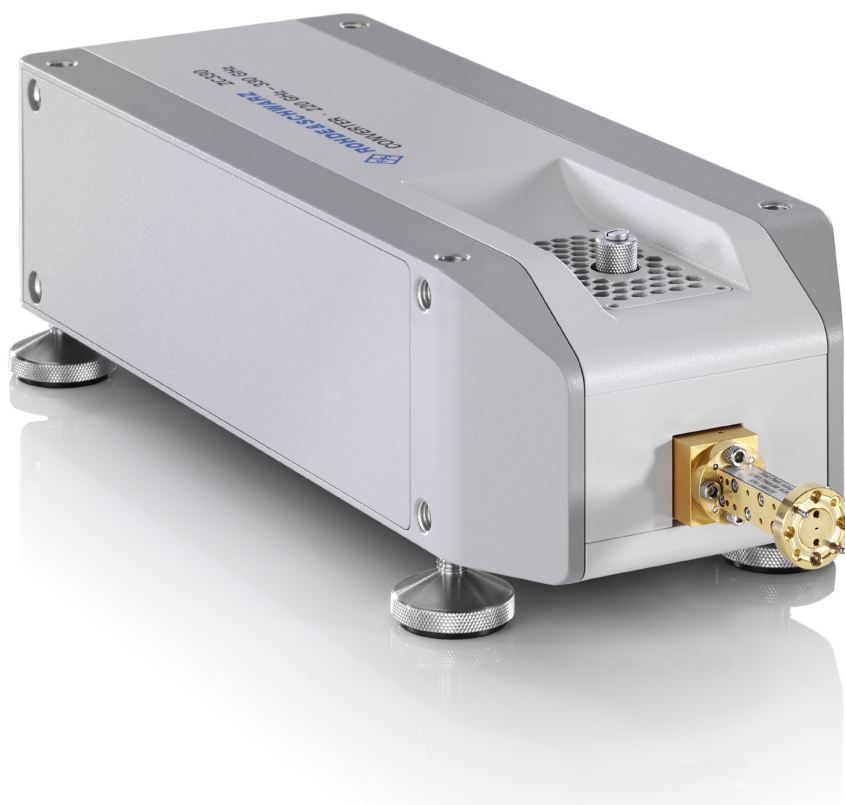


R&S[®] ZCxxx Converters Getting Started



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This manual describes the Rohde & Schwarz models of the R&S®ZCxxx family of frequency converters, where xxx denotes the converter's upper frequency limit. Throughout this manual, the converter R&S®ZC330 is used as a representation for converters of the R&S®ZCxxx family.

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Throughout this manual 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.

Basic Safety Instructions

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

Batteries and rechargeable batteries/cells

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

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

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 señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. Los productos con láser están provistos de indicaciones de advertencia normalizadas en función de la clase de láser del que se trate. Los rayos láser pueden provocar daños de tipo biológico a causa de las propiedades de su radiación y debido a su concentración extrema de potencia electromagnética. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).
8. Clases de compatibilidad electromagnética (conforme a EN 55011 / CISPR 11; y en analogía con EN 55022 / CISPR 22, EN 55032 / CISPR 32)
 - Aparato de clase A:
Aparato adecuado para su uso en todos los entornos excepto en los residenciales y en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.
Nota: Los aparatos de clase A están destinados al uso en entornos industriales. Estos aparatos pueden causar perturbaciones radioeléctricas en entornos residenciales debido a posibles perturbaciones guiadas o radiadas. En este caso, se le podrá solicitar al operador que tome las medidas adecuadas para eliminar estas perturbaciones.
 - Aparato de clase B:
Aparato adecuado para su uso en entornos residenciales, así como en aquellos conectados directamente a una red de distribución de baja tensión que suministra corriente a edificios residenciales.

Instrucciones de seguridad elementales

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

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

Transporte

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

Instrucciones de seguridad elementales

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

Eliminación/protección del medio ambiente

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

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

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.

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Contents

1 Safety Instructions	5
2 Preparing for Use	7
2.1 Test Port Adapter (Waveguide Flange).....	7
2.2 Output Power Adjusting Knob.....	8
2.3 Rear Panel.....	9
2.4 Putting the Converter into Operation.....	11
2.5 Maintenance.....	19
2.6 Storage and Transport.....	20
3 Basic Operation	21
3.1 Required Equipment.....	21
3.2 Measurement Principle.....	22
3.3 Activating the Frequency Converter Mode.....	23
3.4 Connecting the Frequency Converters.....	24
3.5 Calibration.....	24
3.6 Measurement.....	25
3.7 Additional Information.....	26
Index	27

1 Safety Instructions

The frequency converters R&S ZCxxx (xxx indicating the upper frequency limit in GHz) have been designed and tested in accordance with the EC Certificate of Conformity and each of them 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.

When storing or shipping the converter, slip protective caps onto the coaxial connectors on the rear panel.

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. These maximum values are below the maximum RF source power of the network analyzer. The frequency converter modes for the R&S ZCxxx models that are provided by the R&S ZVA/ZVT firmware V3.40 and higher, ensure compatible source powers. Therefore, activate this mode before you connect your frequency converter's RF IN and LO IN to the NWA.

Connection Procedure

1. Connect the frequency converter to the power supply R&S ZCPS and power up R&S ZVA/ZVT and R&S ZCPS
2. Establish a USB connection between frequency converter and NWA

3. At the analyzer GUI, when prompted to configure a two-port measurement setup, select "Yes"

Now the RF and LO cables can be connected safely.



You have to repeat this procedure whenever you are not sure if the frequency converter mode for your particular R&S ZCxxx model is already active.

Switching the NWA off and on preserves the selected frequency converter mode.

Protection of waveguide flanges

NOTICE

Risk of damaging waveguide flanges

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

Protect the waveguide flange of the converter by leaving the test port adapter mounted. When the converter is not in use, slip a protective cap onto the adapter.

Avoid heavy shocks

Heavy shocks can damage inner parts of the instrument. Shock-proof packing should therefore be used for storing, transporting and shipping the frequency converter (see [chapter 2.6, "Storage and Transport"](#), on page 20).

Opening the instrument

Do not open the instrument. If repair is needed, it must be performed at the manufacturer's service 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 21.

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.

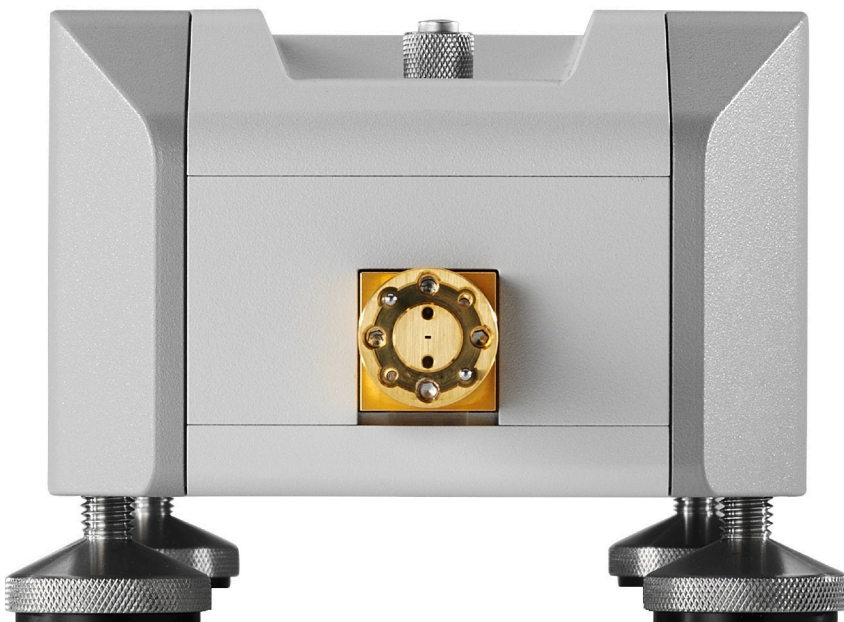


Fig. 2-1: Front of the converter R&S ZC330

The precision waveguide flange of the test port adapter, which is compatible to standard IEEE 1785, consists of an outer ring and a protruding inner contacting surface with the waveguide. On the outer ring there are four UNC 4-40 threads, two dowels and two holes as counterparts of the DUT dowels (see [figure 2-2](#)). Two additional holes in the inner flange surface allow the insertion of precision dowels (delivered with the converter). These additional dowels should be used if

Output Power Adjusting Knob

the flange of the DUT also has holes for them and the accuracy of the connection shall be enhanced.

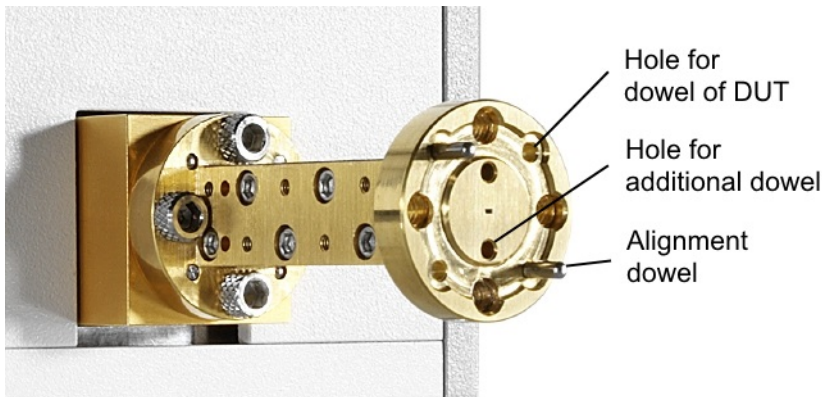


Fig. 2-2: Test port adapter of R&S ZC330

NOTICE**Risk of damaging waveguide flanges**

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

Protect the waveguide flange of the converter by leaving the test port adapter mounted. When the converter is not in use, slip a protective cap onto the adapter.

2.2 Output Power Adjusting Knob



For manual control of output power at the waveguide test port, the converters of the R&S ZCxxx family are provided with a knurled output power adjusting knob stepped in the upper surface of the converter housing. Turning the knob clockwise reduces the output power while turning it counter-clockwise increases the output power. The minimum power is reached at the stop in clockwise direction while maximum power is reached at the stop in counter-clockwise direction. The knob cannot be turned so far in counter-clockwise sense that it protrudes the upper surface of the R&S ZCxxx. So there is no danger that the mechanism of the variable attenuator is damaged when the frequency converter is mounted upside down, e.g. on a wafer prober. If the knob

is turned after power calibration, the power calibration remains valid but system error calibration has to be repeated if it refers to more than one port.

In order to set a flat output power over frequency just by entering a dBm value in the NWA firmware, the Frequency Converter Leveling Tool can be used. This software tool records a 2-dimensional data array of output power vs input power at RF IN and frequency, which can later be applied by the NWA firmware. For further details, refer to the R&S ZVA/ZVT online help (section "GUI Reference > System > System Config > Converter Control"), and to the Getting Started document of the R&S ZVA Frequency Converter Leveling Tool.

The output power of the NWA, which after subtraction of the cable losses is also the RF input power of the frequency converter, is set to a fixed value optimized for the selected type of converter.

2.3 Rear Panel

The rear panel of the frequency converter provides the connectors and control elements described in the following subsections.

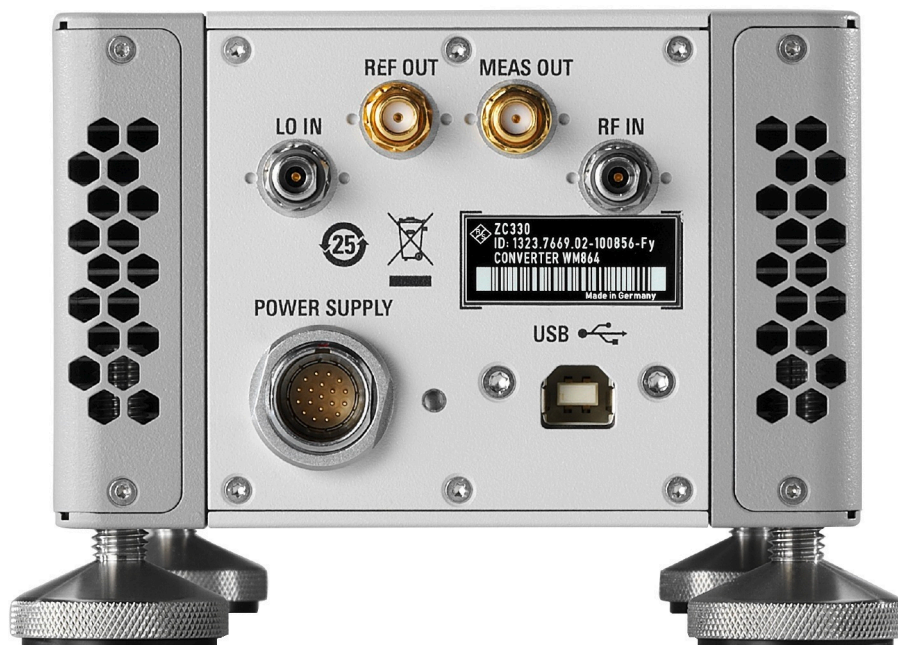


Fig. 2-3: Rear view of the frequency converter

2.3.1 Power Supply Connector



In order to supply the R&S ZCxxx with power, connect it to the external DC power supply R&S ZCPS. Always switch the power supply off before removing the DC cable. For details, see the User Manual of the R&S ZCPS.

NOTICE

Risk of instrument damage

The ZCPS has been designed for use with converters of the R&S ZCxxx family. Do not use other power supplies.

2.3.2 RF Connectors – Input



Two 2.92 mm female input connectors: LO IN (local oscillator signal input) and RF IN (RF source signal input).

For correct cabling please refer to [chapter 2.4.8, "Connecting the RF Cables"](#), on page 15.

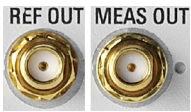
NOTICE

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. These maximum values are below the maximum RF source power of the network analyzer. The frequency converter mode for your R&S ZCxxx ensures compatible source powers. Therefore, activate this mode before you connect RF IN and LO IN to the NWA.

Connect the R&S ZCxxx to the power supply R&S ZCPS. Then establish a USB connection between NWA and R&S ZCxxx. When prompted "Configure Two-Port Measurement Setup...?", select "Yes". Now the RF and LO cables can be connected safely. This procedure is not required if the frequency converter mode suitable for your R&S ZCxxx is already active, e.g. when you have just switched the NWA off and on.

2.3.3 RF Connectors – Output



Two SMA female output connectors: MEAS OUT (measurement signal output) and REF OUT (reference signal output).

For correct cabling please refer to [chapter 2.4.8, "Connecting the RF Cables"](#), on page 15.

2.3.4 USB Connector



The USB Type B connector is used to connect the R&S ZCxxx to the NWA (R&S ZVA/ZVT) via USB.

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 does not show condensation.

Non-observance may cause damage to the converter!

2.4.1 Unpacking the Converter and Checking the Shipment

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

1. Unpack the converter and the other contents from the cardboard shipping box.
2. The shipment must include the following items:

- converter
 - DC supply cable
 - USB cable
 - IF cable EXT REF
 - IF cable EXT MEAS
 - plastic case with 8 flange screws 4-40 UNC 7.6 and 4 flange screws 4-40 UNC 9.24
 - plastic case with 8 precision dowels 1.566 mm ± 0.001 mm
 - 3/32" hex ball driver
 - Getting Started (this document)
3. Inspect the frequency converter, especially the test port adapter and the test port flange surface, to make sure that it has not been damaged during shipment. Should the converter be damaged, immediately notify the shipping company and keep the packing material.

NOTICE**Risk of damaging waveguide flanges**

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

Protect the waveguide flange of the converter by leaving the test port adapter mounted. When the converter is not in use, slip a protective cap onto the adapter.

2.4.2 Setting up the Converter

The frequency converter is designed for use under laboratory conditions on a flat bench top or mounted on a wafer probe station. Four M8 threads are provided on all long sides of the converter in order to allow for mounting the converter on a flat surface. Some on-wafer measurement applications may also require the converter to be tilted in order to bring the test port closer to the chuck. In these cases, an additional bent waveguide adapter may be needed in front of the test port adapter in order to compensate for the tilt angle.

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 NWA.

2.4.3 Adjusting the Feet of the Converter

The instrument can be used with four feet attached to the respective bottom side (depending on the orientation). When the DUT is mounted between two converters (see [chapter 2.4.10, "Mounting a DUT"](#), on page 18) use the feet for alignment of the complete setup. A bubble level may help to align each converter horizontally prior to fitting the DUT.

2.4.4 Connecting the Converter to the DC Supply

Switch the converter power supply R&S ZCPS off. Connect the R&S ZCxxx to either output CONVERTER 1 or CONVERTER 2 of the R&S ZCPS, using the enclosed DC supply cable.

2.4.5 Connecting the Converter to the NWA via USB

Connect the R&S ZCxxx to the NWA using the enclosed USB cable.

A R&S ZCxxx must be connected to a R&S ZVA/ZVT at least once in order to transfer the characteristic data of the converter to the NWA. After that, the converter remains known to the NWA and can be selected (by type and serial number) in the "Frequency Converter" tab of the analyzer firmware's "System Configuration" dialog.

NOTICE**Firmware and Operating System Requirements**

Support of the R&S ZCxxx converters requires firmware version 3.40 or higher to be installed on the NWA. If the operating system of the NWA is Windows® XP, make sure that it has been upgraded at least up to service pack 2. Otherwise USB communication between NWA and converter will fail. In case an upgrade of the operating system is needed, please contact your local Rohde & Schwarz service.

2.4.6 Switching the Converter On

Switch the R&S ZCPS on. After a short time, both the LED of the power output to which the converter is connected and the LED on the rear panel of the converter should light up green. If the LED on the R&S ZCPS lights up red, at least one supply voltage is missing. Contact R&S service in this case.

If the NWA is not yet in the frequency converter mode for the respective R&S ZCxxx, a "Configure Two-Port Measurement Setup...?" dialog appears. Proceed by selecting "Yes".

2.4.7 LED Signaling

The following table lists all possible states of the converter LED along with their associated fault states:

Color	Fault State
green	No fault
yellow	At least one fan is not working properly (rotational speed is out of range or fan stands still)
orange	Temperature is out of range. If it exceeds a critical level, the power supply is switched off
red	At least one supply voltage is out of range or missing

In case of an error, a warning message indicating the current error (fan, voltage or temperature) is displayed on the NWA. Both warning message and converter LED remain in the respective state as long as the fault condition persists. If more

than one fault condition is fulfilled, both warning message and LED show the most severe one.

2.4.8 Connecting the 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.



Switch off the converter power supply R&S ZCPS before connecting the RF cables.

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 ZCxxx 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 2.92 mm female connectors, the cable should ideally have male connectors of the same type (e.g. R&S ZV-Z195, order number 1306.4536.xx). Alternatively, 3.5 mm or SMA male connectors are possible. These are mechanically compatible with 2.92 mm connectors while providing tolerable electrical mismatch (e.g. R&S ZV-Z193, order number 1306.4520.xx).

For a complete test setup for a 2-port transmission measurement - as shown in [figure 2-4](#) - 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.

Putting the Converter into Operation

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 2-5](#) 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 17).

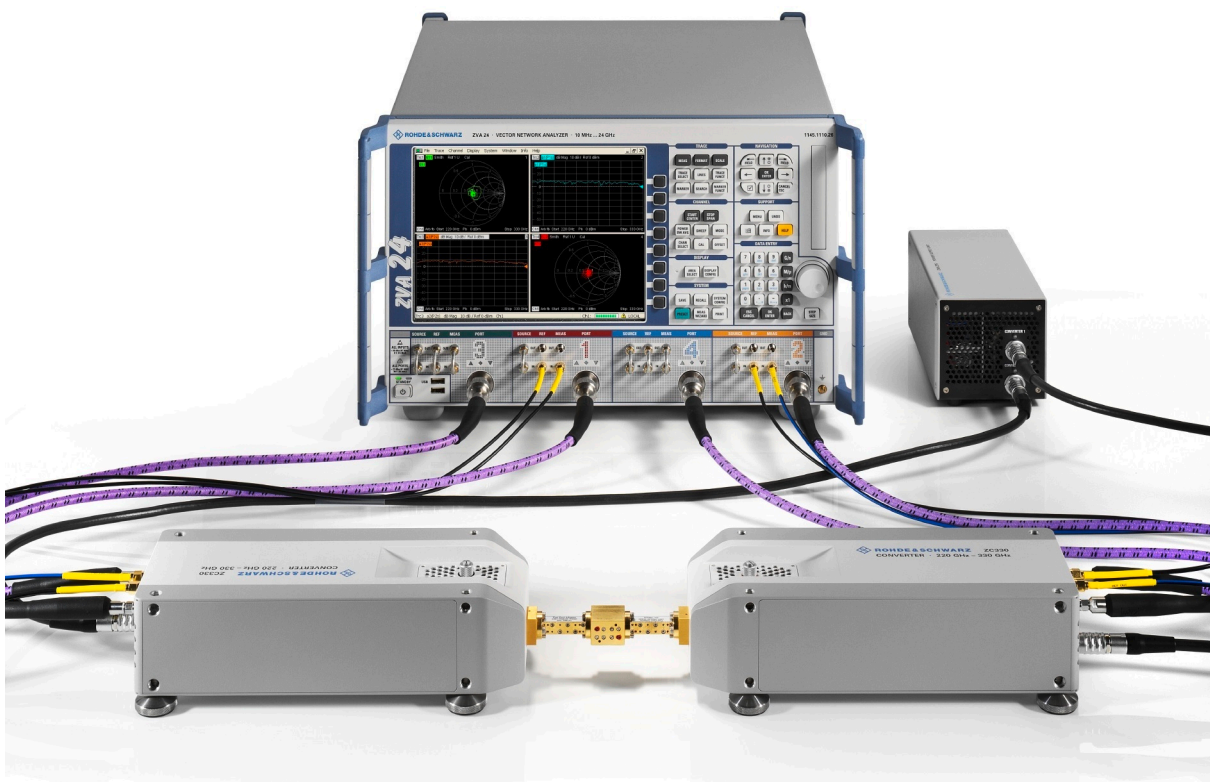


Fig. 2-4: Test setup for 2-port transmission measurement with R&S ZC330 and a NWA with two sources

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 17).

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. 2-5: Test setup for 2-port transmission measurement with R&S ZC330 and a NWA with four sources

Adaption Kits R&S ZCAK

As explained in the previous sections, depending on the NWA model, additional adapters, 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.

2.4.9 Switching the Converter On

Switch the R&S ZCPS on. After a short time, both the LED of the power out to which the converter is connected and the LED on the rear panel of the converter should light up green. For the meaning of the LED color refer to [chapter 2.4.7, "LED Signaling"](#), on page 14.

After switching the measurement setup on, a warm-up time of one hour is required to ensure accurate measurements.

2.4.10 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 2-6](#)).

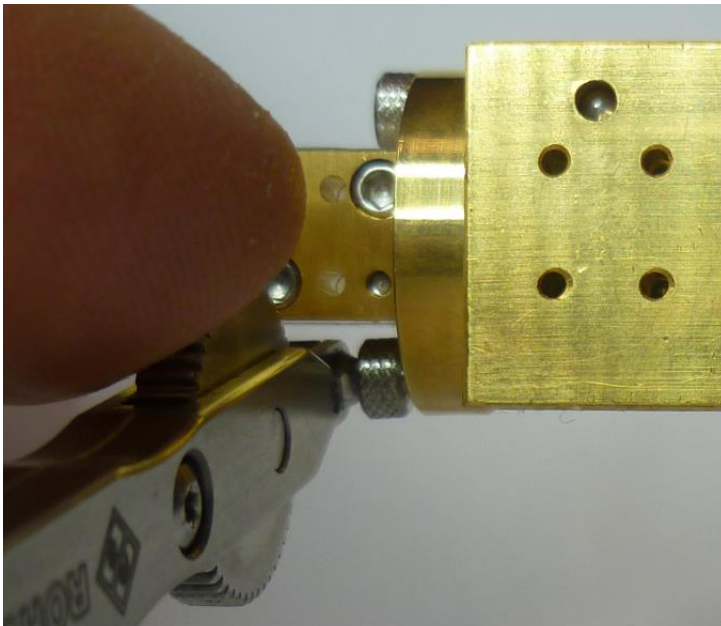


Fig. 2-6: Angled hex ball driver R&S ZCAW (accessory)

For precision calibrations and measurements, use the inner dowels at the test port adapter. A tight and accurate connection is very important to ensure precise measurement results.

For a two- or n-port measurement setup converters and DUT have to be aligned accurately, using the adjustable instrument feet. A bubble level may help for proper alignment.

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, lint-free dust cloth.

NOTICE

Risk of instrument damage

Cleaning agents contain substances that may damage the instrument. Solvent containing cleaning agents may e.g. damage varnish or labeling.

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

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

2.6 Storage and Transport

For storage and transport, use either the original packaging or the transport case R&S ZCSTC, order number 1323.7730.00 (see [figure 2-7](#)).

The case is designed to house two converters R&S ZCxxx and a power supply R&S ZCPS along with the accessories delivered with them. Furthermore it offers space for a waveguide calibration kit R&S ZV-WRxx, (torque) wrenches and other accessories. A dedicated cable pocket is also provided.



Fig. 2-7: R&S ZCSTC Converter Set Transport Case for two R&S ZCPS

Before placing the converter in the case, slip the protective caps onto the waveguide test port and the coaxial connectors on the rear panel.

The converter can be stored at the temperature range quoted in the data sheet.

3 Basic Operation

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

Measurements using other converters of the R&S ZCxxx family are performed in an analogous way.

3.1 Required Equipment

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

- n frequency converters for an n-port measurement
- Vector network analyzer (NWA) R&S ZVA or R&S ZVT with an upper frequency limit of 20 GHz or higher (R&S ZVT 20, R&S ZVA 24, R&S ZVA 40 ...).

The network analyzer must provide one test port for each converter. In addition to that, a common LO signal must be applied to all converters. For R&S ZVT20 with at least 4 ports, R&S ZVA24 var.26, R&S ZVA40 var. 42 and R&S ZVA50 var. 52 the LO can be supplied by two different test ports that are fed by the same internal source. If the NWA is a four-source model R&S ZVA24 var. 28, R&S ZVA40 var. 48 or R&S ZVA67, the signal must be supplied by a single port and split by an external power splitter. For the R&S ZVA67 a mm-wave adapter kit (order number 1323.7746.00) is available which includes the power splitter and all necessary adapters.

The required adapters and splitters are offered as complementary adaption kits (see "[Adaption Kits R&S ZCAK](#)" on page 17).

NOTICE**Firmware and Operating System Requirements**

Support of the R&S ZCxxx converters requires firmware version 3.40 or higher to be installed on the NWA. If the operating system of the NWA is Windows® XP, make sure that it has been upgraded at least up to service pack 2. Otherwise USB communication between NWA and converter will fail. In case an upgrade of the operating system is needed, please contact your local Rohde & Schwarz service.

- Option R&S ZVAxx-B16/R&S ZVT20-B16, "Direct Generator/Receiver Access" at each port
- Option R&S ZVA-K8, "Converter Control"
- Calibration kit for the respective WM-xxxx waveguide

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 mm-wave stimulus signal. After separating incoming wave (test signal) and outgoing wave (reference signal) by means of a directional coupler, the two signals are down-converted via harmonic or sub-harmonic mixers. The local oscillator (LO) for the mixers can be provided either by the NWA or by an external generator.

The measurement involves the following steps:

1. Activation of the converter mode
2. Connection of the frequency converters
3. Calibration using a suitable waveguide calibration kit
4. Connection of the DUT and measurement

3.3 Activating the Frequency Converter Mode

To activate the converter mode for a setup without external generator, establish a USB connection between converter and NWA. Wait for the dialog box to appear and confirm the prompt "Configure Two-Port Measurement Setup...?". The NWA will then read the characteristic data of the R&S ZCxxx via USB and automatically enter the appropriate converter mode.



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. If the NWA allows for low phase noise mode, it is activated. Automatic Level Control (ALC) is disabled. Frequency and source power levels of all ports are displayed in the port configuration dialog ("Channel > Mode > Port Config").

If a USB connection between NWA and converter is currently not possible, but has been established previously, the characteristic data of the frequency converter are already available at the NWA. In this case, open the "System Configuration" dialog ("System > System Config") and activate the "Frequency Converter" tab. Select the adequate converter model in the "Type" combobox, select the LO sources in "Use of External Sources", check the port assignment table and press "Apply" to activate the setting.

Connecting the Frequency Converters

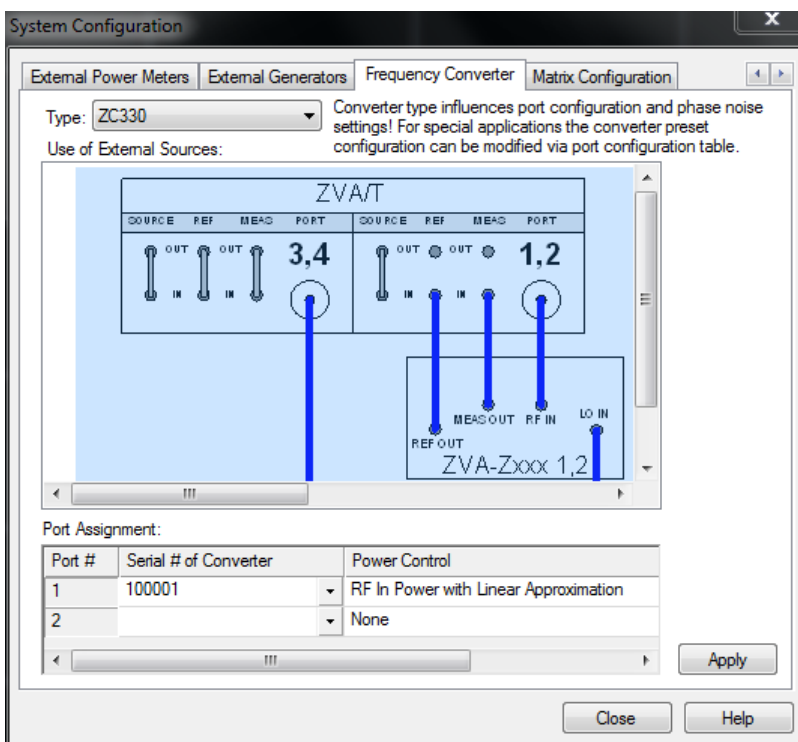


Fig. 3-1: Frequency Converter tab in System Configuration dialog

3.4 Connecting the Frequency Converters

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

- Power supply: [chapter 2.4.4, "Connecting the Converter to the DC Supply"](#), on page 13
- Analyzer ports: [chapter 2.4.8, "Connecting the RF Cables"](#), on page 15
- DUT (usually connected after calibration): [chapter 2.4.10, "Mounting a DUT"](#), on page 18

3.5 Calibration

The output power can be manually set using the adjusting knob (see [chapter 2.2, "Output Power Adjusting Knob"](#), on page 8). A normal power flatness calibration via "Channel > Calibration > Start Power Cal > Source Power Cal" can **not** be

performed. With the help of a receiver power calibration, however, precise monitoring of the output power of converter port i is possible by measuring the corresponding a_i wave. See section "Power Calibration for Converters without Electronic Attenuators" in the R&S ZVA/ZVT online help for details.

Accepting some limitations with respect to temperature stability, the R&S ZVA Frequency Converter Leveling Tool can be applied for the linearization of output power in the frequency range of interest. For further details, refer to the R&S ZVA/ZVT online help (description of "RF In Power (and Electronic Attenuator) with Data Set" option), and the Getting Started document of R&S ZVA Frequency Converter Leveling Tool.

For precise S-parameter measurements, a system error correction is recommended. System error correction requires a calibration kit for the waveguide band of the specific R&S ZCxxx converter. Activating the frequency converter mode for a R&S ZCxxx does not imply automatic installation of a suitable R&S waveguide kit in the ZVA software, as it is the case for the R&S ZVA-Zxxx converters. In order to have at least one cal kit defined when getting started with a R&S ZCxxx converter, the R&S ZVA-WRxx kits have been pre-installed in the ZVA/ZVT software. Be aware that they are assigned, however, to R&S WM-xxxx connectors, as far as the WRxx waveguide bands are identical to the newer WM-xxxx bands.

The standards in the calibration kits allow for OSM, TOSM, UOSM, TOM, TRM and TRL calibrations. Refer to the documentation of the calibration kit or the R&S ZVA/ZVT online help for details.

3.6 Measurement

After power calibration and system error correction, the mm-wave measurement can be performed like any other network analyzer measurement. The port configuration dialog ("Channel > Mode > Port Configuration") shows the frequency and power sweep ranges of all implied signals, including RF IN, LO IN and IF output. All measured quantities (S-parameters, wave quantities, ratios etc.) are available.

Flat power and power sweep are only available if a power correction data set has been previously taken with the R&S ZVA Frequency Converter Leveling Tool.

Please note that 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).

3.7 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 from the Rohde & Schwarz web site (www.rohde-schwarz.com).

Application notes related to frequency converters are also available for download (currently for the R&S ZVA-Zxxx series only).

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.

Index

A	
Adjusting knob	8
B	
Basic operation	21
C	
Calibration	24
Converter setup	12
D	
DUT	18
F	
Feet	13
Frequency converter mode	23
I	
Input powers	10
L	
LO IN	10
M	
Maintenance	19
MEAS OUT	11
Measurement	25
Measurement principle	22
P	
Power adjusting knob	8
Power calibration	24
Power on	18
Power supply connector	10
Preparing for use	7
R	
Rear panel	9
REF OUT	11
Required Equipment	21
RF connection	15
RF connector inputs	10
RF connector outputs	11
RF IN	10
S	
Storing the instrument	20
System Configuration	24
System error correction	25
T	
Test port	7
Test port adapter	7
Transporting the instrument	20
U	
Unpacking	11
USB connector	11
W	
Waveguide flange	7