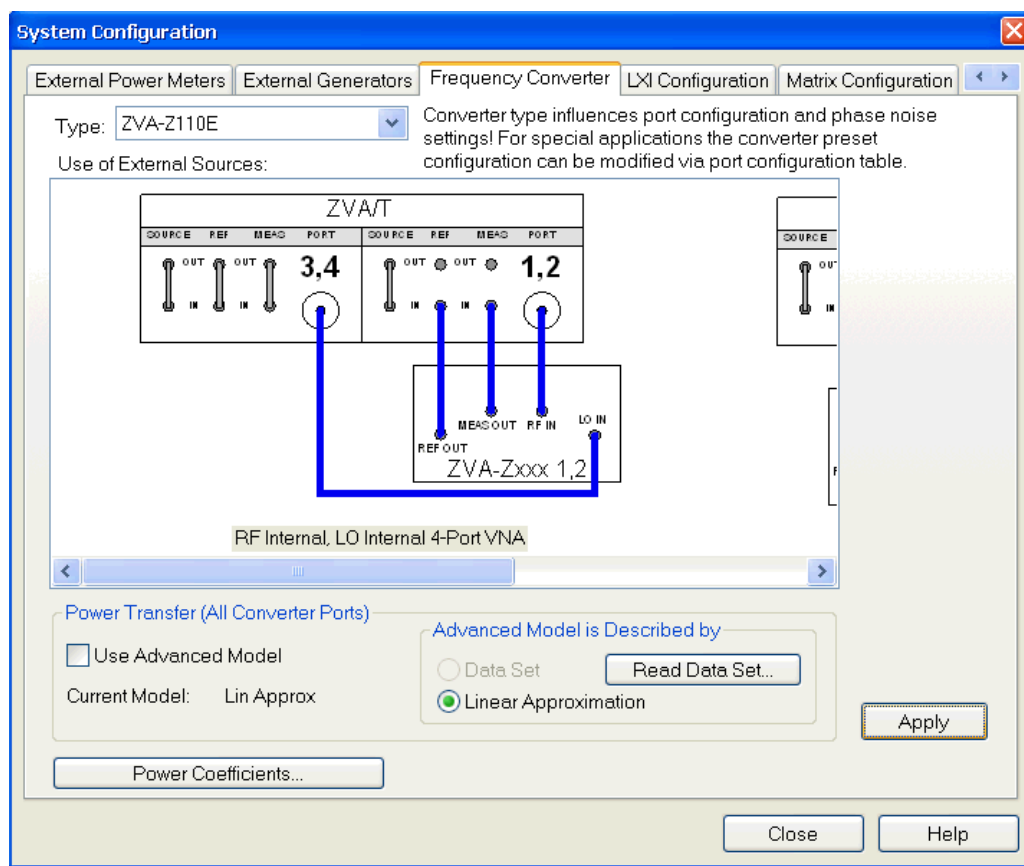


Fig. 3-1: Frequency Converter dialog

3.4 Entering Power Coefficients

For accurate control of the converter output power, the R&S ZVA analyzer must know the (non-linear) current-power characteristic of the converters. The characteristic is sufficiently described by a third-order polynomial. A label with the four polynomial coefficients c_0 , c_1 , c_2 , and c_3 is affixed to each converter.

The power coefficients must be adjusted whenever a new converter is connected to an analyzer port. To enter the coefficients, proceed as follows:

1. Activate the frequency converter mode following the first steps in [chapter 3.3, "Activating the Frequency Converter Mode"](#), on page 20.
2. In the "Frequency Converter" dialog, press "Coefficients".
3. In the "Power Coefficients" dialog opened, clear "Use default coefficients" and enter your coefficients into the appropriate table row.

The numbers of the table rows denote the analyzer ports for the converters.

4. Repeat the last step for all frequency converters in the test setup.

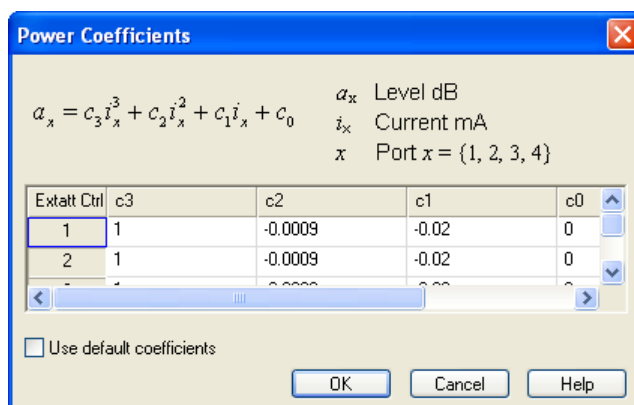


Fig. 3-2: Entry of power coefficients for analyzer port 1

3.5 Connecting the Frequency Converters

Each frequency converter must be connected to the analyzer, the power supply and the DUT. Please refer to the following sections for details.

- Control connection: [chapter 2.4.5, "Connecting the Control Cable"](#), on page 13
- Analyzer ports: [chapter 2.4.6, "Connecting RF Cables"](#), on page 13
- Power supply: [chapter 2.4.7, "Connecting the Converter to the DC Supply"](#), on page 16
- DUT (usually connected after calibration): [chapter 2.4.9, "Mounting a DUT"](#), on page 17

3.6 Power and Frequency Settings

While the frequency converter mode is active, the "Channel > Stimulus" settings of the network analyzer control the frequency and power range of the converters. In addition the "Channel > Mode > Port Configuration" dialog shows an additional row for each converter. The "Power" and "Frequency" settings in the "Source" section of the dialog serve different purposes:

- The "Power" setting defines the output power for each converter. A source power calibration of the converter port ensures that the analyzer will generate the selected source power; see [chapter 3.7, "Calibration"](#), on page 23.
- The source frequency at the converter ports is essentially determined by the port frequency of the analyzer. The converter frequency settings in the "Port Configuration" dialog define the frequency axes for the source power calibrations, however, they do not actually affect the converter output frequencies. For best accuracy, ensure that the correct converter frequencies are set, especially if the test setup contains additional frequency-converting components.

Example:

In the example below, the frequency at the NWA "Port 1" has been increased by a 50 MHz offset. The converter source frequency is six times the NWA source frequency, therefore a 300 MHz offset has been entered for "Converter Port 1". This ensures a correct frequency axis during the power calibration.

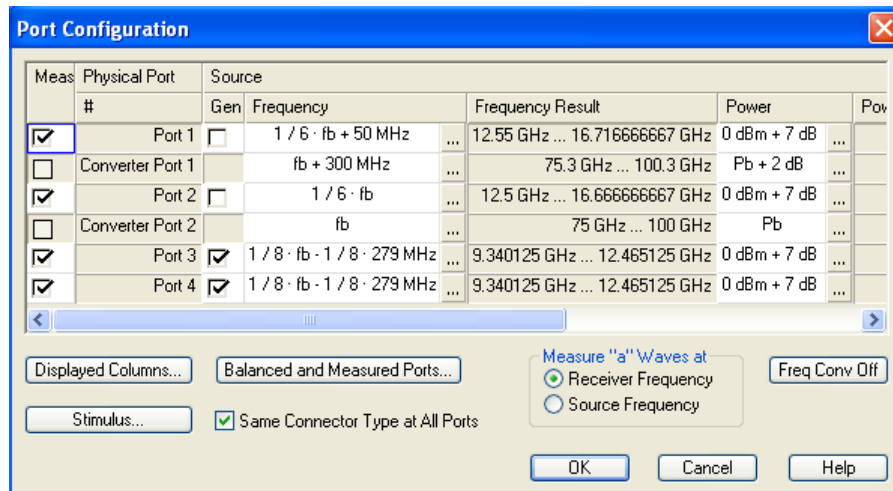


Fig. 3-3: Converter frequency and power settings (example: R&S ZVA-Z110E)

3.7 Calibration

R&S ZVA-Z90E and R&S ZVA-Z110E allow for a variation of the output power by changing the input power or setting an electronic attenuator. The latter requires option R&S ZVA-B8 on the R&S ZVA. With these converter types a source power flatness calibration can be performed.

A source power calibration for a frequency converter requires an appropriate external power meter, to be connected to the converter's waveguide flange; see [chapter 2.1, "Test Port Adapter \(Waveguide Flange\)"](#), on page 6. Waveguide power meters are configured in the ordinary way using the "System Configuration > External Power Meters" tab.

To perform the source power calibration, proceed as follows:

1. Connect the waveguide power meter and open the "Channel > Calibration > Start Power Cal > Source Power Cal" dialog.
2. Select your converter and source port from the "Source" pull-down list (e.g. "Conv 1" for a frequency converter connected to NWA port 1).
3. Click "Modify Settings" and ensure that both "Flatness Cal" and "Reference Receiver Cal" are checked.
4. If your test setup causes strong nonlinear effects, you can choose a "Convergence Factor" different from one.

5. Start the calibration sweep.

If a precise flatness calibration over frequency and power is needed, use the R&S ZVA Frequency Converter Levelling Tool (Free download from the [R&S®ZVA-Z Millimeter-Wave Converters](#) site).

A receiver power calibration of the reference channel (a wave) is always possible if an appropriate external power meter is available. With a calibrated reference receiver, all measurement receivers (b waves) can also be power calibrated. This provides absolute power measurement capability for all wave quantities. Proceed as follows:

1. Ensure that the output power of the frequency converter is not attenuated; adjust the adjusting screw (knurled knob) at the top of the converter to 2 mm.
2. Connect the waveguide power meter to the converter's waveguide flange and open the "Channel > Calibration > Start Power Cal > Source Power Cal" dialog.
3. Click "Modify Settings" and disable "Flatness Cal", leaving "Reference Receiver Cal" checked.
4. Start the calibration sweep via button "Take Cal Sweep". Wait until the "Finished" message appears.
5. Disconnect the power meter and connect the measurement receiver instead. Then open the "Channel > Calibration > Start Power Cal > Receiver Power Cal..." dialog.
6. Select the wave quantity to be calibrated and the source port that you have calibrated in steps 1...4.
7. Start the calibration sweep via button "Take Cal Sweep".



To ensure an accurate source power calibration and quick convergence, use the correct power coefficients; see [chapter 3.7, "Calibration"](#), on page 23.

A receiver power calibration of the b-waves (without external power meter, using the Receiver Power Calibration dialog) is also possible .

After the power calibration procedure a system error correction is recommended. Due to the physical properties of the mm-waves and the waveguides, measurements with frequency converters require a special calibration kit for system error correction. Rohde & Schwarz offers kits for this purpose, e.g. the calibration kits R&S ZV-WR10 and R&S ZV-WR12. The standards in the calibration kit allow all one-port and two-port calibration types supported by the network analyzer except TNA. Refer to the documentation of the calibration kit or the help system of your network analyzer for details.

3.8 Measurement

After power calibration and system error correction, the mm-wave measurement can be performed like any other network analyzer measurement. The analyzer may perform a frequency or power sweep. The "Port Configuration" settings (together with the

"Stimulus" settings), determine the sweep range of the converted signals (for a frequency sweep, the input and output frequencies at the DUT ports). All measured quantities (S-parameters, wave quantities, ratios etc.) and other trace settings are available.

The following example shows the transmission and reflection coefficients of a band-pass filter in the frequency range between 75 GHz and 110 GHz, which is covered by the frequency converter R&S ZVA-Z110E.

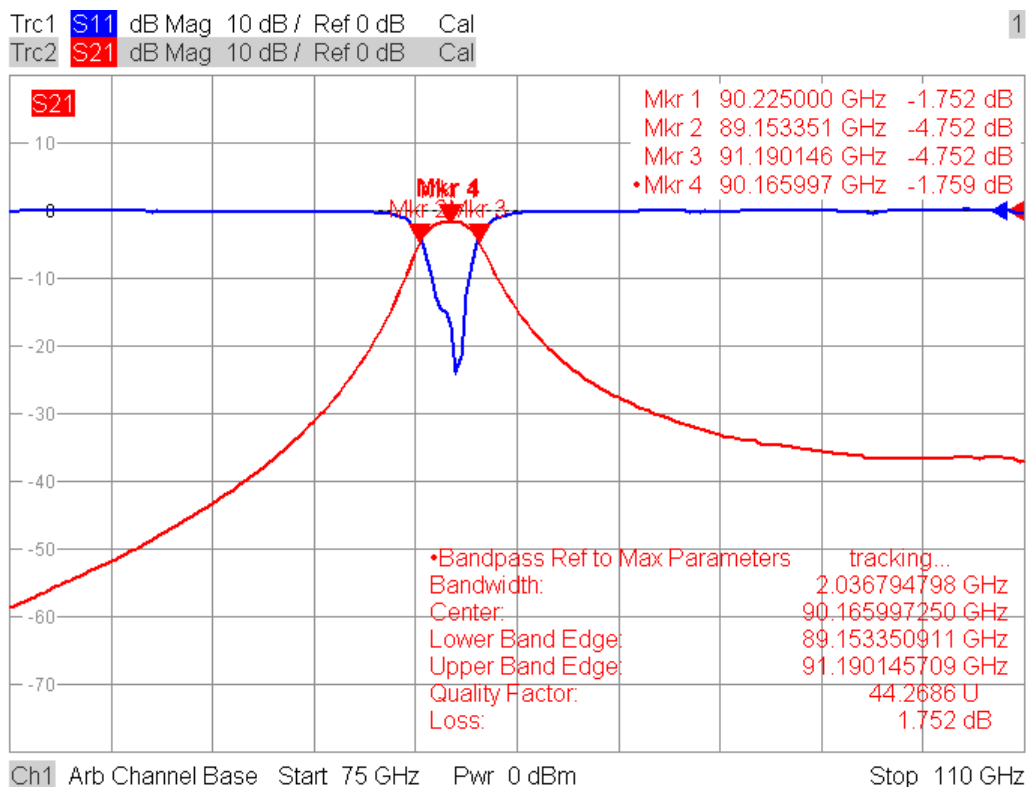


Fig. 3-4: Transmission and reflection of a bandpass filter measured with an R&S ZVA-Z110E

Please note that the measurement results may be degraded if the setup is exposed to an electromagnetic field at the R&S ZVA/ZVT receiver frequency (typically 279 MHz).



For best measurement accuracy, observe the following rules:

- Enter the correct power coefficients of all frequency converters; see [chapter 3.4, "Entering Power Coefficients"](#), on page 21.
- Perform a source power calibration; see [chapter 3.7, "Calibration"](#), on page 23. Using converter output powers outside the calibrated range generally impairs the measurement accuracy. The effect is enhanced if the power coefficients are not correct.
- Perform a system error correction for the power-calibrated test setup using an appropriate calibration kit.

3.9 Troubleshooting

The table below lists possible errors and remedies.

Error	Possible cause	Remedy
No output signal, LED next to the mains switch on the rear of the converter panel off.	Converter not power-supplied	Check power supply and fuse (see chapter 2.3.3, "Fuse Holder" , on page 9)
Power control fails, frequency converter operates at maximum output power.	Control connection not established	Check connecting cable and port assignment of control connectors.
Inaccurate converter source levels	Insufficient settling time, especially for fast sweep and strong power variations	Increase sweep time ("Channel > Sweep > Sweep Time")
Inaccurate converter source levels, even at reduced speed	Power coefficients entered and converters do not match, e.g. the coefficients of port 1 and port 2 are interchanged	Make sure that all coefficients are correct and assigned to the right analyzer ports (see chapter 3.4, "Entering Power Coefficients" , on page 21)

3.10 Additional Information

For a comprehensive description of the frequency converter mode including remote control refer to the R&S ZVA/ZVT online help system or to the printable operating manual, which is available for download at <http://www.rohde-schwarz.com/product/zva>.

Application notes related to the frequency converter are also available for download, see <http://www.rohde-schwarz.com/product/zva-z>.

The text book "Fundamentals of Vector Network Analysis" by Michael Hiebel is an ideal complement for the information given in the user documentation. The book combines theoretical background and practical measurements on an R&S ZVA network analyzer. In case of interest please contact your local R&S office.

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