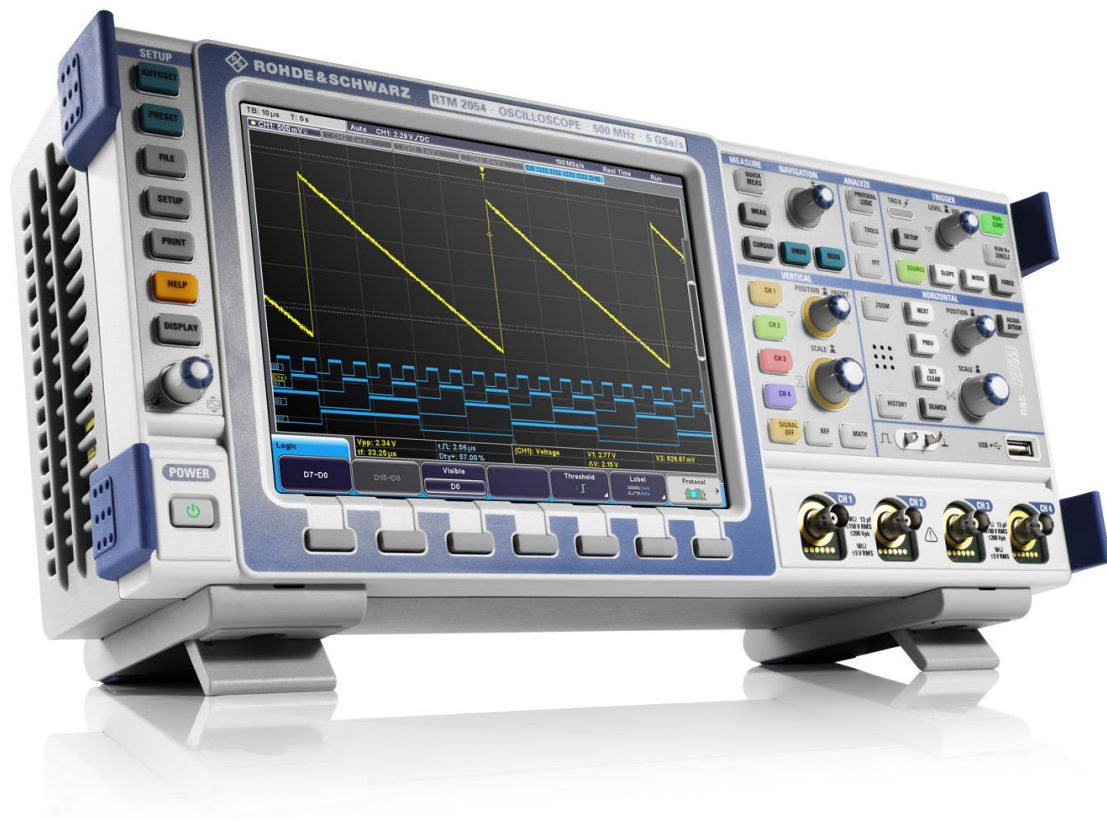


R&S®RTM2000

Digital Oscilloscope

Service Manual



1317.4932.02 – 05

The Service Manual describes the following R&S®RTM2000 models and options:

- R&S® RTM2022 (5710.0999K22)
- R&S® RTM2024 (5710.0999K24)
- R&S® RTM2032 (5710.0999K32)
- R&S® RTM2034 (5710.0999K34)
- R&S® RTM2052 (5710.0999K52)
- R&S® RTM2054 (5710.0999K54)
- R&S® RTM2102 (5710.0999K02)
- R&S® RTM2104 (5710.0999K04)

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

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

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

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Trade names are trademarks of the owners.

The following abbreviations are used throughout this manual:

R&S®RTM is abbreviated as R&S RTM

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

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

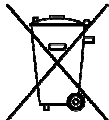
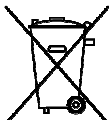
Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety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

Safety labels on products

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

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

Basic Safety Instructions

Symbol	Meaning	Symbol	Meaning
	Warning! Hot surface		Alternating current (AC)
	Protective conductor terminal		Direct/alternating current (DC/AC)
	Ground		Device fully protected by double (reinforced) insulation
	Ground terminal		EU labeling for batteries and accumulators For additional information, see section "Waste disposal/Environmental protection", item 1.
	Be careful when handling electrostatic sensitive devices		EU labeling for separate collection of electrical and electronic devices For additional information, see section "Waste disposal/Environmental protection", item 2.
	Warning! Laser radiation For additional information, see section "Operation", item 7.		

Signal words and their meaning

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



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



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



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



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

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

Basic Safety Instructions

Operating states and operating positions

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

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

Electrical safety

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

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

Basic Safety Instructions

6. The product may be operated only from TN/TT supply networks fuse-protected with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages $V_{rms} > 30$ V, suitable measures (e.g. appropriate measuring equipment, fuse protection, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the protective conductor terminal on site and the product's protective conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

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

Basic Safety Instructions

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

Repair and service

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

Basic Safety Instructions

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

Batteries and rechargeable batteries/cells

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

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

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.
2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Instrucciones de seguridad elementales

Waste disposal/Environmental protection

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

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

Instrucciones de seguridad elementales

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

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

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

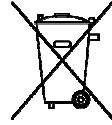
Instrucciones de seguridad elementales

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

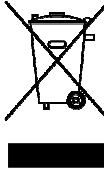
Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto.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

Señalización de seguridad de los productos

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

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

Instrucciones de seguridad elementales

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

Palabras de señal y su significado

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



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



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



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



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

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

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

Estados operativos y posiciones de funcionamiento

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

Instrucciones de seguridad elementales

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

Seguridad eléctrica

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

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

Instrucciones de seguridad elementales

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

Funcionamiento

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

Instrucciones de seguridad elementales

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

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

Transporte

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

Instrucciones de seguridad elementales

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

Eliminación/protección del medio ambiente

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

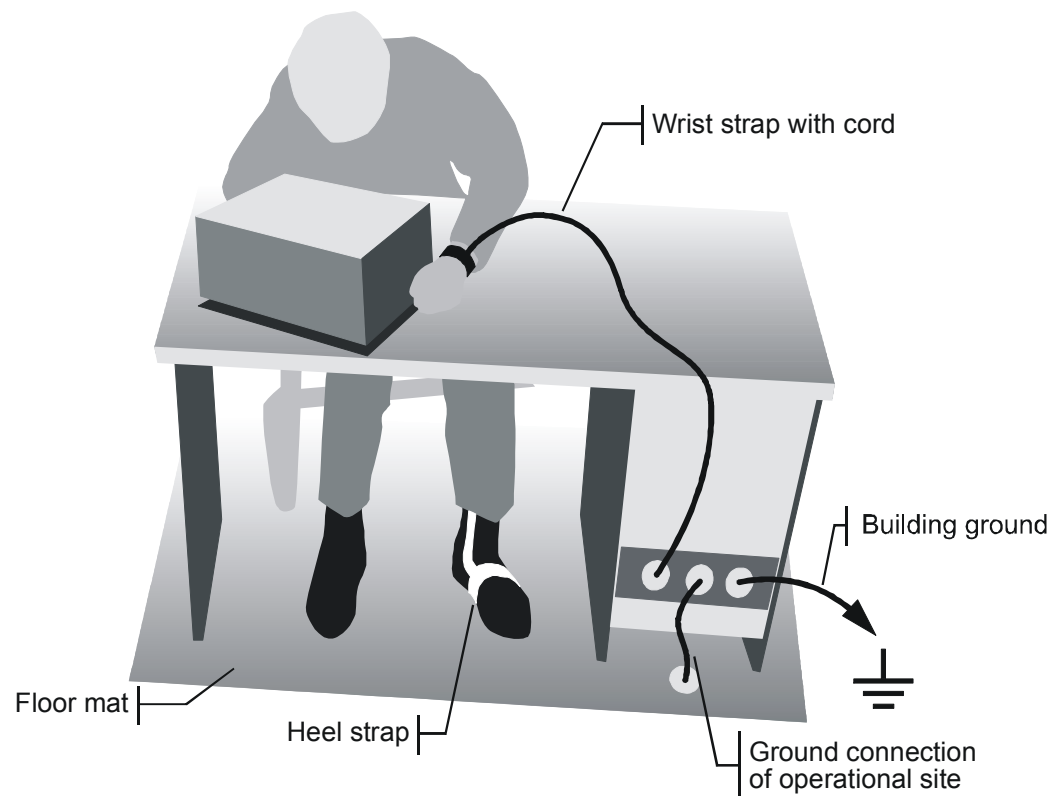
Se puede encontrar más información sobre la protección del medio ambiente en la página web de Rohde & Schwarz.

Instructions for Electrostatic Discharge Protection

NOTICE

Risk of damaging electronic components

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



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

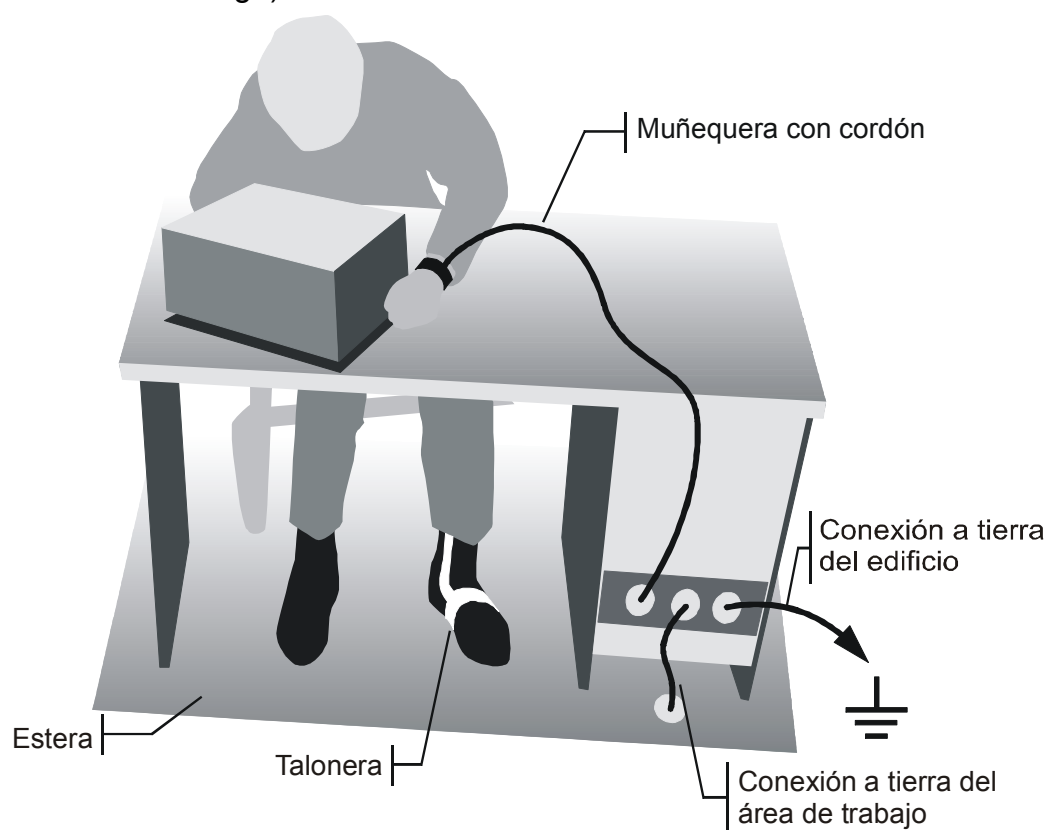
- Wrist strap with cord to ground connection
 - Conductive floor mat and heel strap combination
-

Instrucciones para la protección contra descargas electroestáticas

AVISO

Riesgo de avería de los componentes electrónicos

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



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

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

Procedure in Case of Service and Ordering of Spare Parts

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

Please contact your local Rohde & Schwarz service center if you need service or repair work of your equipment or to order spare parts. You can find the current address of your representative on our homepage www.rohde-schwarz.com.

Shipping the Instrument

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

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

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

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

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

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

Shipping Defective Modules

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

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

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

Exception:

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

Ordering Spare Parts

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

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

Refurbished Modules

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

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

Taking Back Defective Replaced Modules

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

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

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

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

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1 Documentation Overview

The user documentation for the R&S RTM consists of the following parts:

- Online Help system on the instrument
- "Getting Started" printed manual
- Documentation CD-ROM with:
 - Getting Started
 - User Manual
 - Service Manual
 - Data sheet and product brochure
 - Links to useful sites on the R&S internet

Online Help

The Online Help is embedded in the instrument's firmware. It offers quick, context-sensitive description of the softkeys and front panel controls.

Getting Started

This manual is delivered with the instrument in printed form and in PDF format on the Documentation CD-ROM. It provides the information needed to set up and start working with the instrument. Basic operations and typical measurement examples are described. The manual also includes general information, e.g. Safety Instructions.

User Manual

The User Manual is available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. In this manual, all instrument functions are described in detail. Furthermore, it provides an introduction to remote control and a complete description of the remote control commands with programming examples. Information on maintenance, instrument interfaces and error messages is also given.

Service Manual

The Service Manual is available in PDF format - in printable form - on the Documentation CD-ROM delivered with the instrument. It informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for repairing the instrument by the replacement of modules.

2 Performance Test

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

2.1 Test Equipment

Item	Type of equipment	Recommended characteristics or features	Recommended model	R&S Order No.	Application
1	DC calibrator	Max. ± 40 V Resolution min. 1 mV Current min. 120 mA (± 6 V into 50 Ω) Range Accuracy 0.1 V 0.1 % +40 μ V 1 V 0.1 % +400 μ V 6 V 0.1 % +2.8 mV 40 V 0.1 % +16 mV Resistance: 50 Ω / 1 M Ω : 0.1 %	Keithley System SourceMeter Model 2601A		DC gain accuracy, offset accuracy
2	Digital multimeter	DC voltage range 0.1 V 0.1 % +40 μ V	Agilent 34401A		DC gain accuracy, input resistance
3	Signal generator	RF 10 MHz to 1 GHz, power +16 dBm, frequency error $<10^{-6}$	R&S SMB100A Opt. SMB-B101 or higher	1406.6000.02 1407.2509.02	Analog bandwidth, crosstalk, timebase accuracy, internal trigger, external trigger
4	Power sensor	1 MHz to 1 GHz <0.15 dB	R&S NRP-Z91	1168.8004.02	Analog bandwidth, crosstalk, internal trigger, external trigger
5a	Power meter		R&S NRP	1143.8500.02	Analog bandwidth, crosstalk, internal trigger, external trigger
5b	USB adapter for NRP sensors	Alternative	R&S NRP-Z4	1146.8001.02	Analog bandwidth, crosstalk, internal trigger, external trigger

6	Power splitter	DC to 1 GHz	Agilent 11667A		Analog bandwidth, crosstalk, internal trigger, external trigger
7	Frequency counter	1 GHz < 2*10 ⁻⁹	Advantest R5361B		Reference frequency accuracy
8	Termination	Feed through termination 50 Ω			External trigger
9	Adapter	Female SMA to male BNC			Analog bandwidth
10	Active probe	10:1 attenuation, 50 Ω	R&S®RT-ZS10 R&S®RT-ZS10E	1410.4080.02 1418.7007.02	Probe identification
11	Passive probe	10:1 attenuation, 10 MΩ	R&S®RTM-ZP10	1409.7708.02	Probe identification

2.2 Performance Test R&S RTM

Test Instructions

To ensure that rated specifications are maintained, the following preparations must be made prior to checking the rated characteristics:

- Allow for a minimum warm-up time of 30 minutes at ambient temperature.
- Carry out all internal adjustments.
- The values are specified in the data sheet. Additional uncertainties introduced by the test equipment must be taken into account when checking the rated values.

2.2.1 Input Resistance (DC)

Test equipment: ➤ Digital multimeter (refer to "Test Equipment", item 2)

Test setup: ➤ Connect the digital multimeter to CH1 input of the R&S RTM

Note: ➤ The resistance of the test cables must be taken into account.
➤ For best results use 4-wire connection (connect sense lines as close as possible to the RTM input).

Digital multimeter settings: ➤ Resistance measurement
➤ 4-wire
➤ 5 digits

Test: Input resistance 1 M Ω **R&S RTM settings:**

- [PRESET]
- [CH1 : Termination 1 M Ω : Coupling DC : Y-Scale see table below]
- [VERTICAL POSITION 0 div] (After a preset the position of channel 2, 3 and 4 are not set to 0 div!)

Measurement: ➤ Read the resistance display with the following vertical scale settings:

Y-Scale	Digital multimeter range
200 mV/div	10 M Ω
20 mV/div	10 M Ω

Measurement: ➤ Repeat all measurements with the remaining channels

Test: Input resistance 50 Ω **R&S RTM settings:**

- [PRESET]
- [CH1 : Termination 50 Ω : Coupling DC : Y-Scale see table below]
- [VERTICAL POSITION 0 div] (After a preset the position of channel 2, 3 and 4 are not set to 0 div!)

Measurement: ➤ Read the resistance display with the following vertical scale settings:

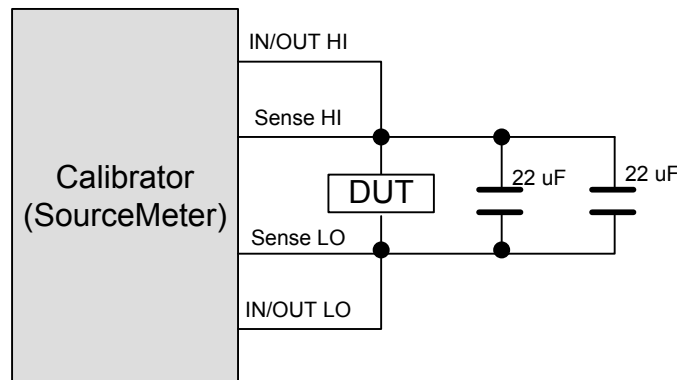
Y-Scale	Digital multimeter range
200 mV/div	100 Ω

- Repeat all measurements with the remaining channels

2.2.2 DC Gain Accuracy

- Test equipment:**
- DC calibrator (refer to "Test Equipment", item 1)
 - Digital multimeter (refer to "Test Equipment", item 2)

- Test setup:**
- Switch output voltage of DC calibrator OFF! (to avoid damage of DUT in 50 Ω termination)
 - Connect DC calibrator output to CH1 input of the R&S RTM



- Note:**
- The voltage drop on the test cables must be taken into account. For example: A DC resistance of 0.2 Ω results in a -0.4 % lower voltage at the 50 Ω RTM input.
 - For best results use 4-wire connection. Connect sense lines as close as possible to the RTM input.
 - If the DC calibrator does not support sensing, use a digital multimeter to control the voltage at the RTM input.
 - To reduce noise of DC calibrator add a capacity direct at the input of RTM.
 - Recommended: 2 * 22 μ F (parallel), min. voltage 40 V.
 - If Keithley SourceMeter 2601A is used as DC calibrator, use the following setting: [CONFIG → SRC → HIGHC-MODE → SRC-ENABLE].

Important note: Due to the voltage measurement accuracy of the Keithley SourceMeter 2601A, for DC voltages below 180 mV the digital multimeter must be used to control the calibrator voltage at the RTM input.

Test: DC gain accuracy with input resistance 1 MΩ**R&S RTM settings:**

- [PRESET]
- [CH1 : Termination 1 MΩ : Bandwidth 20 MHz : Y-Scale see table below]
- [HORIZONTAL SCALE 1 ms/div]
- [ACQUISITION : Waveform Rate "Max. Sa. Rate" : Wfm. Arithmetic "Average" : No Of Averages 2 Wfm.]
- [VERTICAL POSITION 0 div] (After a preset the position of channel 2, 3 and 4 are not set to 0 div!)

Measurement:

- [MEAS : Meas. Type "Mean Value" : Measure 1 "On"]
- Set the calibration voltage to the positive value (refer to below table)
- Measure the calibration voltage at the RTM input ($\rightarrow V_{\text{calibrator_pos}}$)
- Read the mean value from the RTM ($\rightarrow V_{\text{DUT_mean_reading_pos}}$)
- Set the calibration voltage to the negative value (refer to below table)
- Measure the calibration voltage at the RTM input ($\rightarrow V_{\text{calibrator_neg}}$)
- Read the mean value from the RTM ($\rightarrow V_{\text{DUT_mean_reading_neg}}$)

Y-Scale	Calibration voltage
10 V/div	±36 V
5 V/div	±18 V
2 V/div	±7.2 V
1 V/div	±3.6 V
500 mV/div	±1.8 V
200 mV/div	±720 mV
100 mV/div	±360 mV
50 mV/div	±180 mV
20 mV/div	±72 mV
10 mV/div	±36 mV
5 mV/div	±18 mV
2 mV/div	±7.2 mV

Evaluation:

- Calculate the DC gain accuracy for each measurement. Use the following equation:

$$\text{DC gain accuracy} = \left(\frac{V_{\text{DUT_mean_reading_pos}} - V_{\text{DUT_mean_reading_neg}}}{V_{\text{calibrator_pos}} - V_{\text{calibrator_neg}}} - 1 \right) \times 100 [\%]$$

Example:

$$V_{\text{calibrator_pos}} = 124 \text{ mV}$$

$$V_{\text{calibrator_neg}} = -124 \text{ mV}$$

$$V_{\text{DUT_mean_reading_pos}} = 123 \text{ mV}$$

$$V_{\text{DUT_mean_reading_neg}} = -126 \text{ mV}$$

$$\text{DC gain accuracy} = \left(\frac{123 \text{ mV} - (-126 \text{ mV})}{124 \text{ mV} - (-124 \text{ mV})} - 1 \right) \times 100 [\%]$$

$$\text{DC gain accuracy} \approx 0.4 \%$$

- Measurement:**
- Repeat the measurement with all vertical scale settings
 - Repeat all measurements with the remaining channels

Test: DC gain accuracy with input resistance 50 Ω

- R&S RTM settings:**
- [PRESET]
 - [CH1 : Termination 50 Ω : Bandwidth 20 MHz : Y-Scale see table below]
 - [HORIZONTAL SCALE 1 ms/div]
 - [ACQUISITION : Waveform Rate "Max. Sa. Rate" : Wfm. Arithmetic "Average" : No Of Averages 2 Wfm.]
 - [VERTICAL POSITION 0 div] (After a preset the position of channel 2, 3 and 4 are not set to 0 div!)
 - [MEAS : Meas. Type "Mean Value" : Measure 1 "On"]

- Measurement:**
- Set the calibration voltage to the positive value (refer to below table)
 - Measure the calibration voltage at the RTM input ($\rightarrow V_{\text{calibrator_pos}}$)
 - Read the mean value from the RTM ($\rightarrow V_{\text{DUT_mean_reading_pos}}$)
 - Set the calibration voltage to the negative value (refer to below table)
 - Measure the calibration voltage at the RTM input ($\rightarrow V_{\text{calibrator_neg}}$)
 - Read the mean value from the RTM ($\rightarrow V_{\text{DUT_mean_reading_neg}}$)

Y-Scale	Calibration voltage
1 V/div	± 3.6 V
500 mV/div	± 1.8 V
200 mV/div	± 720 mV
100 mV/div	± 360 mV
50 mV/div	± 180 mV
20 mV/div	± 72 mV
10 mV/div	± 36 mV
5 mV/div	± 18 mV
2 mV/div	± 7.2 mV

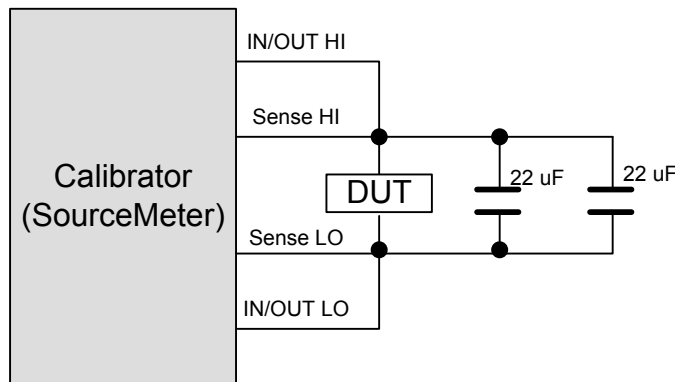
- Evaluation:**
- See evaluation at 1 M Ω termination

- Measurement:**
- Repeat the measurement with all vertical scale settings
 - Repeat all measurements with the remaining channels

2.2.3 Offset Accuracy

- Test equipment:**
- DC calibrator (refer to "Test Equipment", item 1)
 - Digital multimeter (refer to "Test Equipment", item 2)

- Test setup:**
- Switch output voltage of DC calibrator OFF! (to avoid damage of DUT in 50 Ω termination)
 - Connect DC calibrator output to CH1 input of the R&S RTM



- Note:**
- The voltage drop on the test cables must be taken into account.
 - For example: A DC resistance of 0.2 Ω results in a -0.4 % lower voltage at the 50 Ω RTM input.
 - For best results use 4-wire connection. Connect sense lines as close as possible to the RTM input.
 - If the DC calibrator does not support sensing, use a digital voltmeter to control the voltage at the RTM input.
 - To reduce noise of DC calibrator add a capacity direct at the input of RTM.
 - Recommended: 2 * 22 μ F (parallel) min. voltage 40 V.
 - If Keithley SourceMeter 2601A is used as DC calibrator, use the following setting: [CONFIG → SRC → HIGHC-MODE → SRC-ENABLE].

Test: Offset accuracy with input resistance 1 M Ω

R&S RTM settings:

- [PRESET]
- [CH1 : Termination 1 M Ω : Bandwidth 20 MHz : Offset see table below : Y-Scale see table below]
- [VERTICAL POSITION 0 div] (After a preset the position of channel 2, 3 and 4 are not set to 0 div!)
- [HORIZONTAL SCALE 1 ms/div]
- [ACQUISITION : Waveform Rate "Max. Sa. Rate" : Wfm. Arithmetic "Average" : No Of Averages 2 Wfm.]
- [MEAS : Meas. Type "Mean Value" : Measure 1 "On"]

- Measurement:**
- Set the calibration voltage (refer to below table)
 - Measure the calibration voltage at the RTM input ($\rightarrow V_{\text{calibrator}}$)
 - Read the mean value from RTM display ($\rightarrow V_{\text{DUT_mean_reading}}$)

RTM210x				RTM20xx			
Y-Scale	Offset and calibration voltage			Y-Scale	Offset and calibration voltage		
800 mV/div	-40 V	0 V	+40 V	500 mV/div	-40 V	0 V	+40 V
80 mV/div	-9.6 V	0 V	+9.6 V	50 mV/div	-9.75 V	0 V	+9.75 V
5 mV/div	-975 mV	0 V	+975 mV	5 mV/div	-975 mV	0 V	+975 mV

- Evaluation:**
- The offset deviation from the set value is equal to the difference between the applied voltage and the mean value reading.

$$V_{\text{offset_deviation}} = V_{\text{calibrator}} - V_{\text{DUT_mean_reading}}$$

Example:

Y-Scale = 50 mV/div

OFFSET = 9.75 V

$V_{\text{calibrator}}$ = 9.75 V

$V_{\text{DUT_mean_reading}}$ = 9.76 V

$$V_{\text{offset_deviation}} = 9.75 \text{ V} - 9.76 \text{ V} = 0.01 \text{ V}$$

- Measurement:**
- Repeat the measurement with all vertical scale settings
 - Repeat all measurements with the remaining channels

Test: Offset accuracy with input resistance 50 Ω

R&S RTM settings:

- [PRESET]
- [CH1 : Termination 50 Ω : Bandwidth 20 MHz : Offset see table below : Y-Scale see table below]
- [HORIZONTAL SCALE 1 ms/div]
- [ACQUISITION : Waveform Rate "Max. Sa. Rate" : Wfm. Arithmetic "Average" : No Of Averages 2 Wfm.]
- [VERTICAL POSITION 0 div] (After a preset the position of channel 2, 3 and 4 are not set to 0 div!)
- [MEAS : Meas. Type "Mean Value" : Measure 1 "On"]

- Measurement:**
- Set the calibration voltage (refer to below table)
 - Measure the calibration voltage at the RTM input ($\rightarrow V_{\text{calibrator}}$)
 - Read the mean value from RTM display ($\rightarrow V_{\text{DUT_mean_reading}}$)

RTM210x				RTM20xx			
Y-Scale	Offset and calibration voltage			Y-Scale	Offset and calibration voltage		
1 V/div	-5 V	0 V	+5 V	500 mV/div	-5 V	0 V	+5 V
100 mV/div	-5 V	0 V	+5 V	50 mV/div	-5 V	0 V	+5 V
5 mV/div	-975 mV	0 V	+975 mV	5 mV/div	-975 mV	0 V	+975 mV

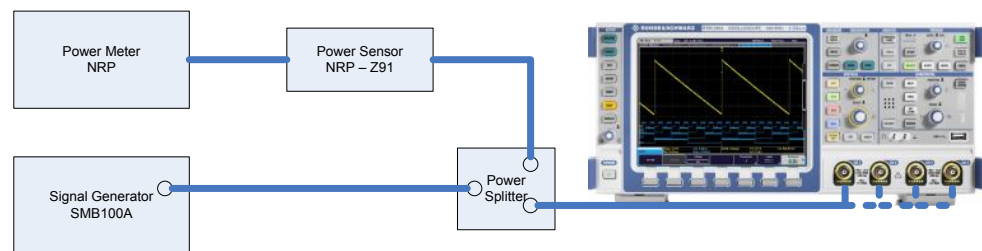
- Evaluation:**
- See evaluation at 1 M Ω termination.

- Measurement:**
- Repeat the measurement with all vertical scale settings
 - Repeat all measurements with the remaining channels

2.2.4 Analog Bandwidth

- Test equipment:**
- Signal generator (refer to "Test Equipment", item 3)
 - Power meter (refer to "Test Equipment", item 5a or 5b)
 - Power sensor (refer to "Test Equipment", item 4)
 - Power splitter (refer to "Test Equipment", item 6)
 - Cables / adapters

- Test setup:**
- Connect the signal generator to the power splitter input.
 - Connect the power sensor to the power splitter output 1.
 - Connect the RTM to the power splitter output 2.



- Note:**
- Before using any BNC adapters please check the rated specification, while not all BNC connectors are suitable for higher RF frequencies.

Test: Analog bandwidth

- R&S RTM settings:**
- [PRESET]
 - [CH1 : Termination 50 Ω : Y-Scale see table below]
 - [HORIZONTAL SCALE 500 ns/div]
 - [ACQUISITION : Waveform Rate "Max. Sa. Rate" : Wfm. Arithmetic "Average" : No Of Averages 32 Wfm.]
 - [TRIGGER SOURCE : Channel 1]
 - [VERTICAL POSITION 0 div] (After a preset the position of channel 2, 3 and 4 are not set to 0 div!)
 - [MEAS : Meas. Type "Peak Peak" : Measure 1 "On"]

- Signal generator settings:**
- [Frequency : 10 MHz]
 - [Level : see table below]

- Reference measurement:**
- Read peak to peak value from R&S RTM at input frequency of 10 MHz
 $V_{\text{RTM_reference}}$ [mV]
 - Read the power sensor level
 $P_{\text{sensor_reference}}$ [dBm]

- R&S RTM settings:**
- [HORIZONTAL SCALE 10 ns/div]

Signal generator settings:

Model	Signal generator frequency
RTM2022 / RTM2024	200 MHz
RTM2032 / RTM2034	350 MHz
RTM2052 / RTM2054	500 MHz
RTM2102 / RTM2104	1GHz

- [Level: see table below]

Bandwidth measurement:

- Read peak to peak value from R&S RTM at input frequency (value see Table above)
 V_{RTM} [mV]
 ➤ Read the power sensor level
 P_{sensor} [dBm]

Measurement settings**R&S RTM signal generator:**

Models: RTM2102 / RTM2104	
Y-Scale	Signal level at RTM input (Due to power splitter, level of signal generator must be 6 dB higher)
500 mV/div	2.00 Vpp 10 dBm
100 mV/div	800 mVpp 2 dBm
5 mV/div	40 mVpp -24 dBm
1 mV/div	8 mVpp -38 dBm

Models: RTM20x2 / RTM20x4	
Y-Scale	Signal level at RTM input (Due to power splitter, level of signal generator must be 6 dB higher)
500 mV/div	2.00 Vpp 10 dBm
50 mV/div	400 mVpp -4 dBm
5 mV/div	40 mVpp -24 dBm
1 mV/div	8 mVpp -38 dBm

Evaluation:

$$L_{\text{RTM}} = 20 \times \log \frac{V_{\text{RTM}}}{V_{\text{RTM_reference}}} - (P_{\text{sensor}} - P_{\text{sensor_reference}}) \text{ [dB]}$$

Example:

Y-Scale = 500 mV/div

$V_{\text{RTM_reference}}$ = 2000 mVpp

V_{RTM} = 1483 mVpp

$P_{\text{sensor_reference}}$ = 10 dBm

P_{sensor} = 9.9 dBm

$$L_{\text{RTM}} = 20 \times \log \frac{1483 \text{ mVpp}}{2000 \text{ mVpp}} - (9.9 \text{ dBm} - 10 \text{ dBm})$$

$$L_{\text{RTM}} \approx -2.5 \text{ dB}$$

- Measurement:**
- Repeat the measurement with all vertical scale settings
 - Repeat all measurements with the remaining channels

Test: Analog Bandwidth, Bandwidth limitation

- R&S RTM settings:**
- [PRESET]
 - [CH1 : Termination 50 Ω : Bandwidth see table below : Y-Scale 5 mV/div]
 - [HORIZONTAL SCALE see table below, column "Reference measurement"]
 - [ACQUISITION : Waveform Rate "Max. Sa. Rate" : Wfm. Arithmetic "Average" : No Of Averages 32 Wfm.]
 - [TRIGGER SOURCE : Channel 1]
 - [VERTICAL POSITION 0 div] (After a preset the position of channel 2, 3 and 4 are not set to 0 div!)
 - [MEAS : Meas. Type "Peak Peak" : Measure 1 "On"]

- Signal generator settings:**
- [Frequency : see table below, column "Reference measurement"]
 - [Level : 40 mVpp (-24 dBm) (Signal level at RTM input. Due to power splitter, level of signal generator must be 6 dB higher)]

- Reference measurement:**
- Read peak to peak value from R&S RTM at reference generator frequency
 $V_{\text{RTM_reference}}$ [mV]
 - Read the power sensor level
 $P_{\text{sensor_reference}}$ [dBm]

- R&S RTM settings:**
- [HORIZONTAL SCALE see table below, column "Bandwidth measurement"]

- Signal generator settings:**
- [Frequency : see table below, column "Bandwidth measurement"]
- Bandwidth measurement:**
- Read peak to peak value from R&S RTM
 V_{RTM} [mV]
 - Read the power sensor level
 P_{sensor} [dBm]

**Measurement settings
R&S RTM &
signal generator:**

Model	RTM Bandwidth setting	Reference measurement		Bandwidth measurement	
		HORIZONTAL SCALE	Generator frequency	HORIZONTAL SCALE	Generator frequency
1 GHz oscilloscopes	500 MHz	500 ns/div	10 MHz	10 ns	500 MHz
500 MHz oscilloscopes	400 MHz	500 ns/div	10 MHz	10 ns	400 MHz
1 GHz / 500 MHz oscilloscopes	200 MHz	5 µs/div	1 MHz	20 ns	200 MHz
all	20 MHz	50 µs/div	0.1 MHz	200 ns	20 MHz

Evaluation:

$$L_{\text{RTM}} = 20 \times \log \frac{V_{\text{RTM}}}{V_{\text{RTM_reference}}} - (P_{\text{sensor}} - P_{\text{sensor_reference}}) \text{ [dB]}$$

- Measurement:**
- Repeat the measurement with all settings from table above
 - Repeat all measurements with the remaining channels

2.2.5 Channel to Channel Isolation

- Test equipment:**
- Signal generator (refer to "Test Equipment", item 3)
 - Cables / adapters

Test: Channel-to-channel isolation CH1 to CH2

- Test setup:**
- Connect the RF output of the signal generator directly to the R&S RTM input channel 1.

- Signal generator settings:**
- [LEVEL: 8 dBm]

Model	Signal generator frequency
RTM2022 / RTM2024	200 MHz
RTM2032 / RTM2034	350 MHz
RTM2052 / RTM2054	499 MHz
RTM2102 / RTM2104	998 MHz

- R&S RTM settings:**
- [PRESET]
 - [HORIZONTAL SCALE 5 μ s/div]
 - [CH1 : Termination 50 Ω : Y-Scale 200 mV/div]
 - [CH2 : Termination 50 Ω : Y-Scale 200 mV/div]
 - [FFT : Wfm. Arithmetic "Average" : No. of Averages 4]
 - **RTM2022 / RTM2024:**
[FFT : FFT Setup : Points 65536 : Span 50 MHz : Center 200 MHz]
 - **RTM2032 / RTM2034:**
[FFT : FFT Setup : Points 65536 : Span 50 MHz : Center 350 MHz]
 - **RTM2052 / RTM2054:**
[FFT : FFT Setup : Points 65536 : Span 50 MHz : Center 499 MHz]
 - **RTM2102 / RTM2104:**
[FFT : FFT Setup : Points 65536 : Span 50 MHz : Center 998 MHz]
 - [FFT : Y(t) Setup : Show Channels]
 - [CURSOR : Set cursor 1 with NAVIGATION knob to FFT center frequency]

- Measurement:**
- [CH2]
 - Read cursor level L1
 $L1_{CH2}$ [dBm]
 - [CH1] (now the FFT of channel 1 is displayed)
 - Read cursor level L1
 $L1_{CH1}$ [dBm] (approximated 8 dBm – RTM attenuation of $\approx$ 2.5 dB)

Evaluation: Channel-to-channel isolation CH1 to CH2
 $a_{CH1-CH2} = L1_{CH1} - L1_{CH2}$ [dB]

Test: Channel-to-channel isolation CH4 to CH3 (only for RTM2xx4)

Test setup: ➤ Connect the RF output of the signal generator directly to the R&S RTM input channel 4.

Signal generator settings: ➤ [LEVEL: 8 dBm]

Model	Signal generator frequency
RTM2024	200 MHz
RTM2034	350 MHz
RTM2054	499 MHz
RTM2104	998 MHz

R&S RTM settings:

- [PRESET]
- [HORIZONTAL SCALE 200 ns/div]
- [CH4 : Termination 50 Ω : Y-Scale 200 mV/div]
- [CH3 : Termination 50 Ω : Y-Scale 200 mV/div]
- [FFT : Wfm. Arithmetic "Average" : No. of Averages 4]
- **RTM2024:**
FFT : FFT Setup : Points 65536 : Span 50 MHz : Center 200 MHz]
- **RTM2034:**
[FFT : FFT Setup : Points 65536 : Span 50 MHz : Center 350 MHz]
- **RTM2054:**
[FFT : FFT Setup : Points 65536 : Span 50 MHz : Center 499 MHz]
- **RTM2104:**
[FFT : FFT Setup : Points 65536 : Span 50 MHz : Center 998 MHz]
- [FFT : Y(t) Setup : Show Channels]
- [CURSOR : Set cursor 1 with NAVIGATION knob to FFT center frequency]

Measurement:

- [CH3]
- Read cursor level L1
 $L1_{CH3}$ [dBm]
- [CH4] (now the FFT of channel 1 is displayed)
- Read cursor level L1
 $L1_{CH4}$ [dBm] (approximated 8 dBm – RTM attenuation of ≈ 2.5 dB)

Evaluation: Channel-to-channel isolation CH4 to CH3
 $a_{CH4-CH3} = L1_{CH4} - L1_{CH3}$ [dB]

2.2.6 Reference frequency accuracy

- Test equipment:** ➤ Frequency counter (refer to "Test Equipment", item 7)
- Test setup:** ➤ Connect the RF input of the frequency counter directly to the R&S RTM trigger output
- R&S RTM settings:**
- [PRESET]
 - [SETUP : Page 3/3]
 - [Trigger Output: Output "Ref. Freq."]
 - SCPI:
:TRIGger:OUT:MODE REFerence
- Adjustment:**
- Read the current value:
:DIAGnostic:SERVice:CORRection:TEST 1,6000, ?
 - Tune the frequency:
:DIAGnostic:SERVice:CORRection:TEST 1,6000,<Value>
where $0 \leq \text{<Value>} \leq 4095$
- Increase or decrease the <Value> so that the frequency counter shows 10 MHz $\pm$ 2.5 ppm (10 MHz $\pm$ 25 Hz).
- Measurement:**
- Set frequency counter to appropriate resolution
 - Read frequency counter display
- Note:** ➤ If the reference frequency is out of tolerance, the frequency of the reference oscillator must be adjusted.
- Saving Results:**
- Saving the alignment value:
:DIAGnostic:SERVice:CORRection:TEST 1,5010,0
 - Saving the alignment value to factory defaults:
:DIAGnostic:SERVice:CORRection:TEST 1,5000,0
- Note:** ➤ After tuning, the alignment value is only stored in the RAM memory. The value gets lost after POWER OFF.
Use the saving commands to store the value permanently.

2.2.7 Internal Trigger

Test equipment: ➤ Signal generator (refer to "Test Equipment", item 3)
➤ Cables / adapters

Test setup: ➤ Connect the RF output of the signal generator directly to the R&S RTM input channel 1.

Test: **Trigger Sensitivity A**

R&S RTM settings:

- [PRESET]
- [CH1 : Termination 50 Ω : Y-Scale 20 mV/div]
- [VERTICAL POSITION 0 div] (After a preset the position of channel 2, 3 and 4 are not set to 0 div!)
- [HORIZONTAL SCALE see table below]
- [TRIGGER SOURCE : Channel 1]
- [TRIGGER LEVEL : 0 V]
- [TRIGGER SETUP : Setup : Slope "Both"]
- [MEAS : Meas. Type "Trigger Freq." : Measure 1 "On"]

R&S RTM & signal generator:

Model	RTM HORIZONTAL SCALE	Signal generator level	Signal generator frequency
RTM20xx	200 μ s/div	0.8 div at DUT $\approx$ -32 dBm	10 kHz
RTM21xx	200 μ s/div	1.4 div at DUT $\approx$ -27 dBm	10 kHz
RTM2022 / RTM2024	10 ns/div	0.8 div at DUT $\approx$ -29.5 dBm	200 MHz
RTM2032 / RTM2034	5 ns/div	0.8 div at DUT $\approx$ -29.5 dBm	350 MHz
RTM2052 / RTM2054	5 ns/div	0.8 div at DUT $\approx$ -29.5 dBm	500 MHz
RTM2102 / RTM2104	1 ns/div	1.4 div at DUT $\approx$ -26 dBm	1 GHz

Measurement:

- Read indicated trigger frequency on RTM within 2 % of generator frequency.
- Repeat all measurements with the remaining channels.

Test: Trigger Sensitivity B**R&S RTM settings:**

- [PRESET]
- [CH1 : Termination 50 Ω : Y-Scale 20 mV/div]
- [VERTICAL POSITION 0 div] (After a preset the position of channel 2, 3 and 4 are not set to 0 div!)
- [HORIZONTAL SCALE see table below]
- [TRIGGER SOURCE : Channel 1]
- [TRIGGER LEVEL : 0 V]
- [TRIGGER SETUP : Setup : Slope "Both"]
- [TRIGGER SETUP : B-Trigger]
- [TRIGGER SETUP : B-Setup : B-Source "CH1" : Slope "Both" : Level "0 V"]
- [MEAS : Meas. Type "Trigger B Freq." : Measure 1 "On"]

R&S RTM & signal generator settings:

Model	RTM HORIZONTAL SCALE	Signal generator level	Signal generator frequency
RTM20xx	200 μ s/div	0.8 div at DUT $\approx$ -32 dBm	10 kHz
RTM21xx	200 μ s/div	1.4 div at DUT $\approx$ -27 dBm	10 kHz
RTM2022 / RTM2024	10 ns/div	0.8 div at DUT $\approx$ -29.5 dBm	200 MHz
RTM2032 / RTM2034	5 ns/div	0.8 div at DUT $\approx$ -29.5 dBm	350 MHz
RTM2052 / RTM2054	5 ns/div	0.8 div at DUT $\approx$ -29.5 dBm	500 MHz
RTM2102 / RTM2104	1 ns/div	1.4 div at DUT $\approx$ -26 dBm	1 GHz

- Measurement:**
- Read indicated trigger B frequency on RTM within 2 % of generator frequency.
 - Repeat all measurements with the remaining channels

Test: Trigger source: AC Line**R&S RTM settings:**

- [PRESET]
- [TRIGGER SOURCE : AC Line]
- [MEAS : Meas. Type "Trigger Freq." : Measure 1 "On"]

- Measurement:**
- Read out Trigger Frequency

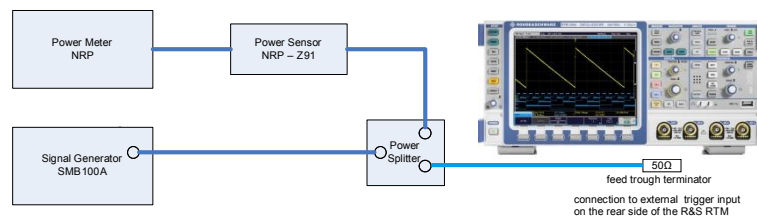
- Evaluation:**
- Depending on the AC line frequency of the location, the frequency reading is 50 Hz or 60 Hz.

2.2.8 External Trigger

- Test equipment:**
- Signal generator (refer to "Test Equipment", item 3)
 - Power sensor (refer to "Test Equipment", item 4)
 - Power meter (refer to "Test Equipment", item 5a or 5b)
 - Power splitter (refer to "Test Equipment", item 6)
 - Feed through termination 50 Ω (refer to "Test Equipment", item 8)
 - Cables / Adapters

- Test setup:**
- Connect equipment as shown below.
 - Connect the signal generator to the power splitter input.
 - Connect the power splitter output 1 to power sensor.
 - Connect the power splitter output 2 via a 50 Ω feed through terminator to the external trigger input of the RTM.

- Note:**
- Ensure, that the cables from the splitter to the power sensor and to the external trigger input are of equal length and are so short as possible!



Test: Ext. Trigger Sensitivity

R&S RTM settings:

- [PRESET]
- [TRIGGER SOURCE : Extern : DC]
- [TRIGGER LEVEL : 0V]
- [TRIGGER SETUP : Setup : Slope "Both"]
- [MEAS : Meas. Type "Trigger Freq." : Measure 1 "On"]

Signal generator settings:

Signal generator frequency	Voltage at external trigger input	Power meter display
10 kHz	300 mVpp	-6.48 dBm
500 MHz	300 mVpp	-6.48 dBm

Note the 6 dB attenuation of the power splitter for setup signal generators level.

- Measurement:**
- Read indicated trigger frequency on RTM within 2 % of generator frequency

2.2.9 Probe Identification

Test: Identification Passive Probe

Test equipment: ➤ Passive 10:1 Probe (refer to "Test Equipment", item 11)

Test setup: ➤ Ensure no Probe is connected to the R&S RTM

R&S RTM settings:

- [PRESET]
- [CH1 : Coupling DC : Termination 50 Ω : Y-Scale 50 mV/div]
- [HORIZONTAL SCALE 500 μ s/div]
- [TRIGGER LEVEL 50 mV]

Measurement setup:

- Connect probe to R&S RTM CH1 input
- Connect probe tip to Probe Compensation signal output

Measurement:

- Check that the impedance at CH1 is switched to 1 M Ω
- Check that the Y-Scale at CH1 is switched to 500 mV/div
- Check the Display: square wave with approximated 1 Vpp (2 divisions) amplitude
- Repeat all measurements with the remaining channels

Test: Identification Active Probe

Test equipment: ➤ Active 10:1 Probe (refer to "Test Equipment", item 10)

Test setup: ➤ Ensure no Probe is connected to the R&S RTM

R&S RTM settings:

- [PRESET]
- [CH1 : Coupling DC : Termination 1 M Ω : Y-Scale 50 mV/div]
- [HORIZONTAL SCALE 500 μ s/div]
- [TRIGGER LEVEL 50 mV]

Measurement setup:

- Connect probe to R&S RTM CH1 input
- Connect probe tip to Probe Compensation signal output

Measurement:

- Check that the impedance at CH1 is switched to 50 Ω
- Check that the Y-Scale at CH1 is switched to 500 mV/div
- Check the Display: square wave with approximated 1 Vpp (2 divisions) amplitude
- Repeat all measurements with the remaining channels

2.3 Performance Test Report R&S RTM

ROHDE&SCHWARZ	Digital Oscilloscope
	R&S RTM2022 5710.0999.22
	R&S RTM2024 5710.0999.24
	R&S RTM2032 5710.0999.32
	R&S RTM2034 5710.0999.34
	R&S RTM2052 5710.0999.52
	R&S RTM2054 5710.0999.54
	R&S RTM2104 5710.0999.04
	R&S RTM2102 5710.0999.02
Model:	_____
Serial number:	_____
Date:	_____
Person responsible:	_____
Signature:	_____

For nominal data and limit values refer to the data sheet supplied with the instrument.

2.3.1 Input Resistance

Channel 1; Input Resistance: 1 M Ω

Vertical Scale	DL	Actual		MU
200 mV/div	1 M Ω $\pm$ 1 %		M Ω	
20 mV/div	1 M Ω $\pm$ 1 %		M Ω	

Channel 1; Input Resistance: 50 Ω

Vertical Scale	DL	Actual		MU
20 mV/div	50 Ω $\pm$ 1.5 %		Ω	

Channel 2; Input Resistance: 1 M Ω

Vertical Scale	DL	Actual		MU
200 mV/div	1 M Ω $\pm$ 1 %		M Ω	
20 mV/div	1 M Ω $\pm$ 1 %		M Ω	

Channel 2; Input Resistance: 50 Ω

Vertical Scale	DL	Actual		MU
20 mV/div	50 Ω $\pm$ 1.5 %		Ω	

Channel 3; Input Resistance: 1 M Ω (only for RTM2xx4)

Vertical Scale	DL	Actual		MU
200 mV/div	1 M Ω $\pm$ 1 %		M Ω	
20 mV/div	1 M Ω $\pm$ 1 %		M Ω	

Channel 3; Input Resistance: 50 Ω (only for RTM2xx4)

Vertical Scale	DL	Actual		MU
20 mV/div	50 Ω $\pm$ 1.5 %		Ω	

Channel 4; Input Resistance: 1 M Ω (only for RTM2xx4)

Vertical Scale	DL	Actual		MU
200 mV/div	1 M Ω $\pm$ 1 %		M Ω	
20 mV/div	1 M Ω $\pm$ 1 %		M Ω	

Channel 4; Input Resistance: 50 Ω (only for RTM2xx4)

Vertical Scale	DL	Actual		MU
20 mV/div	50 Ω $\pm$ 1.5 %		Ω	

2.3.2 DC Gain Accuracy

Channel 1; Input Resistance: 1 M Ω

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	± 36 V	± 1.5 %		%	
5 V/div	± 18 V	± 1.5 %		%	
2 V/div	± 7.2 V	± 1.5 %		%	
1 V/div	± 3.6 V	± 1.5 %		%	
500 mV/div	± 1.8 V	± 1.5 %		%	
200 mV/div	± 720 mV	± 1.5 %		%	
100 mV/div	± 360 mV	± 1.5 %		%	
50 mV/div	± 180 mV	± 1.5 %		%	
20 mV/div	± 72 mV	± 1.5 %		%	
10 mV/div	± 36 mV	± 1.5 %		%	
5 mV/div	± 18 mV	± 2.0 %		%	
2 mV/div	± 7.2 mV	± 2.0 %		%	

Channel 1; Input Resistance: 50 Ω

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	± 3.6 V	± 1.5 %		%	
500 mV/div	± 1.8 V	± 1.5 %		%	
200 mV/div	± 720 mV	± 1.5 %		%	
100 mV/div	± 360 mV	± 1.5 %		%	
50 mV/div	± 180 mV	± 1.5 %		%	
20 mV/div	± 72 mV	± 1.5 %		%	
10 mV/div	± 36 mV	± 1.5 %		%	
5 mV/div	± 18 mV	± 2.0 %		%	
2 mV/div	± 7.2 mV	± 2.0 %		%	

Channel 2; Input Resistance: 1 M Ω

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	± 36 V	± 1.5 %		%	
5 V/div	± 18 V	± 1.5 %		%	
2 V/div	± 7.2 V	± 1.5 %		%	
1 V/div	± 3.6 V	± 1.5 %		%	
500 mV/div	± 1.8 V	± 1.5 %		%	
200 mV/div	± 720 mV	± 1.5 %		%	
100 mV/div	± 360 mV	± 1.5 %		%	
50 mV/div	± 180 mV	± 1.5 %		%	
20 mV/div	± 72 mV	± 1.5 %		%	
10 mV/div	± 36 mV	± 1.5 %		%	
5 mV/div	± 18 mV	± 2.0 %		%	
2 mV/div	± 7.2 mV	± 2.0 %		%	

Channel 2; Input Resistance: 50 Ω

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	± 3.6 V	± 1.5 %		%	
500 mV/div	± 1.8 V	± 1.5 %		%	
200 mV/div	± 720 mV	± 1.5 %		%	
100 mV/div	± 360 mV	± 1.5 %		%	
50 mV/div	± 180 mV	± 1.5 %		%	
20 mV/div	± 72 mV	± 1.5 %		%	
10 mV/div	± 36 mV	± 1.5 %		%	
5 mV/div	± 18 mV	± 2.0 %		%	
2 mV/div	± 7.2 mV	± 2.0 %		%	

Channel 3; Input Resistance: 1 M Ω (only for RTM2xx4)

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	± 36 V	± 1.5 %		%	
5 V/div	± 18 V	± 1.5 %		%	
2 V/div	± 7.2 V	± 1.5 %		%	
1 V/div	± 3.6 V	± 1.5 %		%	
500 mV/div	± 1.8 V	± 1.5 %		%	
200 mV/div	± 720 mV	± 1.5 %		%	
100 mV/div	± 360 mV	± 1.5 %		%	
50 mV/div	± 180 mV	± 1.5 %		%	
20 mV/div	± 72 mV	± 1.5 %		%	
10 mV/div	± 36 mV	± 1.5 %		%	
5 mV/div	± 18 mV	± 2.0 %		%	
2 mV/div	± 7.2 mV	± 2.0 %		%	

Channel 3; Input Resistance: 50 Ω (only for RTM2xx4)

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	± 3.6 V	± 1.5 %		%	
500 mV/div	± 1.8 V	± 1.5 %		%	
200 mV/div	± 720 mV	± 1.5 %		%	
100 mV/div	± 360 mV	± 1.5 %		%	
50 mV/div	± 180 mV	± 1.5 %		%	
20 mV/div	± 72 mV	± 1.5 %		%	
10 mV/div	± 36 mV	± 1.5 %		%	
5 mV/div	± 18 mV	± 2.0 %		%	
2 mV/div	± 7.2 mV	± 2.0 %		%	

Channel 4; Input Resistance: 1 M Ω (only for RTM2xx4)

Vertical Scale	Calibration Voltage	DL	Actual		MU
10 V/div	± 36 V	± 1.5 %		%	
5 V/div	± 18 V	± 1.5 %		%	
2 V/div	± 7.2 V	± 1.5 %		%	
1 V/div	± 3.6 V	± 1.5 %		%	
500 mV/div	± 1.8 V	± 1.5 %		%	
200 mV/div	± 720 mV	± 1.5 %		%	
100 mV/div	± 360 mV	± 1.5 %		%	
50 mV/div	± 180 mV	± 1.5 %		%	
20 mV/div	± 72 mV	± 1.5 %		%	
10 mV/div	± 36 mV	± 1.5 %		%	
5 mV/div	± 18 mV	± 2.0 %		%	
2 mV/div	± 7.0 mV	± 2.0 %		%	

Channel 4; Input Resistance: 50 Ω (only for RTM2xx4)

Vertical Scale	Calibration Voltage	DL	Actual		MU
1 V/div	± 3.6 V	± 1.5 %		%	
500 mV/div	± 1.8 V	± 1.5 %		%	
200 mV/div	± 720 mV	± 1.5 %		%	
100 mV/div	± 360 mV	± 1.5 %		%	
50 mV/div	± 180 mV	± 1.5 %		%	
20 mV/div	± 72 mV	± 1.5 %		%	
10 mV/div	± 36 mV	± 1.5 %		%	
5 mV/div	± 18 mV	± 2.0 %		%	
2 mV/div	± 7.2 mV	± 2.0 %		%	

2.3.3 Offset Accuracy

Channel 1; Input Resistance: 1 M Ω

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
500 mV/div	0 V	± 75.00 mV		mV	
500 mV/div	+40 V	± 275.00 mV		mV	
500 mV/div	-40 V	± 275.00 mV		mV	
50 mV/div	0 V	± 7.50 mV		mV	
50 mV/div	+9.75 V	± 56.25 mV		mV	
50 mV/div	-9.75 V	± 56.25 mV		mV	
5 mV/div	0 V	± 0.75 mV		mV	
5 mV/div	+975 mV	± 5.63 mV		mV	
5 mV/div	-975 mV	± 5.63 mV		mV	

Channel 1; Input Resistance: 50 Ω

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
500 mV/div	0 V	± 75.00 mV		mV	
500 mV/div	+5 V	± 100.00 mV		mV	
500 mV/div	-5 V	± 100.00 mV		mV	
50 mV/div	0 V	± 7.50 mV		mV	
50 mV/div	+5 V	± 32.50 mV		mV	
50 mV/div	-5 V	± 32.50 mV		mV	
5 mV/div	0 V	± 0.75 mV		mV	
5 mV/div	+975 mV	± 5.63 mV		mV	
5 mV/div	-975 mV	± 5.63 mV		mV	

Channel 2; Input Resistance: 1 M Ω

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
500 mV/div	0 V	± 75.00 mV		mV	
500 mV/div	+40 V	± 275.00 mV		mV	
500 mV/div	-40 V	± 275.00 mV		mV	
50 mV/div	0 V	± 7.50 mV		mV	
50 mV/div	+9.75 V	± 56.25 mV		mV	
50 mV/div	-9.75 V	± 56.25 mV		mV	
5 mV/div	0 V	± 0.75 mV		mV	
5 mV/div	+975 mV	± 5.63 mV		mV	
5 mV/div	-975 mV	± 5.63 mV		mV	

Channel 2; Input Resistance: 50 Ω

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
500 mV/div	0 V	± 75.00 mV		mV	
500 mV/div	+5 V	± 100.00 mV		mV	
500 mV/div	-5 V	± 100.00 mV		mV	
50 mV/div	0 V	± 7.50 mV		mV	
50 mV/div	+5 V	± 32.50 mV		mV	
50 mV/div	-5 V	± 32.50 mV		mV	
5 mV/div	0 V	± 0.75 mV		mV	
5 mV/div	+975 mV	± 5.63 mV		mV	
5 mV/div	-975 mV	± 5.63 mV		mV	

Channel 3; Input Resistance: 1 M Ω (only for RTM2xx4)

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
500 mV/div	0 V	± 75.00 mV		mV	
500 mV/div	+40 V	± 275.00 mV		mV	
500 mV/div	-40 V	± 275.00 mV		mV	
50 mV/div	0 V	± 7.50 mV		mV	
50 mV/div	+9.75 V	± 56.25 mV		mV	
50 mV/div	-9.75 V	± 56.25 mV		mV	
5 mV/div	0 V	± 0.75 mV		mV	
5 mV/div	+975 mV	± 5.63 mV		mV	
5 mV/div	-975 mV	± 5.63 mV		mV	

Channel 3; Input Resistance: 50 Ω (only for RTM2xx4)

Vertical Scale	Offset and Calibration Voltage	DL	Actual		MU
500 mV/div	0 V	± 75.00 mV		mV	
500 mV/div	+5 V	± 100.00 mV		mV	
500 mV/div	-5 V	± 100.00 mV		mV	
50 mV/div	0 V	± 7.50 mV		mV	
50 mV/div	+5 V	± 32.50 mV		mV	
50 mV/div	-5 V	± 32.50 mV		mV	
5 mV/div	0 V	± 0.75 mV		mV	
5 mV/div	+975 mV	± 5.63 mV		mV	
5 mV/div	-975 mV	± 5.63 mV		mV	

Channel 4; Input Resistance: 1 M Ω (only for RTM2xx4)

Vertical scale	Offset and calibration Voltage	DL	Actual		MU
500 mV/div	0 V	± 75.00 mV		mV	
500 mV/div	+40 V	± 275.00 mV		mV	
500 mV/div	-40 V	± 275.00 mV		mV	
50 mV/div	0 V	± 7.50 mV		mV	
50 mV/div	+9.75 V	± 56.25 mV		mV	
50 mV/div	-9.75 V	± 56.25 mV		mV	
5 mV/div	0 V	± 0.75 mV		mV	
5 mV/div	+975 mV	± 5.63 mV		mV	
5 mV/div	-975 mV	± 5.63 mV		mV	

Channel 4; Input Resistance: 50 Ω (only for RTM2xx4)

Vertical scale	Offset and calibration Voltage	DL	Actual		MU
500 mV/div	0 V	± 75.00 mV		mV	
500 mV/div	+5 V	± 100.00 mV		mV	
500 mV/div	-5 V	± 100.00 mV		mV	
50 mV/div	0 V	± 7.50 mV		mV	
50 mV/div	+5 V	± 32.50 mV		mV	
50 mV/div	-5 V	± 32.50 mV		mV	
5 mV/div	0 V	± 0.75 mV		mV	
5 mV/div	+975 mV	± 5.63 mV		mV	
5 mV/div	-975 mV	± 5.63 mV		mV	

2.3.4 Analog Bandwidth

Channel 1; Analog Bandwidth

Vertical scale	R&S RTM bandwidth setting	Level signal generator peak to peak	Generator frequency reference value	Generator frequency				DLL	Actual		MU
				RTM202x	RTM203x	RTM205x	RTM210x				
500 mV/div	Full	2 V	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
50 mV/div	Full	400 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
5 mV/div	Full	40 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
1 mV/div	Full	8 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	

Channel 1; Analog Bandwidth; Bandwidth limitation

R&S RTM Vertical Scale: 5 mV/div								
Level Signal Generator peak to peak: 40 mV								
Models	R&S RTM Bandwidth setting	Generator frequency reference value	Generator frequency	DLL / dB	DUL / dB	Actual		MU
RTM2102 / RTM2104	500 MHz	10 MHz	500 MHz	-3.50	-1.80		dB	
RTM2052 / RTM2054	400 MHz	10 MHz	400 MHz	-3.50	-1.80		dB	
RTM2102 / RTM2104 RTM2052 / RTM2054 RTM2032 / RTM2034	200 MHz	1 MHz	200 MHz	-3.50	-1.80		dB	
all	20 MHz	0.1 MHz	20 MHz	-3.50	-1.80		dB	

Channel 2; Analog Bandwidth

Vertical scale	R&S RTM bandwidth setting	Level signal generator peak to peak	Generator frequency reference value	Generator frequency				DLL	Actual		MU
				RTM202x	RTM203x	RTM205x	RTM210x				
500 mV/div	Full	2 V	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
50 mV/div	Full	400 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
5 mV/div	Full	40 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
1 mV/div	Full	8 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	

Channel 2; Analog Bandwidth; Bandwidth limitation

R&S RTM Vertical Scale:		5 mV/div									
Level Signal Generator peak to peak:		40 mV									
Models	R&S RTM Bandwidth setting	Generator frequency reference value	Generator frequency	DLL / dB	DUL / dB	Actual		MU			
RTM2102 / RTM2104	500 MHz	10 MHz	500 MHz	-3.50	-1.80		dB				
RTM2052 / RTM2054	400 MHz	10 MHz	400 MHz	-3.50	-1.80		dB				
RTM2102 / RTM2104 RTM2052 / RTM2054 RTM2032 / RTM2034	200 MHz	1 MHz	200 MHz	-3.50	-1.80		dB				
all	20 MHz	0.1 MHz	20 MHz	-3.50	-1.80		dB				

Channel 3; Analog Bandwidth (only for RTM2xx4)

Vertical scale	R&S RTM bandwidth setting	Level signal generator peak to peak	Generator frequency reference value	Generator frequency				DLL	Actual		MU
				RTM2024	RTM2034	RTM2054	RTM2104				
500 mV/div	Full	2 V	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
50 mV/div	Full	400 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
5 mV/div	Full	40 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
1 mV/div	Full	8 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	

Channel 3; Analog Bandwidth; Bandwidth limitation (only for RTM2xx4)

R&S RTM Vertical Scale:		5 mV/div						
Level Signal Generator peak to peak:		40 mV						
Models	R&S RTM Bandwidth setting	Generator frequency reference value	Generator frequency	DLL / dB	DUL / dB	Actual		MU
RTM2104	500 MHz	10 MHz	500 MHz	-3.50	-1.80		dB	
RTM2054	400 MHz	10 MHz	400 MHz	-3.50	-1.80		dB	
RTM2104 RTM2054 RTM2034	200 MHz	1 MHz	200 MHz	-3.50	-1.80		dB	
all	20 MHz	0.1 MHz	20 MHz	-3.50	-1.80		dB	

Channel 4; Analog Bandwidth (only for RTM2xx4)

Vertical scale	R&S RTM bandwidth setting	Level signal generator peak to peak	Generator frequency reference value	Generator frequency				DLL	Actual		MU
				RTM2024	RTM2034	RTM2054	RTM2104				
500 mV/div	Full	2 V	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
50 mV/div	Full	400 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
5 mV/div	Full	40 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	
1 mV/div	Full	8 mV	10 MHz	200 MHz	350 MHz	500 MHz	1 GHz	-3 dB		dB	

Channel 4; Analog Bandwidth; Bandwidth limitation (only for RTM2xx4)

R&S RTM Vertical Scale:		5 mV/div						
Level Signal Generator peak to peak:		40 mV						
Models	R&S RTM Bandwidth setting	Generator frequency reference value	Generator frequency	DLL / dB	DUL / dB	Actual		MU
RTM2104	500 MHz	10 MHz	500 MHz	-3.50	-1.80		dB	
RTM2054	400 MHz	10 MHz	400 MHz	-3.50	-1.80		dB	
RTM2104 RTM2054 RTM2034	200 MHz	1 MHz	200 MHz	-3.50	-1.80		dB	
all	20 MHz	0.1 MHz	20 MHz	-3.50	-1.80		dB	

2.3.5 Channel-to-channel isolation

Channel-to-channel isolation (CH1 to CH2); Input Resistance 50Ω

Models	FFT center frequency	FFT frequency span	FFT points	Generator frequency	DLL	Actual	MU
RTM2102 / RTM2104	998 MHz	50 MHz	65536	998 MHz	50.00 dB	dB	
RTM2052 / RTM2054	499 MHz	50 MHz	65536	499 MHz	50.00 dB	dB	
RTM2032 / RTM2034	350 MHz	50 MHz	65536	350 MHz	50.00 dB	dB	
RTM2022 / RTM2024	200 MHz	50 MHz	65536	200 MHz	50.00 dB	dB	

Channel-to-channel isolation (CH4 to CH3); Input Resistance 50Ω (RTM2xx4)

Models	FFT center frequency	FFT frequency span	FFT points	Generator frequency	DLL	Actual	MU
RTM2104	998 MHz	50 MHz	65536	998 MHz	50.00 dB	dB	
RTM2054	499 MHz	50 MHz	65536	499 MHz	50.00 dB	dB	
RTM2034	350 MHz	50 MHz	65536	350 MHz	50.00 dB	dB	
RTM2024	200 MHz	50 MHz	65536	200 MHz	50.00 dB	dB	

2.3.6 Reference Frequency Accuracy

Reference frequency	DL	Actual	MU
10 MHz at TRIGGER OUT	±2.5 ppm	ppm	

2.3.7 Internal Trigger A

Channel 1; Internal Trigger A Sensitivity

Horizontal scale	Vertical scale	Generator frequency			Input Level		Trigger Check
		RTM202x	RTM203x	RTM205x			
200 μ s/div	20 mV/div	10 kHz	10 kHz	10 kHz	0.8 div	Pass / Fail	
5 ns/div	20 mV/div	200 MHz	350 MHz	500 MHz	0.8 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Input Level		Trigger Check
		RTM2102 / RTM2104			
200 μ s/div	20 mV/div	10 kHz	1 div	Pass / Fail	
5 ns/div	20 mV/div	1 GHz	1 div	Pass / Fail	

Channel 2; Internal Trigger A Sensitivity

Horizontal scale	Vertical scale	Generator frequency			Input Level		Trigger Check
		RTM202x	RTM203x	RTM205x			
200 μ s/div	20 mV/div	10 kHz	10 kHz	10 kHz	0.8 div	Pass / Fail	
5 ns/div	20 mV/div	200 MHz	350 MHz	500 MHz	0.8 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Input Level		Trigger Check
		RTM2102 / RTM2104			
200 μ s/div	20 mV/div	10 kHz	1 div	Pass / Fail	
5 ns/div	20 mV/div	1 GHz	1 div	Pass / Fail	

Channel 3; Internal Trigger A Sensitivity (only for RTM2xx4)

Horizontal scale	Vertical scale	Generator frequency			Input Level		Trigger Check
		RTM2024	RTM2034	RTM2054			
200 μ s/div	20 mV/div	10 kHz	10 kHz	10 kHz	0.8 div	Pass / Fail	
5 ns/div	20 mV/div	200 MHz	350 MHz	500 MHz	0.8 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Input Level		Trigger Check
		RTM2104			
200 μ s/div	20 mV/div	10 kHz	1 div	Pass / Fail	
5 ns/div	20 mV/div	1 GHz	1 div	Pass / Fail	

Channel 4; Internal Trigger A Sensitivity (only for RTM2xx4)

Horizontal scale	Vertical scale	Generator frequency			Input Level		Trigger Check
		RTM2024	RTM2034	RTM2054			
200 μ s/div	20 mV/div	10 kHz	10 kHz	10 kHz	0.8 div	Pass / Fail	
5 ns/div	20 mV/div	200 MHz	350 MHz	500 MHz	0.8 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Input Level		Trigger Check
		RTM2104			
200 μ s/div	20 mV/div	10 kHz	1 div	Pass / Fail	
5 ns/div	20 mV/div	1 GHz	1 div	Pass / Fail	

2.3.8 Internal Trigger B**Channel 1; Internal Trigger B Sensitivity**

Horizontal scale	Vertical scale	Generator frequency			Input Level		Trigger Check
		RTM202x	RTM203x	RTM205x			
200 μ s/div	20 mV/div	10 kHz	10 kHz	10 kHz	0.8 div	Pass / Fail	
5 ns/div	20 mV/div	200 MHz	350 MHz	500 MHz	0.8 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Input Level		Trigger Check
		RTM2102 / RTM2104			
200 μ s/div	20 mV/div	10 kHz	1 div	Pass / Fail	
5 ns/div	20 mV/div	1 GHz	1 div	Pass / Fail	

Channel 2; Internal Trigger B Sensitivity

Horizontal scale	Vertical scale	Generator frequency			Input Level		Trigger Check
		RTM202x	RTM203x	RTM205x			
200 μ s/div	20 mV/div	10 kHz	10 kHz	10 kHz	0.8 div	Pass / Fail	
5 ns/div	20 mV/div	200 MHz	350 MHz	500 MHz	0.8 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Input Level		Trigger Check
		RTM2102 / RTM2104			
200 μ s/div	20 mV/div	10 kHz	1 div	Pass / Fail	
5 ns/div	20 mV/div	1 GHz	1 div	Pass / Fail	

Channel 3; Internal Trigger B Sensitivity (only for RTM2xx4)

Horizontal scale	Vertical scale	Generator frequency			Input Level		Trigger Check
		RTM2024	RTM2034	RTM2054			
200 μ s/div	20 mV/div	10 kHz	10 kHz	10 kHz	0.8 div	Pass / Fail	
5 ns/div	20 mV/div	200 MHz	350 MHz	500 MHz	0.8 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Input Level		Trigger Check
		RTM2104			
200 μ s/div	20 mV/div	10 kHz	1 div	Pass / Fail	
5 ns/div	20 mV/div	1 GHz	1 div	Pass / Fail	

Channel 4; Internal Trigger B Sensitivity (only for RTM2xx4)

Horizontal scale	Vertical scale	Generator frequency			Input Level		Trigger Check
		RTM2024	RTM2034	RTM2054			
200 μ s/div	20 mV/div	10 kHz	10 kHz	10 kHz	0.8 div	Pass / Fail	
5 ns/div	20 mV/div	200 MHz	350 MHz	500 MHz	0.8 div	Pass / Fail	

Horizontal scale	Vertical scale	Generator frequency	Input Level		Trigger Check
		RTM2104			
200 μ s/div	20 mV/div	10 kHz	1 div	Pass / Fail	
5 ns/div	20 mV/div	1 GHz	1 div	Pass / Fail	

2.3.9 Trigger Source: AC Line

	Trigger Check
Pass / Fail	

2.3.10 External Trigger

External Trigger; Trigger Sensitivity

Generator frequency				Input voltage		Trigger Check
RTM202x	RTM203x	RTM205x	RTM210x			
10 kHz	10 kHz	10 kHz	10 kHz	300 mVpp	Pass / Fail	
200 MHz	350 MHz	500 MHz	1 GHz	300 mVpp	Pass / Fail	

2.3.11 Probe Identification; Passive Probe

Channel 1; Passive Probe

		Actual
Identification	Pass / Fail	

Channel 2; Passive Probe

		Actual
Identification	Pass / Fail	

Channel 3; Passive Probe (only for RTM2xx4)

		Actual
Identification	Pass / Fail	

Channel 4; Passive Probe (only for RTM2xx4)

		Actual
Identification	Pass / Fail	

2.3.12 Probe Identification; Active Probe

Channel 1; Active Probe

		Actual
Identification	Pass / Fail	

Channel 2; Active Probe

		Actual
Identification	Pass / Fail	

Channel 3; Active Probe (only for RTM2xx4)

		Actual
Identification	Pass / Fail	

Channel 4; Active Probe (only for RTM2xx4)

		Actual
Identification	Pass / Fail	

3 Adjustment

NOTICE

Risk of incorrect measurement results

Adjustment must be carried out exclusively by qualified personnel since any change can considerably affect the instrument's measurement accuracy.

3.1 Self-Alignment Process

The instrument is equipped with a self-alignment feature; no extra manual adjustments are necessary after module replacement.

Parameters that cannot be adjusted using the self-alignment feature and which require additional measuring equipment to be adjusted or corrected are pre-adjusted in the factory, or the level deviations are determined as correction values.

The alignment values are stored in the serial flash memory of the individual boards. Thus, after exchanging the board, it is only necessary to perform a self-alignment.

The description below describes the block diagram theory of the self-alignment procedure. The indicated numbers refer to the block diagram at the end of this document.

1. For the self-alignment process, the 16-bit DACs **13** at the frontend are used as signal sources to determine the level deviation at various settings. The test signals are looped through the DC/Offset controls **9** into the signal path.
2. The test signals are then either measured by the ADC **12** at the frontend or acquisition ADC **3**, **4** at the mainboard depending on the adjustment steps.
3. The measured values are stored in the serial flash memory **15** at the frontend. During startup of the instrument this data are copied to the DDF (device data field) to be used in the measurement.

The self-alignment procedure consists of a series of adjustment steps as described in [Table 3-1](#).

Most alignment steps are performed at all the available channels in parallel.

Note: in the following table, <x> describes channel number 1 and 2 for R&S RTM2xx2, or 1 to 4 for R&S RTM2xx4.

The self-alignment is grouped in three categories as follows:

1. At Step 1 to 7 will be the analog inputs and their amplifiers on the front end aligned.
2. Step 8 to 11 aligns the acquisition.
3. Step 12 to 14 aligns the trigger system of the oscilloscope.

Step	Label	Description	Hardware location
1	CH<x> PP Check	Check the channels for a voltage swing, e.g. from a connected generator or radiation	Frontend
2	FE ADC Zero Error	Determines the offset voltage of the ADC 12	Frontend
3	CH<x> Gain1	Adjust the gain of the 0dB, 10dB and 20dB preamplifiers on Majuro2 behind the inputs IN0, IN1 and IN2 by means of VGA1	Frontend
6	CH<x> Offset2	Evaluate the working point of VGA2 to obtain constant offset at different gain sets.	Frontend
7	CH<x> Gain2 Characteristic	Evaluate the gain characteristic of the VGA2 on Majuro2 at different gain sets.	Frontend
8	CH<x> ACQ norm Offset	Eliminate the offset voltage at different sensitivity by means of offset adjust of acquisition ADC 3 4 .	Mainboard
9	CH<x> ACQ interl. Offset	Eliminate the offset voltage at different sensitivity by means of offset adjust of acquisition ADC 3 4 . (Interlaced Mode)	Mainboard
10	CH<x> ACQ norm Gain at gain step f: 2V	Adjust the gain of the acquisition ADC 3 4 at 2 V/div sensitivity settings to meet the nominal.	Mainboard
11	CH1 ACQ interl. Gain at gain step f: 2V	Adjust the gain of the measuring ADC 3 4 at 2 V/div sensitivity settings to meet the nominal. (Interlaced mode)	Mainboard
12	CH1 Trigger A & B & HFreject & LFreject CH<2..4> Trigger A & B	Adjust offset and gain of Trigger level A and B to match to the offset and gain of the acquisition. Furthermore are the trigger filters aligned.	Frontend
13	Trigger Extern & HFreject & Mp & Mp LFreject	Adjustment of Trigger level external offset without and with filters	Frontend
14	CH<x> Trigger Mp	Determines the offset voltage of the trigger amplifiers.	Frontend

Table 3-1: List of self-alignment steps

3.2 Performing Self-Alignment

Prerequisites:

- Instrument has to be switched on for at least 20 minutes prior to performing the self-alignment. In other case a warning will be displayed.
- All cables connected to the instrument at the front and the rear of the instrument must be removed.

Performing self-alignment:

1. Activate the self-alignment by selecting [**SETUP** : More : Self-alignment : Start]

During the self-alignment the status information is displayed on the screen.

After self-alignment has been successfully completed, a message is displayed.

If a non-correctable level deviation or limit violation is detected during the self-alignment, the process is aborted and an error message window is shown on the display.



Figure 3-1: Self-alignment finished

2. The self-alignment result log file can be exported to a USB storage for detailed investigation by selecting [**SETUP** : Self-alignment : Export the log file]



Figure 3-2: Screenshot of softkey GUI for exporting log file

4 Repair

The following chapter describes how to replace modules in the R&S RTM. The general procedures to open and complete the instrument are described in the introduction. For all descriptions, the numbers in parenthesis refer to the elements indicated in the inserted graphics.

WARNING

Shock hazard

Before opening the housing, make sure that the instrument is switched off and disconnected from all power supplies.

Read all safety instructions at the beginning of this manual carefully!

NOTICE

Plastic parts should be treated with a suitable antistatic solution. Fluid must not enter the instrument.

Do not use other cleansing agents as they may adversely affect the plastic or lacquered surfaces.

Dirt can be removed from housing, handle, all metal and plastic parts using a cloth moistened with water and 1 % detergent.

4.1 Functional Description

This chapter describes the electrical operation of the RTM to the module level, please refer to the block diagram provided as a cross reference.

The RTM2xxx series are two and four channel oscilloscopes, featuring sampling rates up 2.5 GSa/s with a memory depth of 10 MByte for each channel and 5 GSa/s with 20 MByte in interlace mode.

The oscilloscope is equipped with 8.4" XGA TFT colour display, an extra DVI-D monitor can be connected via the DVI-D interface on rear panel of the oscilloscope.

The oscilloscope has a wide range power supply from 105 to 253 V. There is hence no line voltage selector. The line fuse is accessible on the rear panel and part of the line input connector.

The oscilloscope has self-alignment function, so after module exchange no extra manual adjustments nor are equipment's for adjustment needed.

The RTM2xxx series comprises of the following modules:

- Frontend
- Mainboard
- Front controller
- Key PCB
- Power supply
- 8.4" XGA TFT display
- Interface card

Two types of interface cards can be installed to the slot on the rear panel:

- USB and Ethernet card for networking (default)
- IEEE-488 GPIB card for remote control (option)

These modules of the R&S RTM family are described in detail in the next sections.

The numbers in the boxes () refer to the block circuit diagram at the end of this document. In each module, the numbers start at 1 and are incremented.

4.1.1 Frontend

The frontend is the analog part of the R&S RTM oscilloscope.

In the frontend, the signal passes from the BNC connector at the input channel through the various stages of the amplifier to the analog-digital converter for signal acquisition on the mainboard.

The individual components in the block diagram are described here:

(The external trigger comprising components , ,  is described in connection with the trigger unit, see [External trigger](#) on page 52.)

CH1/2 (3/4)

R&S RTM2xx4 provide 4 channels at the frontend, while R&S RTM2xx2 provide 2 channels. Every channel has an input impedance of 1 MOhm or 50 Ohm.

50 Ohm termination

If the channels use the 50 Ohm impedance, a 50 Ohm termination is switched to the signal path. The 50 Ohm termination is protected against overload .

Overload protection

In case the 50 Ohm termination is overloaded, it is disconnected, the impedance of the input switches back to 1 MOhm and an error message is displayed on the TFT display.

AC/DC

The AC/DC is used to switch the input coupling.

Signal attenuation ⁷

For signal attenuation, a divider with the divider ratios of 1:1, 10:1, 100:1 (0dB / 20dB / 40dB attenuation) is used. The setting of the divider depends on the selected input sensitivity. The adjustment is done by Silicon Tuning Diodes.

Majuro 2 ⁸

The “Majuro 2” is an integrated buffer amplifier with various stages of Variable Gain Amplifier (VGA) and an input selector with 0 dB, 10 dB and 20 dB preamplifier to scale the input signal.

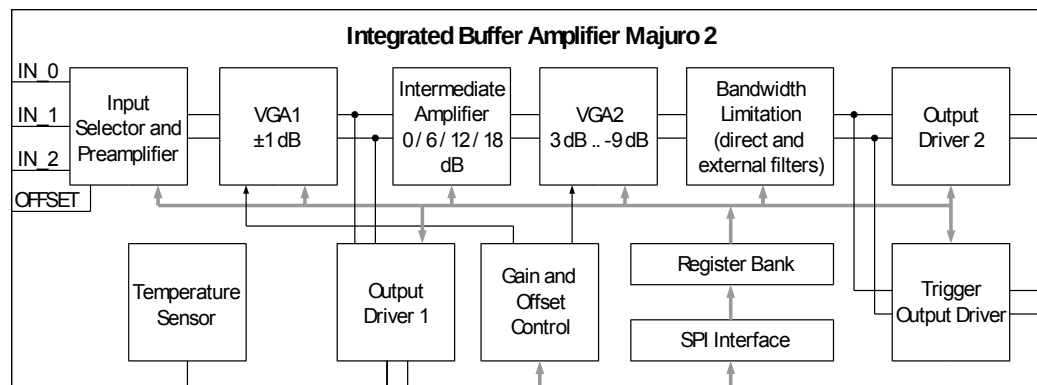


Figure 4-1: Block diagram of Majuro 2

The Majuro comprises the following modules:

Input selector and preamplifier

An input selector and preamplifier is placed at the front of the Majuro 2 to select the signal inputs. The following inputs are available:

- Direct input
- Input for divider ratio 10:1 (20dB)
- Input for divider ratio 100:1 (40dB)
- Input for offset position

The selected signal is routed to VGA1.

VGA1 (Variable Gain Amplifier 1)

The VGA1 is the correction amplifier, it is used to adjust preamplifier gain to DC control ⁹ and compensate temperature.

Intermediate amplifier

The switchable intermediate amplifier is used to implement a step gain with a fixed gain of 0 dB, 6 dB 12 dB and 18 dB.

VGA2 (Variable Gain Amplifier 2)

The VGA2 is a variable amplifier used to switch the continuous gain between the fixed steps. The input signal is then routed to the acquisition ADC on the mainboard for

digitization and to the trigger unit for triggering purposes.

A differential to single ended amplifier [8a] is used for alignment of the gain and offset.

Temperature sensor

Majuro 2 has an on-chip temperature sensor. It provides temperature gain compensation and overheating protection.

DC/Offset control [9]

The DC/Offset control can add a DC offset to the input signal and stabilizes the input amplifier.

Trigger unit [10]

The trigger unit is implemented with comparators for both A and B triggers. It has a trigger source selector at the input, where the input channels, line or external trigger signals can be selected.

- The A trigger is coupled with a filter (LF reject, HF reject, Low-pass). Various trigger types (Edge, Width, Video, Pattern) and AC/DC coupling can be switched on.
- The B trigger has DC-coupling only.

External trigger

The external trigger circuitry consists of an AC/DC [1] coupling switch, a 12 dB attenuator [2] for decoupling and an amplifier [3] to provide the necessary trigger level for the trigger system.

ADC [12]

The 8-channel 12-bit plus sign ADC is used during the alignment procedure and for determination the trigger level.

DAC [13]

Various types of DACs for different tasks are implemented on the frontend:

- 16-bit / 4 channels DAC
Provide voltages for position and offset. The voltage is to be added to input channels and the reference source for self-alignment
- 8-bit / 24 channels DAC
Provide the control voltages for amplifiers on Majuro 2
- 12-bit / 2 channels DAC
Generate differential voltages for trigger level A and B.

CCU [14]

The central control unit (CCU) is a programmable logic device (CPLD). It mainly consists of a chain of shift registers. It is connected via an SPI interface to the microcontroller of the oscilloscope.

The SPI interface to the microcontroller is bidirectional, so that the microcontroller can control the frontend, but can also read data from the ADC [12] and status information from the PLD. It contains the logic for the TV-Trigger and the TV line counter.

Serial flash [15]

Serial flash [15] is a storage for alignment and correction values of the frontend.

4.1.2 Mainboard

The mainboard is used to convert the analog signals from the frontend, process the signals and control the oscilloscope. The mainboard displays the signal and controls the other modules.

The mainboard has an interface to the front controller board, the frontend board, the Interface Board (USB and Ethernet card or GPIB card available as an option), the two Logic-Pods, the TFT-LC display, the DVI-D interface, USB interface on rear panel and via USB hub on the front controller for mass storage and active probes.

The following main components of the mainboard are described in the next sections.

- CPU (Blackfin embedded processor) [9]
- acquisition FPGA [7]
- bus controller FPGA [10] with built-in graphic controller
- USB host controller [17]
- various types of memories [8], [11], [13], [14], [19]

Additional components are described at the end of this chapter.

Memories

- SDR-SDRAM [14]

The SDR-SDRAM serves as working memory for the Blackfin embedded processor.

The memory has a 32-bit wide data bus.

- DDR2-SDRAM [11]

The DDR2-SDRAMs, serves as video memory for the graphics controller implemented in FPGA [10], it is connected to the external 16-bit memory bus of the FPGA [10].

- Parallel flash [13]

The parallel flash is used to store the firmware. It has a boot block protection and a 16-bit wide data bus. Also the backup copy of the correction values is stored in the parallel flash. Furthermore, the internal file system is contained in the flash. It is used to store the help files as well as user data such as device settings, references, masks, waveforms and equation sets. The flash is connected to the data bus of the Blackfin embedded processor [9].

- NVRAM [19]

The non-volatile serial FRAM is used to store correction values and current device settings.

The data bus and control bus are connected via SPI interface to the FPGA [10](#).

- **RTC [20](#)**

The RTC with backup battery provides the system time and communicates via an SPI interface of the FPGA [10](#) to the CPU. In addition, the power-on reset is realized via the RTC.

CPU [9](#)

The CPU is a 32-bit Blackfin embedded processor. It configures the two FPGAs on the mainboard.

This microprocessor provides the (normally 32-bit wide) external data bus and, additionally, two Parallel Peripheral Interfaces (PPI). The PPIs work simultaneously with the data bus and relieve these substantially.

The PPIs are 16 bit wide interfaces. One is used to read the data from acquisition, the other one writes data to the display controller in the bus control FPGA [10](#). The data bus connects the SDRAM, flash memory, the USB host controller and the bus controller FPGA.

FPGA [10](#)

The FPGA is a bus controller with a built-in graphic controller.

The architecture of this FPGA makes data transmission between different bus systems possible and it implements the necessary bus protocols.

The FPGA has the following interfaces:

- Bus interface to acquisition FPGA
- Bus interface for graphics
- Data bus interface to Blackfin embedded processor
- Two compatible parallel interfaces to the Blackfin's PPI
- SPI interfaces to the front controller, frontend, high-speed ADCs and serial NVRAM and RTC
- Serial interface to the external Interface Card
- Provides PWM signal to control both Fans via PWM to DC [30](#)
- Measures FAN RPM for each Fan separately

Furthermore, the FPGA includes a separate graphics controller with external DDR2 SDRAM.

The TFT-LC display is directly controlled via LVDS. And the FPGA provides the DVI-D signals via DVI-driver to the external monitor.

USB controller [17](#)

A USB host controller is used which is connected via the external data bus to the Blackfin processor.

One host ports is used for mass storage and a printer at the rear panel. The second host port is used for mass storage and active probe control via USB hub on the front controller.

High speed ADC [3](#), [4](#)

The 8-bit high-speed ADC has a sampling rate of 2.5 GHz per channel (CH1 to CH4).

The ADC has four cores with a sampling rate of 1.25 GHz.

Each channel uses 2 cores in interlace mode.

The digitized data is routed to the acquisition FPGA via a DDR LVDS interface.

Acquisition FPGA [7](#)

The main functions of the FPGA are:

- To receive the incoming digitized data from the ADC
- To receive the incoming data from the two Logic Pods
- To perform digital signal processing and store the data in the acquisition memory
- To allocate the processed data for data polling to the bus controller FPGA [9](#)

Acquisition memory [8](#)

The acquisition memory is a DDR3 SDRAM with a common interface and is used to store the sampling data.

ADC sampling clock generation [5](#)

A PLL based synthesizer generates the sampling clock for the two high-speed ADCs.

A TCXO is used as a reference clock.

Timing [6](#)

A time measurement circuit is required for timing interpolation of the time records.

Power supply [24](#)

Generates the required supply voltages for on-board digital circuitries (e.g. CPU, FPGAs and RAMs...)

Provides overcurrent protection for rear USB port and Logic Pods.

Standby Power supply [27](#)

It provides standby voltages to the front controller.

System temperature sensor [25](#)

A permanent temperature monitoring circuitry prevents the instrument from overheating and eventually damaging the mainboard.

A temperature alert results in shutdown of the standby power [27](#). Thus, the power on the control signal from the front panel to the standby power supply is disconnected.

PWM to DC 30

It generates the DC voltage for both Fans controlled via PWM signal by the FPGA 10

4.1.3 Front Unit

The front controller is the main user control interface. Together with the keyboard matrix 3, 6 rotary encoders 4 and the key PCB it enables data entry, setting up the oscilloscope and menu and softkey navigation. All functions of this unit and the communication with the instrument are controlled by a microcontroller Z8. The front controller also controls the operating states of the oscilloscope “Standby” and “Operate” 10.

The supply voltages for the active probes are also switched to the front controller. In addition, the probe connectors provide the required operation voltage for R&S RT-ZCxxB current probes. Due to power limitation, a maximum of 3 current probes can be operated at the same time.

In addition, the front unit comprises the following components:

- On-board USB hub 5: automatic active probe detection and support
- Front panel LEDs 2: illuminate the keys with brightness control and color mixing 9
- Beeper 8: provides an acoustic response to user input
- Front controller: provides the test signals 7 for probe adjustment and a USB host interface 1 on the front panel

4.1.4 Power Supply

The power supply consists of an industrial SPS module XL160-1ATX and a power interface board.

SPS module

The SPS module supplies the basic supply voltages of 3.3V, 5V, 12V, -12V and the 5V standby for the instrument.

Power interface board

The power interface board loops through the DVI-D 5 and USB 6 host lines from the mainboard to the interface connectors on the rear panel to connect an external DVI-D monitor. A BNC jack 11 with a pertinent buffer provides the TRIGGER OUT signal or the reference frequency from the acquisition ADC on the mainboard as output. The supply voltages distributed to the boards are extra short-circuit protected by SMD-fuses 1 on the power interface board.

The power interface board comprises the following components:

- DC/DC converters: generate additional -5V 2 and a second 5V 3 supply
- SEPIC converter 11: 12 V supply for current probes
- Line Trigger generator 4

4.1.5 USB and Ethernet Interface Card

Two types of interface cards can be installed to the slot on rear panel:

- By default an Ethernet and USB (client) interface is installed in the option slot on the back of the R&S RTM.
- This can be exchanged against a GPIB card, which is available as an option.

4.2 Opening and Completing the Instrument

⚠ WARNING

Shock hazard

Before opening the housing, make sure that the instrument is switched off and disconnected from all power supplies.

Read all safety instructions at the beginning of this manual carefully!

NOTICE

Risk of electrostatic discharge

Protect the work area against electrostatic discharge to avoid damage to electronic components in the modules. For details, refer to the safety instructions at the beginning of this manual.

4.2.1 Removing and Replacing the Housing

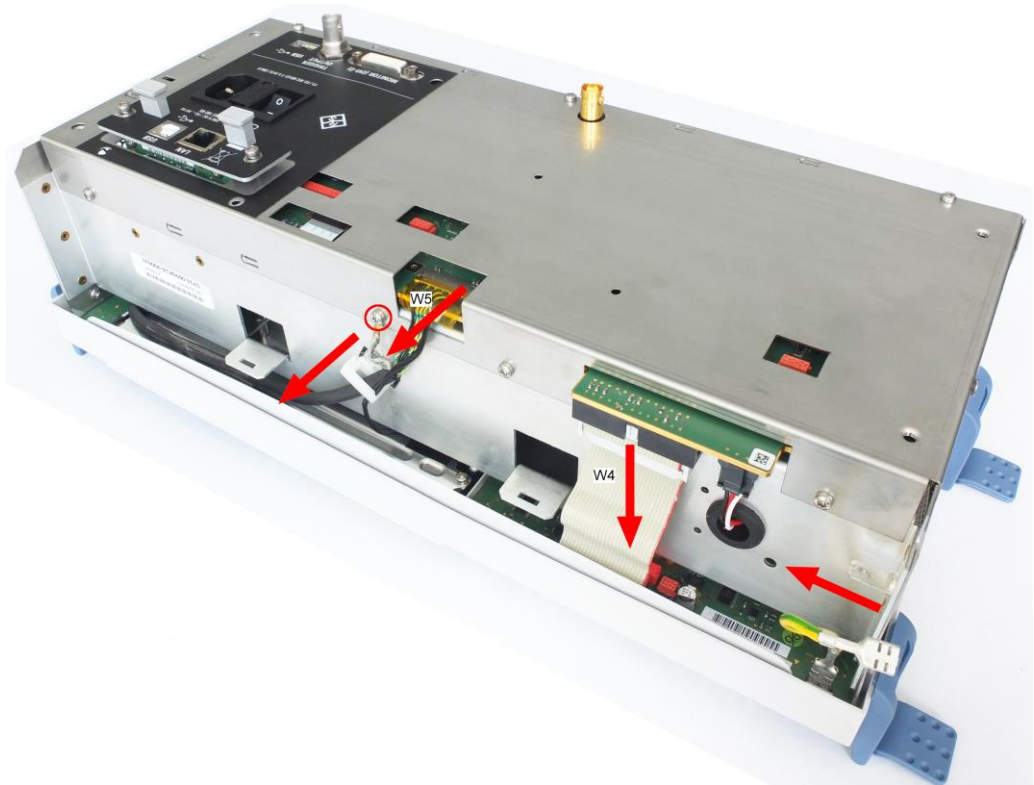


Figure 4-2: Removing the Housing

1. Place the instrument face down on the workbench.
2. Remove the two instrument feet screws using a TORX T20 screwdriver.
3. Slip the instrument feet to the rear and remove them from the housing.
4. Unscrew the 4 screws on the rear, which secure the housing to the base unit of the instrument, using a TORX T20 screwdriver.
5. Gently slide off the housing from the instrument in a vertical direction.
6. Reverse this procedure to reinstall the housing.

4.2.2 Removing and Replacing the Front Unit and the Base Unit

1. Remove the housing as described above. (See [4.2.1](#))

**Figure 4-3: Removing the Front Unit**

2. Remove the four decorative covers, unscrew the screws and pull off the instrument bumpers.
3. Place the R&S RTM face down on the workbench very gently to avoid damage to the BNC connectors and rotary knobs.
4. Unplug the ribbon cable W4, which leads from the mainboard to the front unit.
5. Unscrew the metal grounding from W5
6. Release the cable W5 from the cable clamp and unplug it.

7. Use flat pliers to disconnect the grounding cable that leads from the base unit to the front unit.
8. Gently lift off the base unit from the front unit.
9. Reverse this procedure to reinstall the front unit.

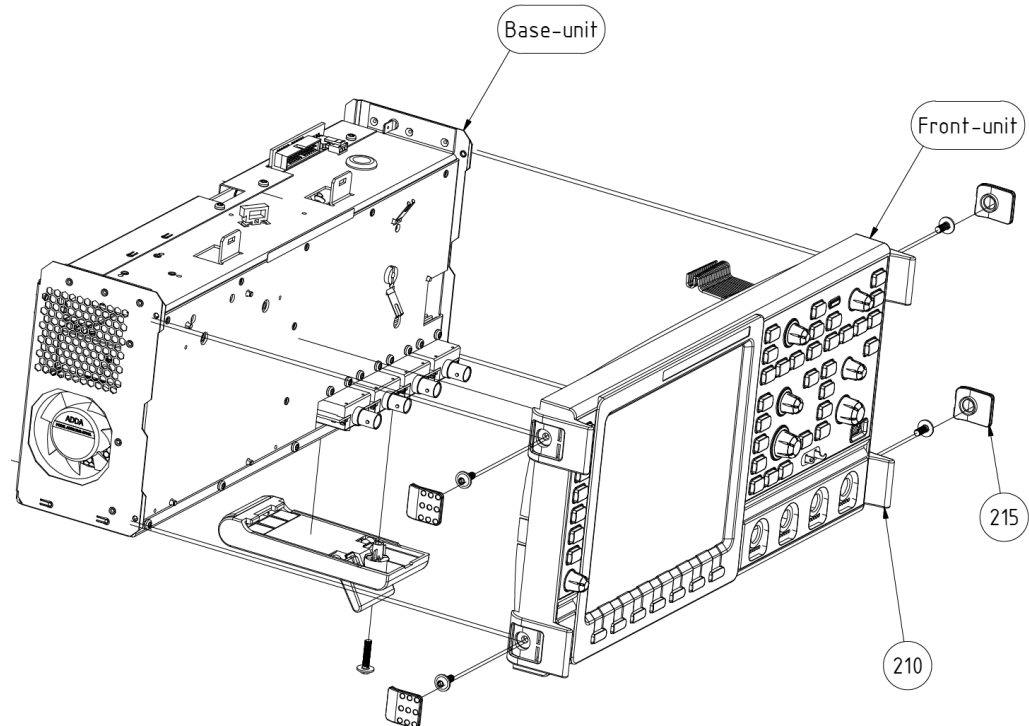


Figure 4-4: Removing the Front and Base Units

4.3 Module Replacement

⚠ WARNING

Danger of injury during module replacement

Any adjustments, replacement of parts, maintenance or repair must be carried out exclusively by technical personnel authorized by Rohde & Schwarz.

Observe the safety instructions for units with a removable housing.

Follow the step-by-step instructions for module replacement carefully to avoid injury and to help ensure safe operation.

4.3.1 Replacing the Front Controller Board

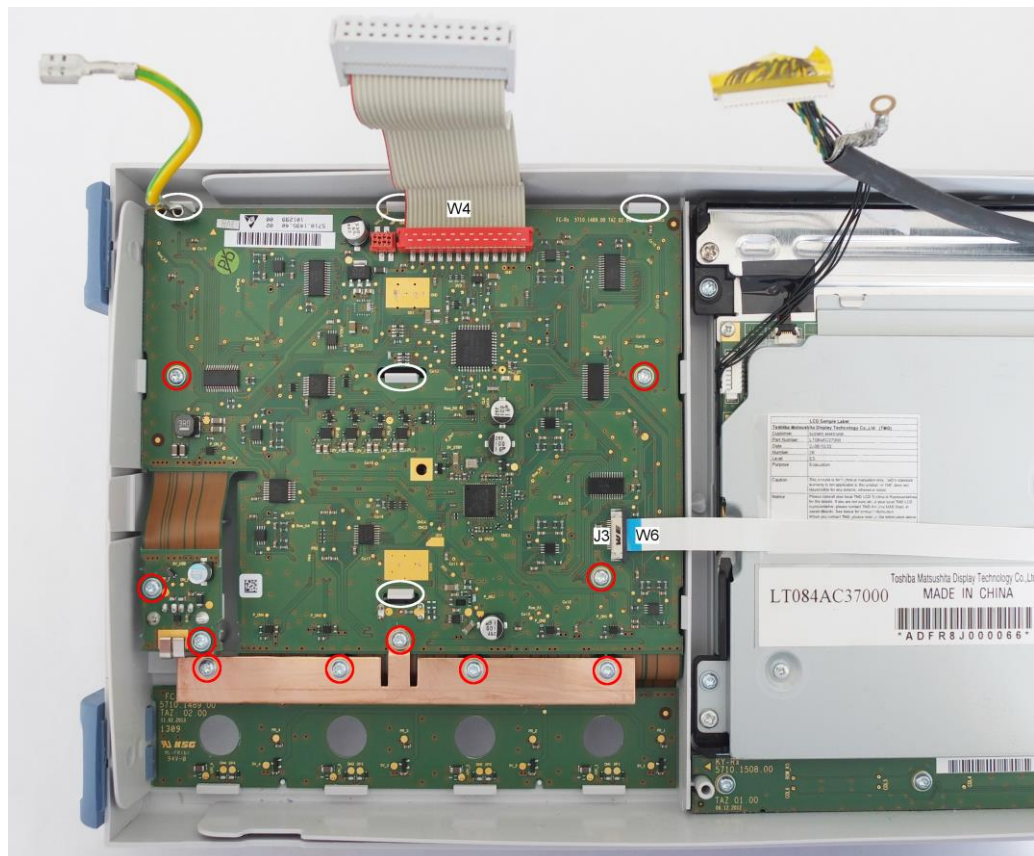
NOTICE

Risk of damaging the front unit boards

A screw driver with a TORX T9 blade is required to unscrew the front controller board, the TFT display and the key PCB board from the front unit.

When these components are screwed onto the front unit, the torque must be limited to 0.3 Nm. Otherwise there is a risk of damage to the boards.

1. Remove the housing and the front unit as described above (see [4.2.1](#) and [4.2.2](#)).



2. Use a T9 TORX blade screwdriver to remove the screws that secure the front controller board and the metal bracket to the front unit.
3. Unlatch the socket J3 and remove the flex ribbon cable W6 from the front controller board.
4. Remove the ribbon cable W4 from the socket J1 on the front controller.
5. Flip the front unit over to access the rotary knobs at the front.

6. Gently pull off the six rotary knobs from the front
7. Flip the front unit over to the back to access the PCB boards.
8. Unlatch 8 PCB latches with a flat blade driver to release the front controller board from the plastics part of the front unit. First release the latches on the right upper corner next to the TFT display.

It is recommended to carefully push a pair of V-shaped tweezers as a wedge between the PCB board and the plastics frame.

Unlatch the rest of the latches from right to left.

9. Carefully lift the front controller board and remove it from the front unit.
10. Insert a new front controller board and push it down until it clicks under the latches. Ensure that all latches snap over the PCB.
11. Reverse steps 1...7 to complete and reinstall the front unit.

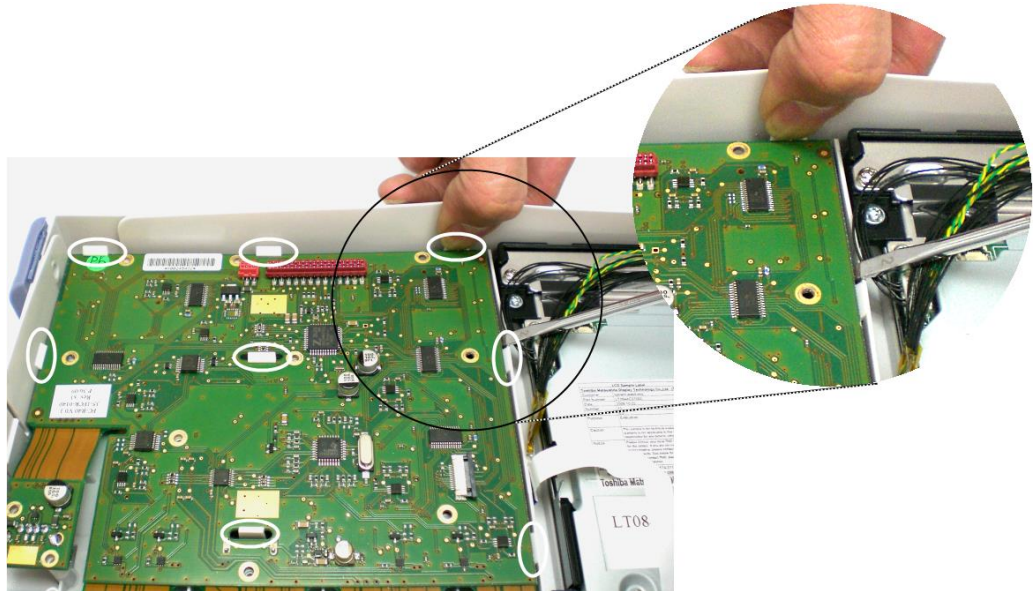


Figure 4-5: Removing the Front Controller Board from the Front Unit



Figure 4-6: Removing the Rotary Knobs from the Front Unit

4.3.2 Replacing the Key PCB

1. Remove the housing and the front unit as described in [4.2.1](#) and [4.2.2](#).
 2. Gently pull off the intensity rotary knob at the front of the front unit.
 3. Unlatch socket J3 and unplug the flex ribbon cable W6
 4. Remove the cable W2 from the display unit.
 5. Unscrew the screws securing the key PCB to the front unit with a TORX T9 screwdriver.
 6. First lift the key PCB on the side with no latch.
 7. Then use a flat blade screwdriver to unlatch the PCB latches and release the key PCB from the front unit.
- For easier unlatching it is recommended to carefully push a pair of V-shaped tweezers as a wedge between the key PCB and the front unit plastics.
8. Press the intensity rotary encoder from the front to separate the key PCB from the front unit.
 9. Insert a new key PCB and push it down until it clicks under the latches. Ensure all latches snap over the PCB.
 10. Reverse this procedure to reinstall the key PCB board.

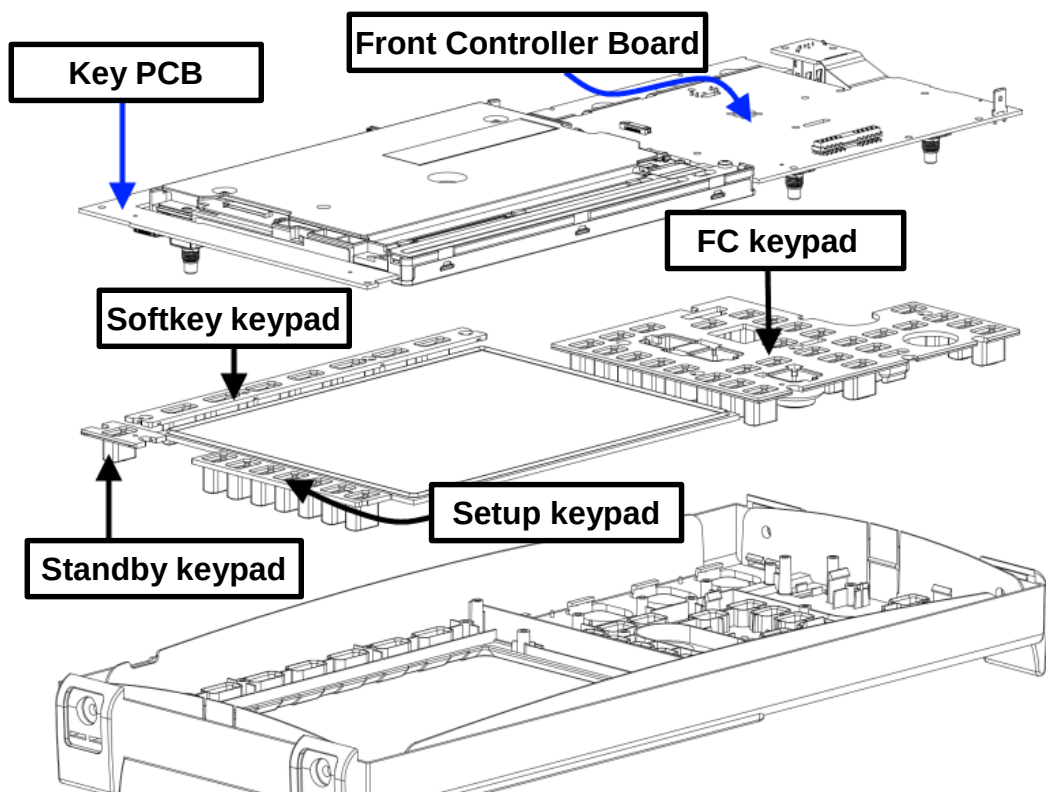


Figure 4-7: Removing the Key PCB from the Front Unit

4.3.3 Replacing the Rubber Keypad

The keypad consists of four segments. It is manufactured and delivered as one part, but needs to be separated into the four segments with a sharp knife before it can be installed.

The largest element is placed on the front controller board. The other three elements are located on the key PCB.



4.3.3.1 Replacing the Keypad located on the Front Controller Board

1. Remove the housing, the front unit and front controller board as described in [4.2.1](#), [4.2.2](#) and [4.3.1](#).
2. Lift the defective keypad from the front unit.
3. Insert a new keypad and align it
4. Reverse this procedure to reinstall the keypad.

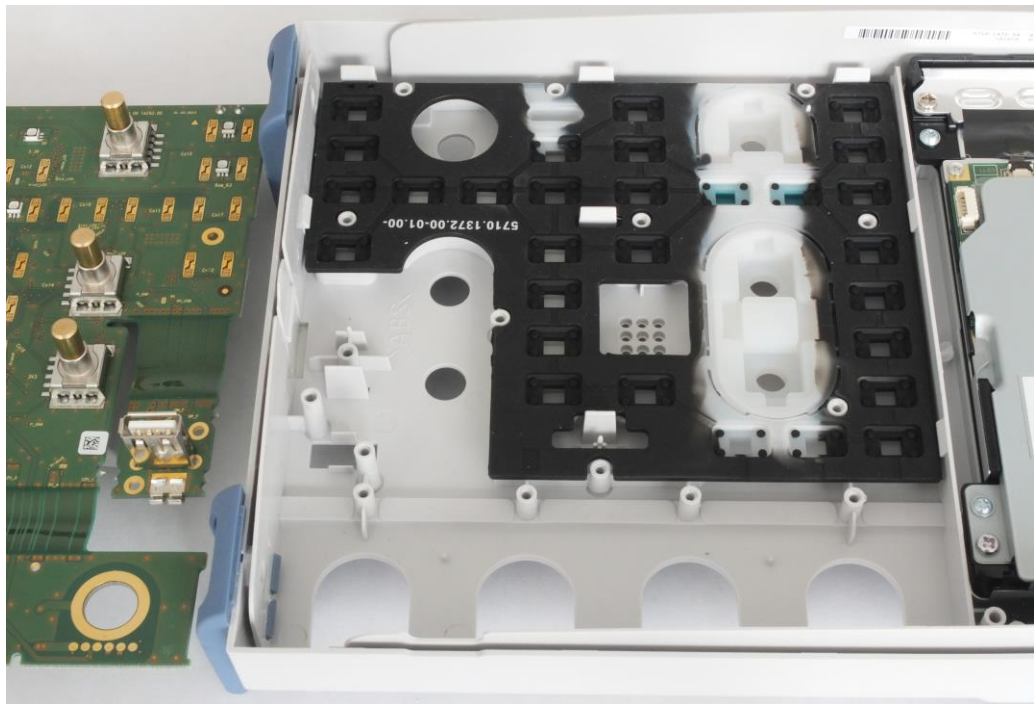


Figure 4-8: Keypad for the Front Controller Board

4.3.3.2 Replacing the Keypads located on the Key PCB

1. Remove the case, the front unit and the key PCB as described in [4.2.1](#) , [4.2.2](#) and [4.3.2](#).
2. Lift the defective keypads from the front unit.
3. Insert the new keypads and align them.
4. Reverse this procedure to complete the instrument.



Figure 4-9: Silicone Keypads under the Key PCB

4.3.4 Replacing the TFT-Display

1. Clean the TFT LC-display surface and screen from dust and fingerprints before installing them.

NOTICE**Instrument damage caused by cleaning agents**

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

Never use cleaning agents such as solvents (thinners, acetone, etc), acids, bases, or other substances. Avoid spraying liquids on the display surface. Avoid scrubbing the display with excessive force.

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

2. Remove the housing and the front unit as described in [4.2.1](#) and [4.2.2](#).
3. Unplug the display cable from the socket on the TFT display.
4. Remove all tapes that hold the ribbon cables in place.
5. Unscrew the four screws securing the display to the front unit.
6. Remove the TFT display from the front unit.
7. Clean the screen filter and insert the new display into the front unit.
8. Reverse this procedure to reinstall the TFT display.

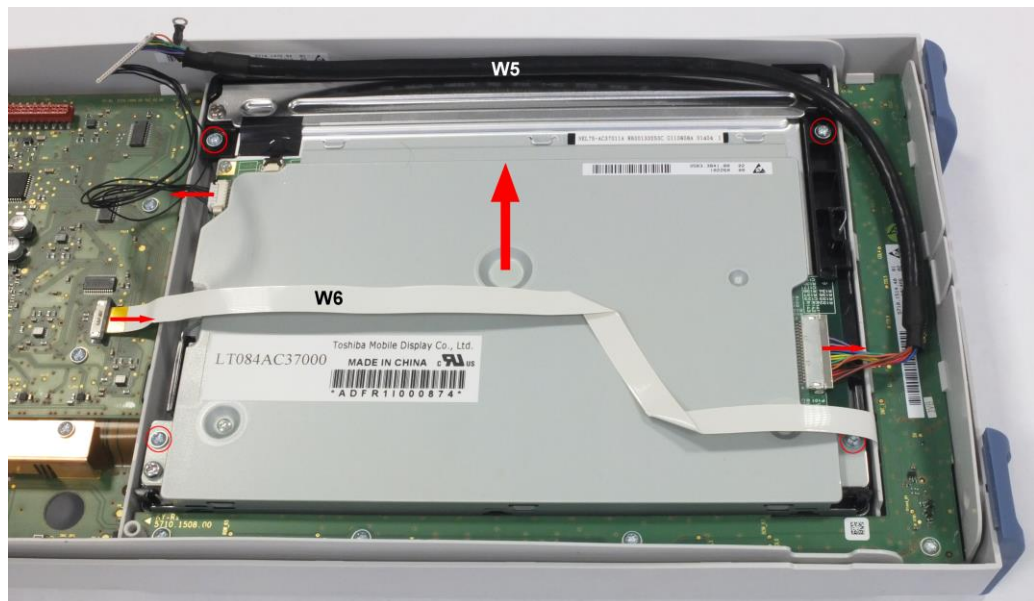


Figure 4-10: Replacing the TFT LC-Display

4.3.5 Replacing the Screen Filter

1. Clean the TFT LC-display surface and screen filter from dust and fingerprints before installing them.

NOTICE**Instrument damage caused by cleaning agents**

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

Never use cleaning agents such as solvents (thinners, acetone, etc), acids, bases, or other substances. Avoid spraying liquids on the display surface. Avoid scrubbing the display with excessive force.

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

2. Remove the housing and the front unit as described in [4.2.1](#) , [4.2.2](#).
3. Unplug the display cable from the socket on the TFT display.
4. Unscrew the four screws securing the display to the front unit.
5. Remove all tapes that hold the ribbon cables in place.
6. Remove the display from the front unit.
7. Lift off the screen filter.
8. Insert a new screen filter with sealing.
9. Clean the display surface from dust and fingerprints, remove the seal from the screen filter and insert the display in the front unit.
10. Reverse this procedure to reinstall.

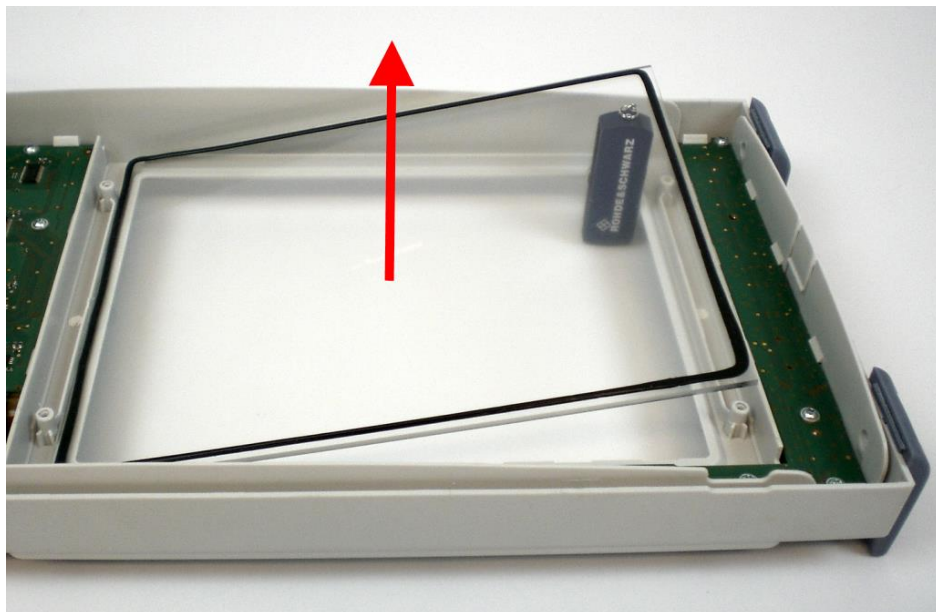


Figure 4-11: Replacing the Screen Filter

4.3.6 Replacing the Mainboard

1. Remove the housing as described in [4.2.1](#).
2. Remove the R&S RTM interface card, if installed (see [4.3.12](#)).
3. Unscrew all screws securing the rear cover to the base unit using a TORX T10 screwdriver.
4. Push the cable clip to release the W5 cable.
5. Remove the ribbon cable W4 from the mainboard to the front unit.
6. Lift off the rear cover.

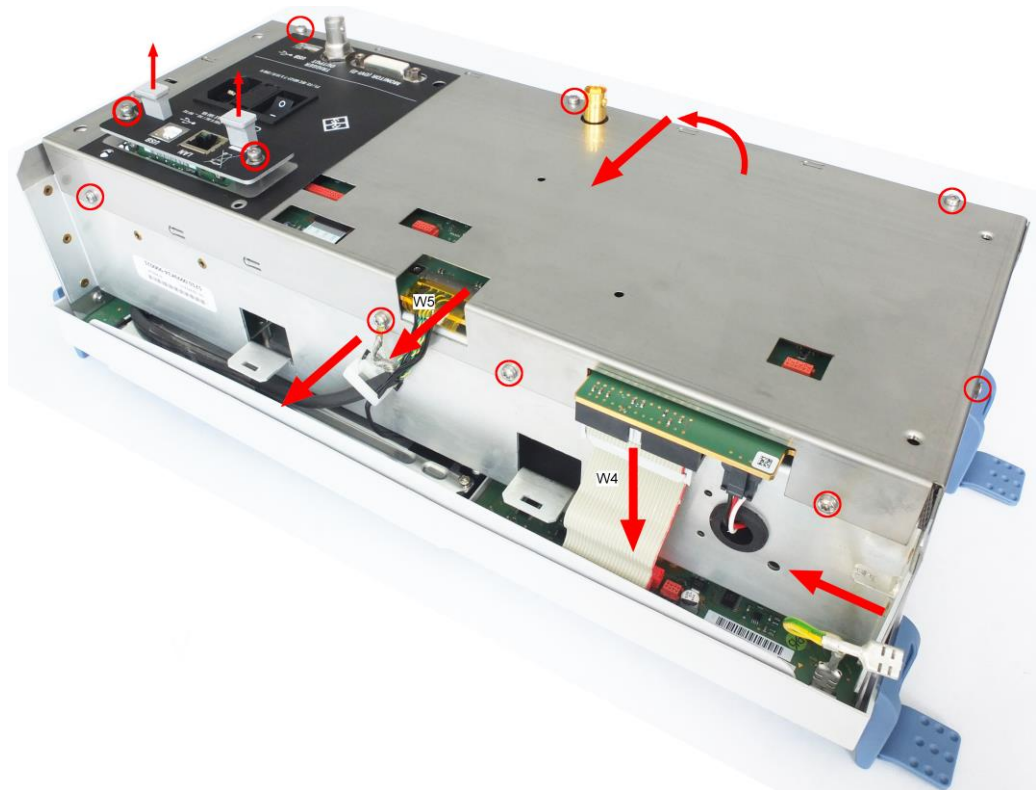


Figure 4-12: Removing the Rear Cover

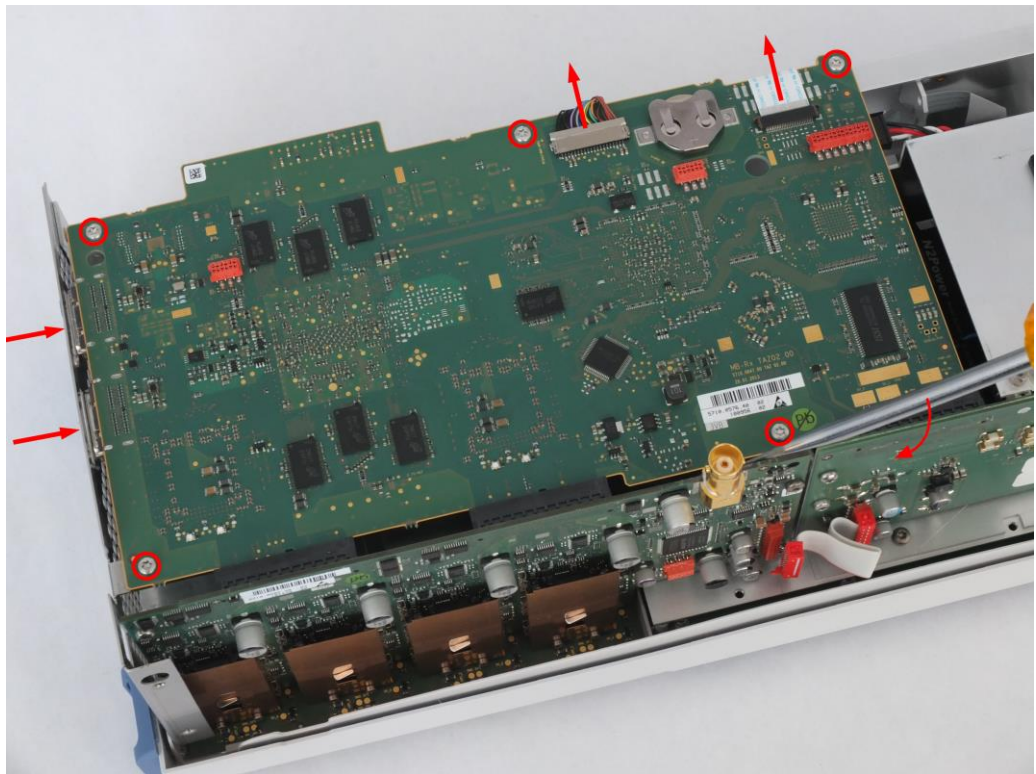


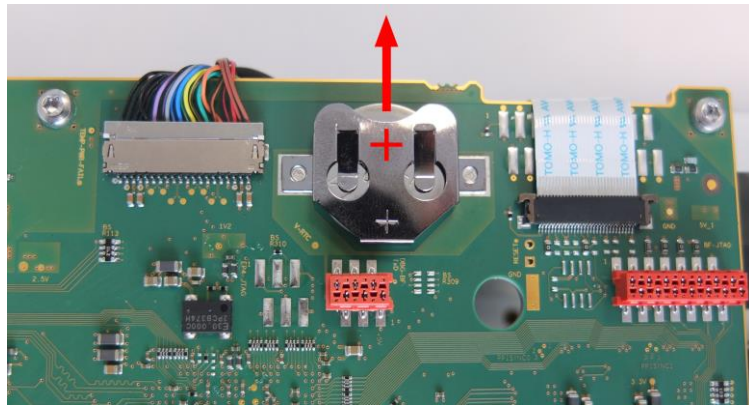
Figure 4-13: Removing the Mainboard from the Base Unit.

7. Unscrew the screws securing the mainboard to the base unit using a TORX T10 screwdriver.
8. Gently pull the mainboard from the card edge connectors and lift it from the base unit.
9. Reverse this procedure to reinstall the mainboard.

4.3.7 Replacing the Lithium Battery

1. Remove the housing as described in [4.2.1](#).
1. Access the mainboard as described in [4.3.6](#)., steps 1..6
2. Eject the lithium battery from the battery holder.
3. Insert a new lithium battery.

4. Reverse this procedure to reinstall after replacing the battery.



4.3.8 Replacing the Frontend

5. Remove the housing, the base unit and the mainboard as described in [4.2.1](#) , [4.2.2](#) and [4.3.6](#).
6. Unscrew the three screws securing the metal cover to the bottom of the base unit and remove the cover.
7. Unscrew the four/eight screws securing the input amplifier heat sink to the base unit using a TORX T10 screwdriver.

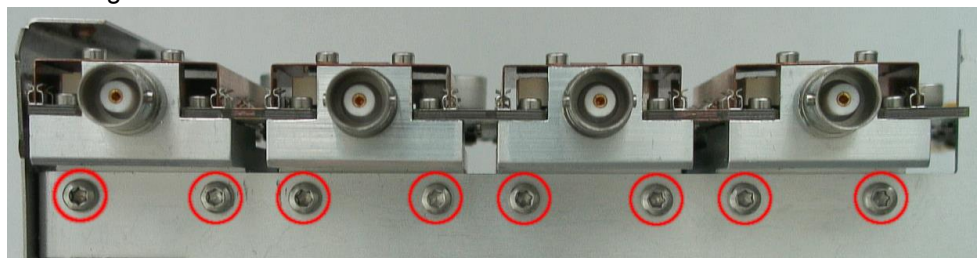


Figure 4-14: Unscrewing the Frontend from the Base Unit

8. Disconnect the ribbon cable W3, which connects J8 on the frontend to J1 on the power supply module.
9. Unscrew the three screws securing the frontend PCB to the base unit.
10. Lift off the frontend board from the base unit.
11. Insert a new frontend.
12. Reverse this procedure to install the new frontend board.

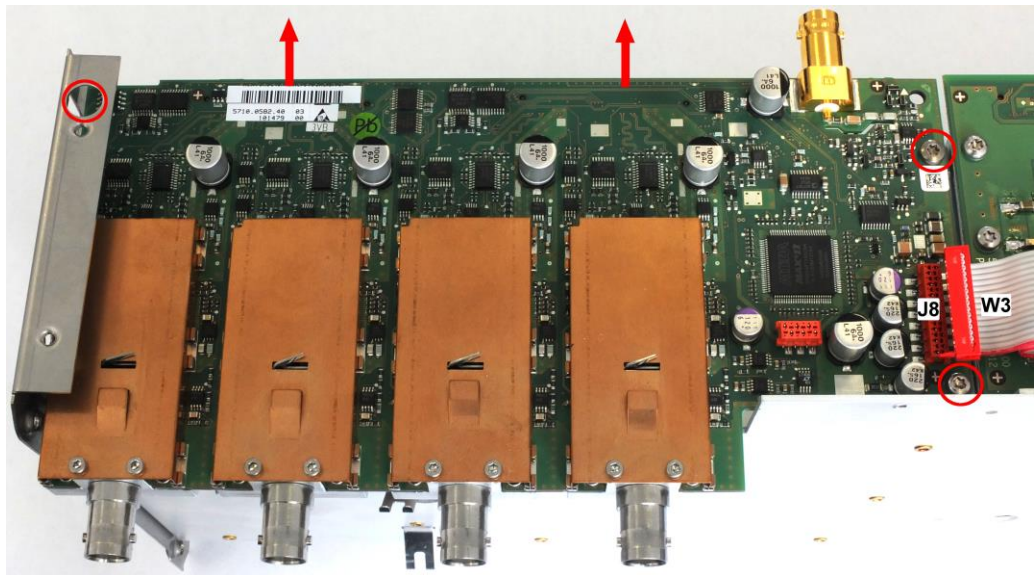


Figure 4-15: Removing the Frontend

4.3.9 Replacing the Power Supply

1. Remove the housing and the mainboard as described in [4.2.1](#) and [4.3.6](#).
2. Unscrew the three screws securing the metal cover to the bottom of the base unit and remove the cover.
3. Disconnect the ribbon cable W3, which connects J8 on the frontend to J1 on the power supply module.
4. Unplug the two fan supply cables from sockets J4 and J7 on the power supply.
5. Unscrew the four screws securing the power supply to the base unit using a TORX T10 screwdriver.
6. Slide out the power supply module at the bottom and remove it.
7. Reverse this procedure to reinstall the power supply.

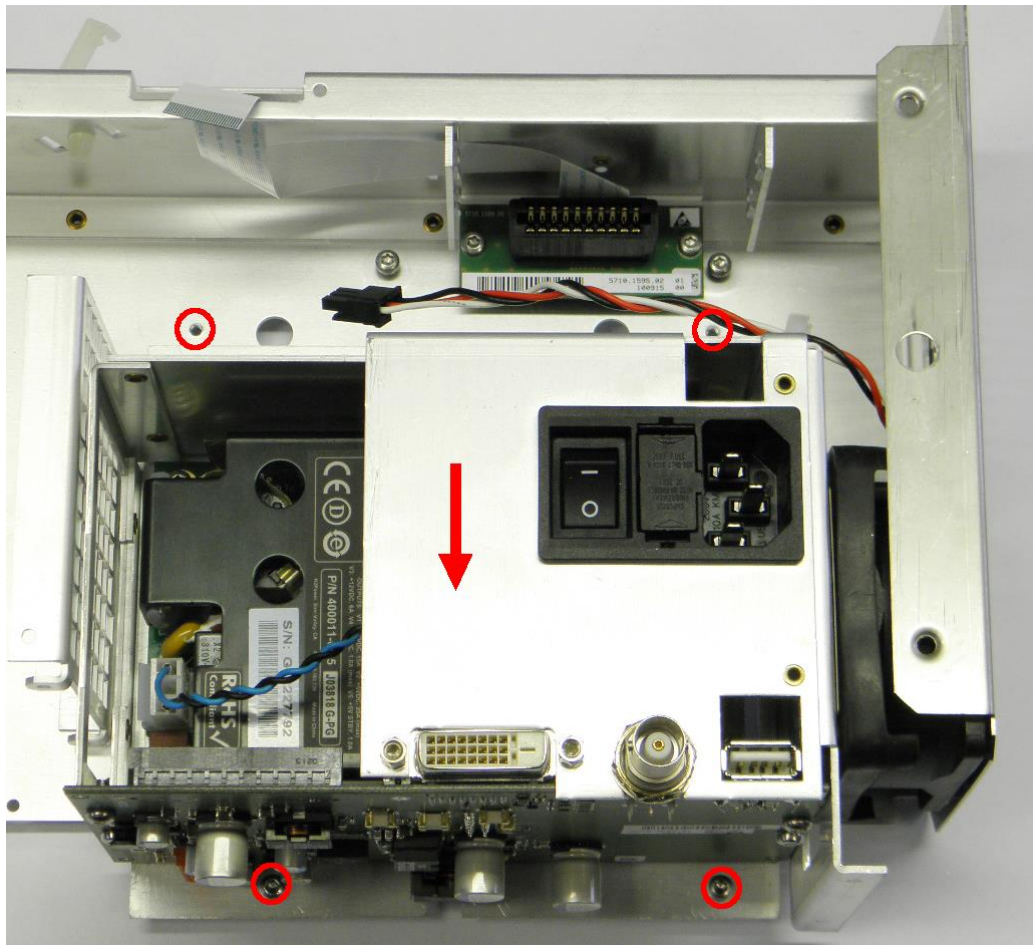


Figure 4-16: Replacing the Power Supply

4.3.10 Replacing the Power Supply Fan

1. Remove the housing, the mainboard and the power supply as described in [4.2.1](#), [4.3.6](#) and [4.3.9](#).
2. Detach the fan from the rubber noise absorber.
3. Reverse this procedure to reinstall the power supply fan.

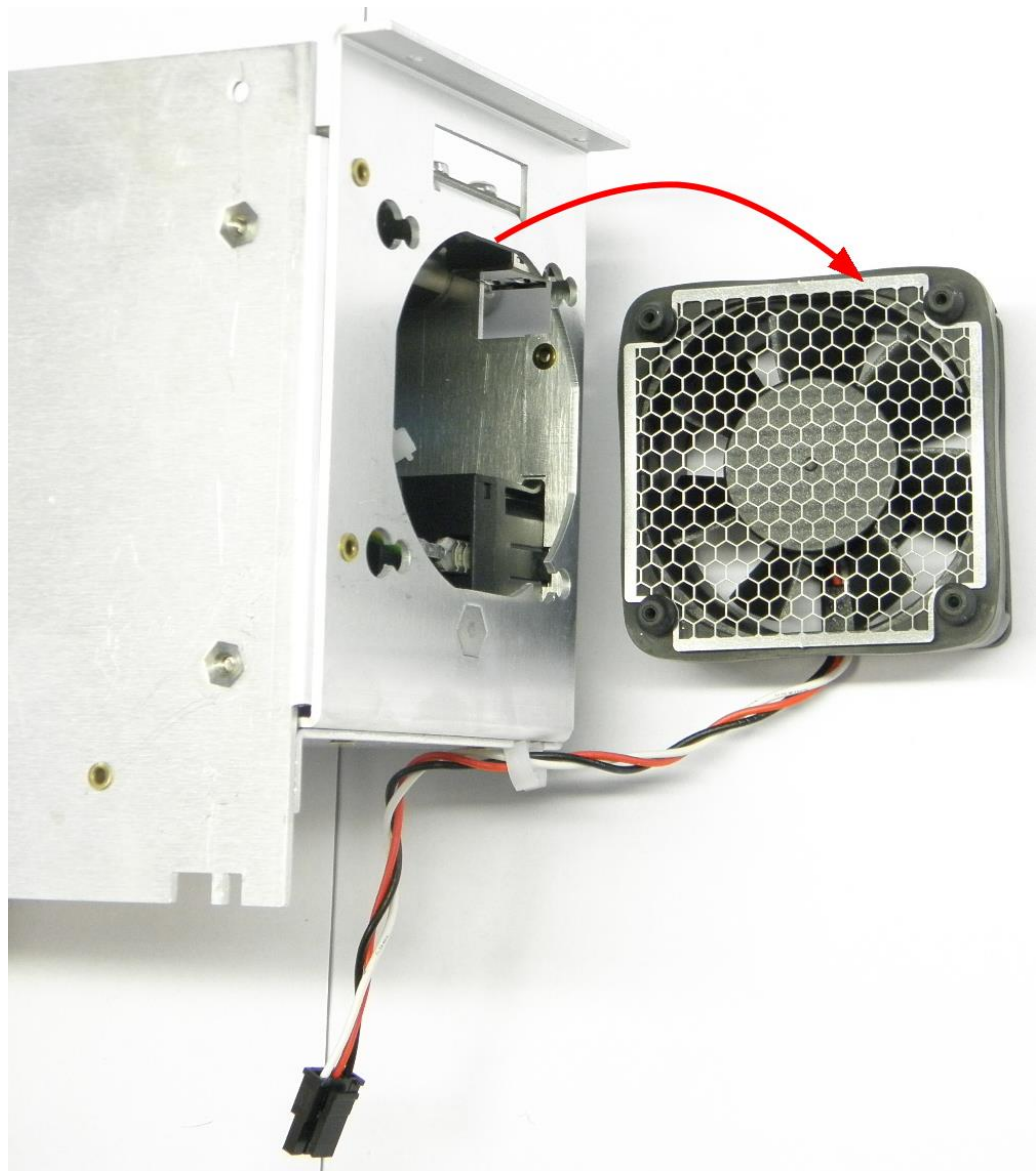


Figure 4-17: Replacing the Power Supply Fan

4.3.11 Replacing the Fan Unit

1. Remove the housing as described in [4.2.1](#).
2. Remove the R&S RTM interface card, if installed. (See [4.3.12](#))
3. Remove the mainboard as described in [4.3.6](#).
4. Unscrew the three screws securing the fan unit to the base unit.
5. Unplug the fan supply cable from J4 socket on the power supply.
6. Take off the fan unit.
7. Reverse this procedure to reinstall the fan unit.

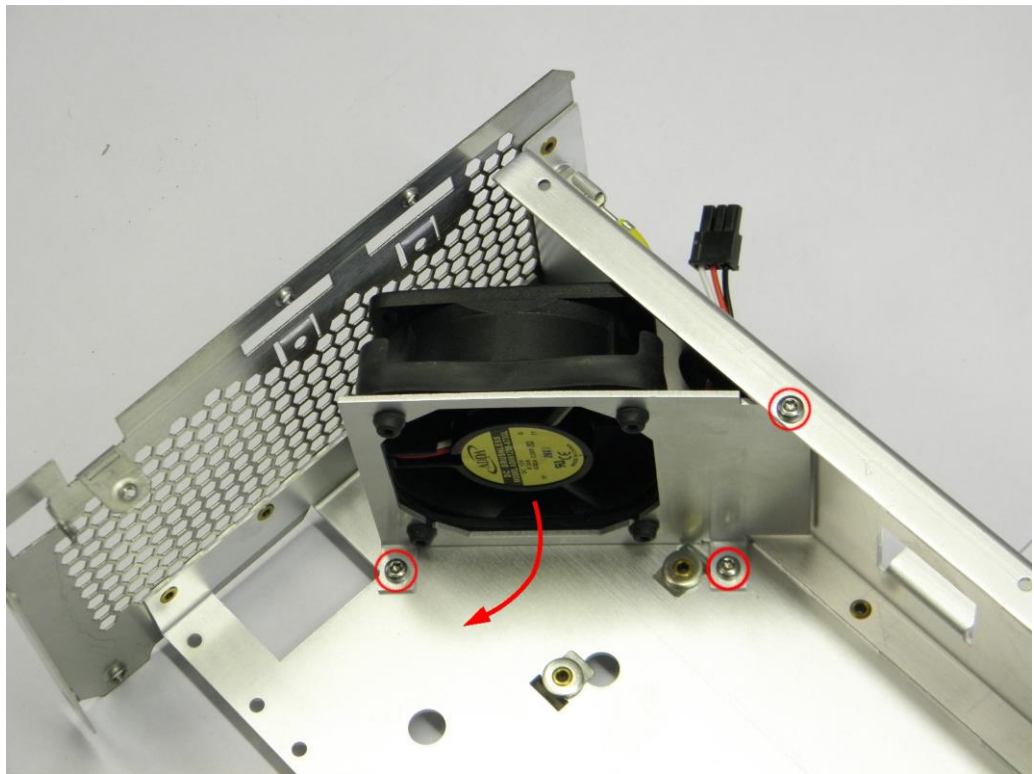


Figure 4-18: Replacing the fan unit

4.3.12 Replacing the USB & Ethernet Interface Card / GPIB Option Card

1. Unscrew the two screws securing the card to the rear panel.
2. Pull out the card.
3. Reverse the procedure to reinstall the interface option. Make sure to slide the interface card into the guide rails that are located to the left and right of the instrument's card slot. This ensures good positioning of the card edge with the connector in the instrument.

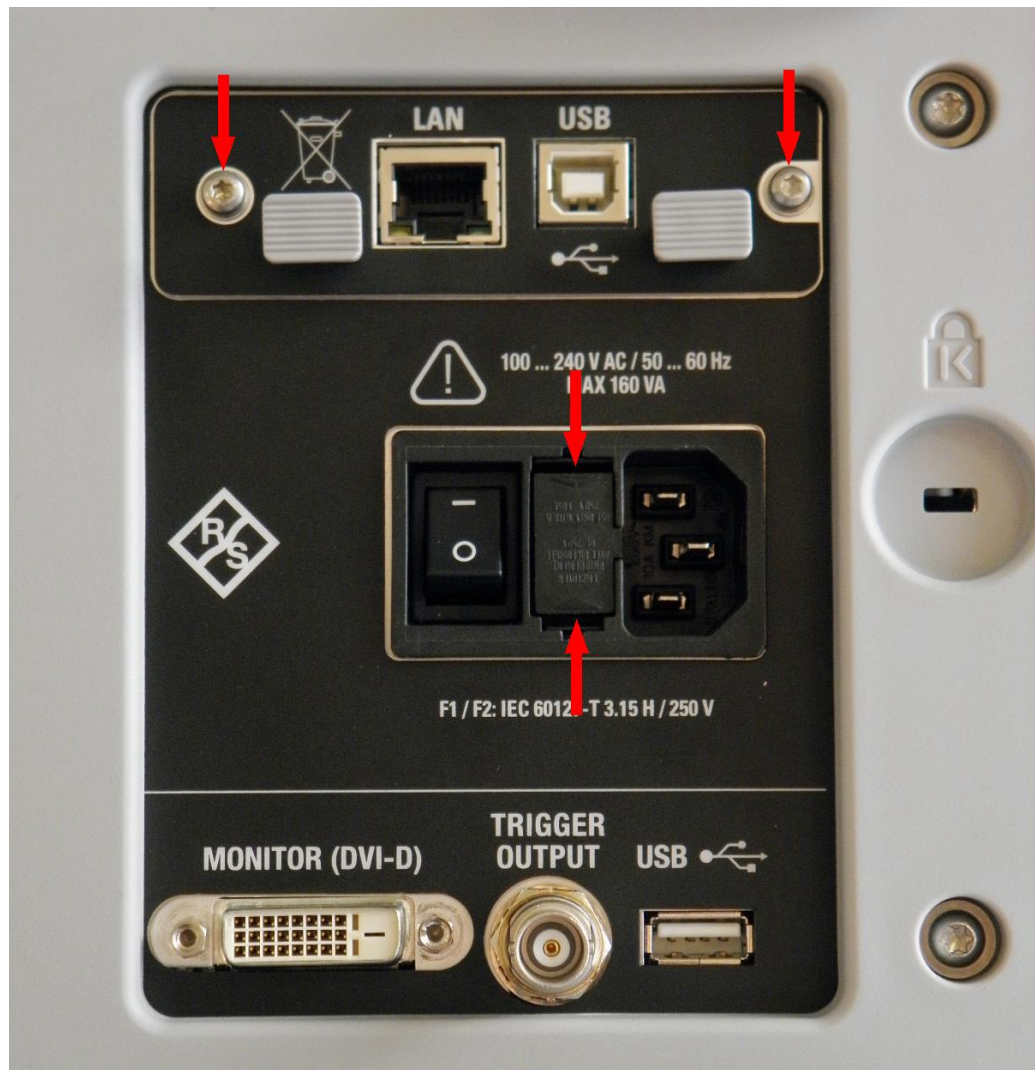


Figure 4-19: Replacing interface and line fuses

4.3.13 Replacing the Line Fuses

The instrument is protected by two fuses. The fuse holder is located on the rear panel between the main power switch and AC power supply socket.

⚠ WARNING**Shock hazard**

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

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

Type of fuses to use (see also section [6.2 Spare Parts](#) on page 91):
Size 5x20mm, 250V~, T3.15H IEC60127/V

1. Pull the fuse holder out of its slot on the power entry module.
2. Replace the defective fuse/s.
3. Insert the fuse holder carefully back in its slot until it is latched.

4.4 Troubleshooting

This chapter describes how to locate general errors, trace them down to a board level and make the instrument ready for use again by means of board replacement.

The material numbers of the replacement boards can be found in chapter [6.2 Spare Parts](#).

We recommend that the instrument be shipped to our experts in the service centers (see address list) for module replacement and further error elimination.

⚠ WARNING**Shock hazard**

Before opening the housing, make sure that the instrument is switched off and disconnected from all power supplies.

Any adjustments, replacement of parts, maintenance or repair must be carried out exclusively by technical personnel authorized by Rohde & Schwarz.

Read all safety instructions at the beginning of this manual carefully!

NOTICE**Risk of damage to the boards**

Be careful not to cause short circuits when measuring voltages at pins placed close to each other!

4.4.1 Measuring Equipment and Accessories for Troubleshooting

Item	Type of equipment	Equipment recommended	R&S-Order No.	Quantity	Equipment recommended
1	DMM	R&S URE	0350.5315.02	1	Power-on failure troubleshooting
1	DVI-D monitor			1	No display troubleshooting
1	Active probe	RT-ZS20	1410.3502	1	Active probe recognition

4.4.2 Primary Troubleshooting Procedure

The primary troubleshooting procedure helps you to determine the next step. The more detailed troubleshooting procedures destined to isolate a failure are described later.

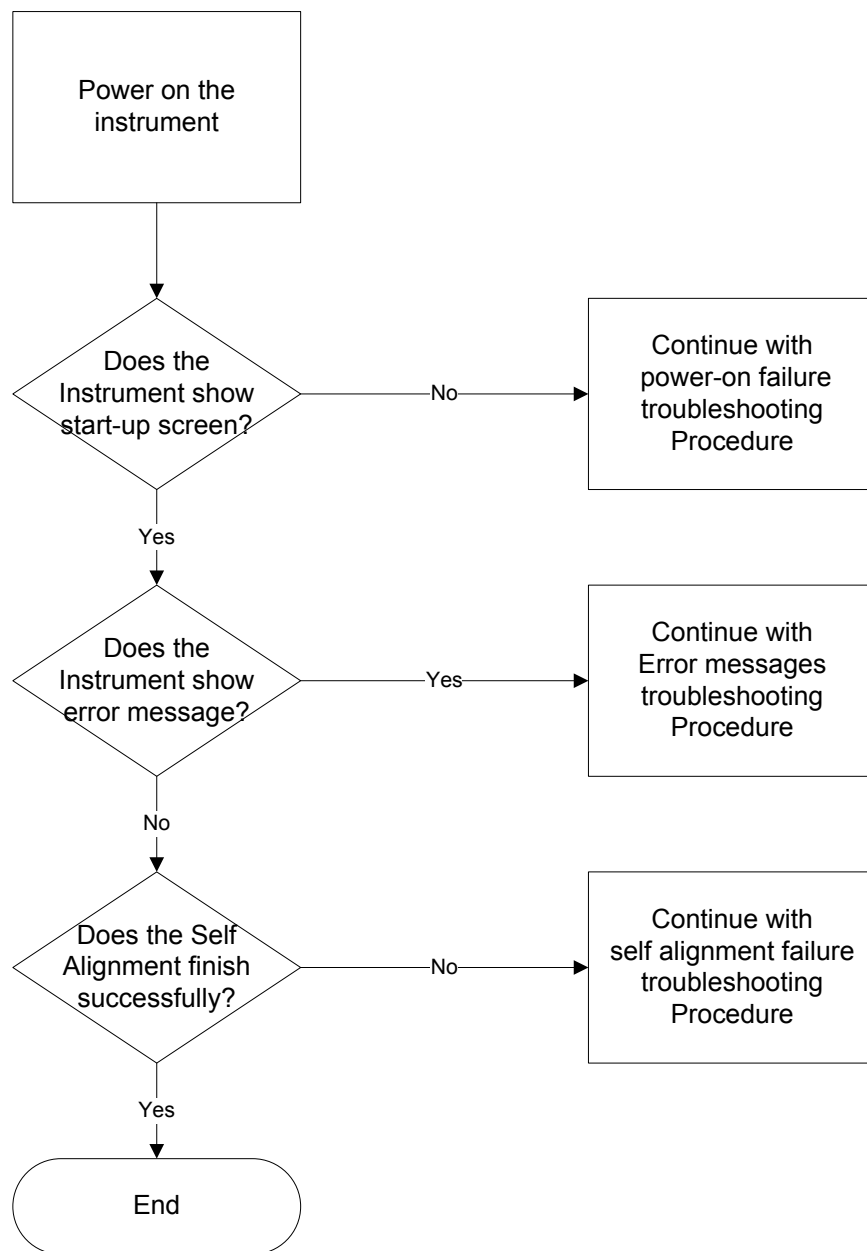


Figure 4-20: Primary troubleshooting procedure

4.4.3 Detailed Troubleshooting Procedures

4.4.3.1 Power on Failure

Problem: R&S RTM does not switch on after pressing the ON/STANDBY key

Solution: Follow the power-on troubleshooting procedures below to isolate the problem.

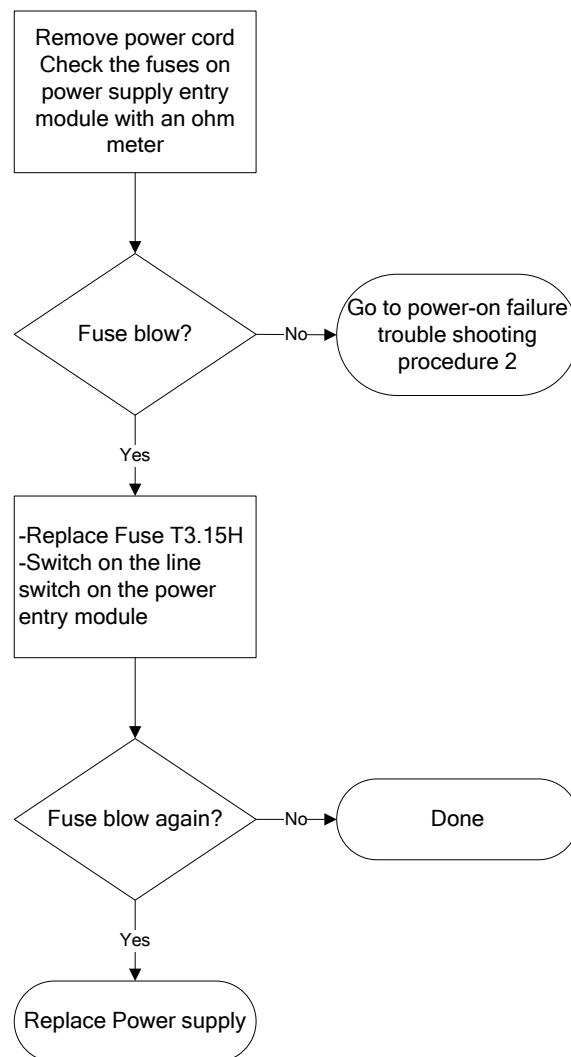


Figure 4-21: Power-on failure troubleshooting procedure 1

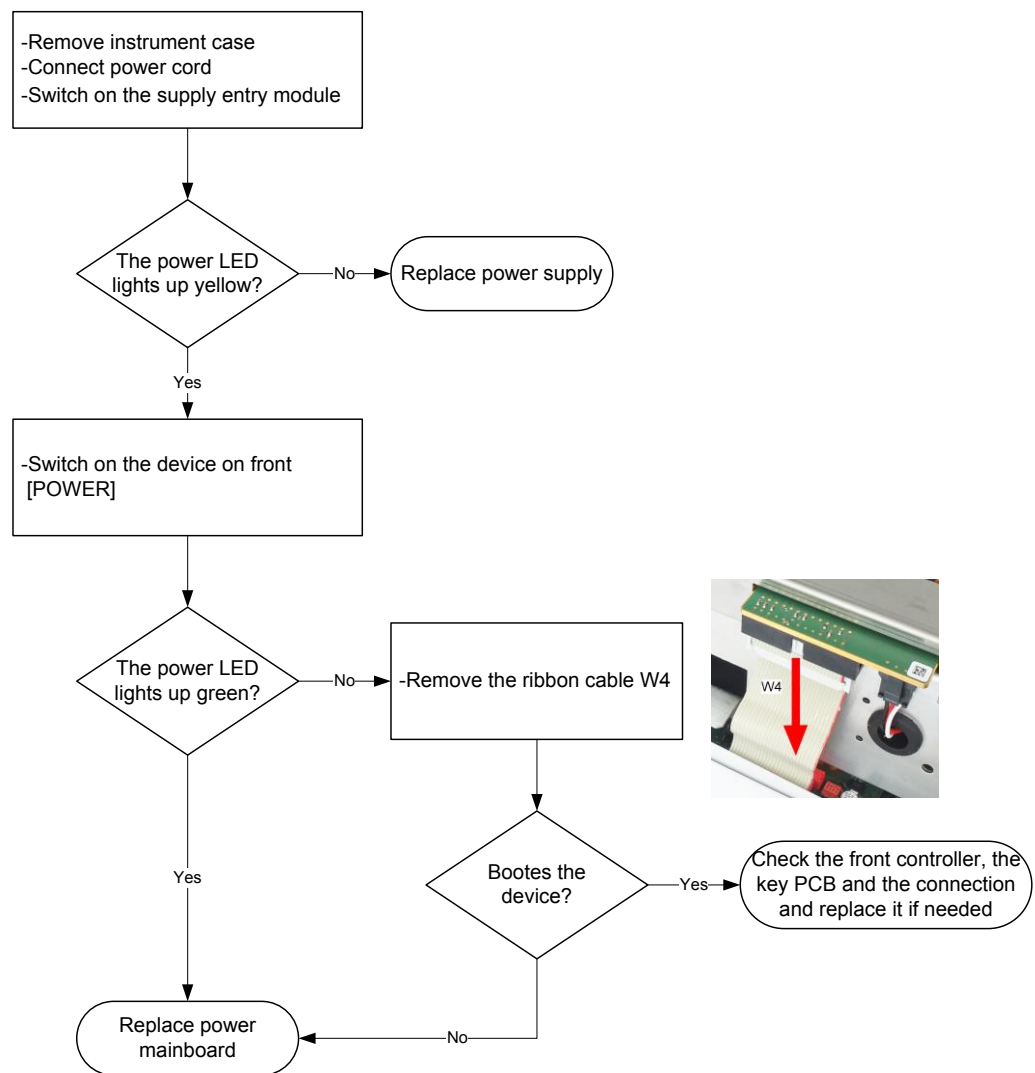


Figure 4-22: Power-on failure troubleshooting procedure 2

4.4.3.2 Error Messages

There are three categories of error messages which may appear on the display:

1. "Hardware identification error" or "Hardware does not match the device configuration"

The instrument may show this error message during application start. The problem can be an EEPROM readout error or the module has a new hardware revision, which is not recognized or supported by the installed firmware version. A firmware update is required.

2. Temperature related problems

Majuro 2 (on the frontend), the FPGAs and the ADCs (on the mainboard) have temperature sensors on the chip. A temperature sensor alert results in a warning/error message. In case of overheating (error message), the instrument is

shut down by the firmware to prevent the chip from being damaged. A reboot is possible.

An alert from the system temperature sensor (hardware on mainboard) results in a shutdown with no error message to prevent the instrument from damage. A reboot is not possible if the overheating condition still remains. Check the fans for proper ventilation to ensure a continuous airflow through the instrument and ensure the housing perforation is not covered.

3. Overvoltage condition at the input

This condition occurs if the input level exceeds the rated voltage of the 50 Ohm input. The 50 Ohm termination at the input is switched off to prevent being damaged and a warning message is shown on the display.

No.	Error Message	Description
1	Hardware Identification Error Frontend doesn't match the device configuration.	EEPROM read error or HW revision is not supported by the installed firmware.
2	Hardware Identification Error Frontend-PLD Version doesn't match the device configuration.	EEPROM read error or HW revision is not supported by the installed firmware.
3	Hardware Identification Error Front controller doesn't match the device configuration.	EEPROM read error or HW revision is not supported by the installed firmware.
4	Hardware Identification Error Mainboard doesn't match the device configuration.	EEPROM read error or HW revision is not supported by the installed firmware.
5	Warning Chip: <i>Chip</i> . ADC is too hot!	ADC's on chip temp. sensor alert.
6	Error Chip: <i>Chip</i> . Device has been switched off because of overheating.	ADC's on chip temp. sensor overheating alert.
7	Warning Chip: <i>Chip</i> . FPGA is too hot!	FPGA's on chip temp. sensor alert.
8	Error Chip: <i>Chip</i> . Device has been switched off because of overheating..	FPGA's on chip temp. sensor overheating alert.
9	Warning Channel: <i>Channel</i> . FE-Channel is too hot!	Frontend channel temp. sensor alert.
10	Error Channel: <i>Channel</i> . Device has been switched off because of overheating.	Frontend channel temp. sensor overheating alert.
11	Warning 50 Ohm has been switched off because of overvoltage.	Overvoltage at the input detected .

Table 4-1 List of error and warning messages

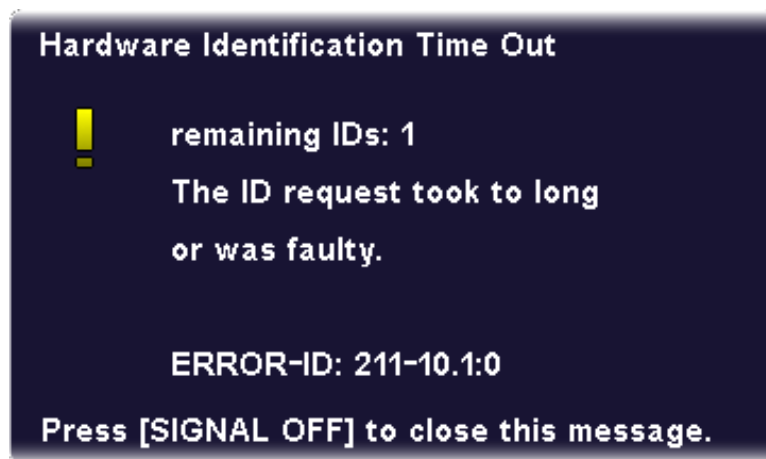


Figure 4-23: Hardware Identification Error

4.4.3.3 Self-alignment Failure

If during the self-alignment a non-correctable level deviation or limit violation is detected, the self-alignment process is aborted and an error message window is shown on the display.

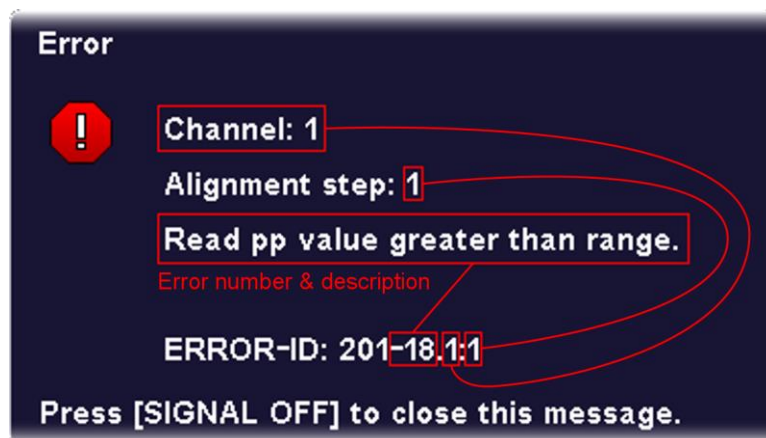


Figure 4-24: Screenshot of self-alignment error message

The error message window shows the related channel no., error message and the step number of the alignment that cannot be adjusted to be within the tolerance. When the step shows a number with more than three digits, the last three digits indicate the current alignment step number (see also [Table 3-1: List of self-alignment steps](#)).

Error No.	Error message	Comment
-1	ADJ_ERROR_FACTORY_DB	Error in Factory Database (Memory for Factory alignment)
-2	ADJ_ERROR_USER_DB	Error in User Database (Memory for User Self-alignment)
-4	ADJ_ERROR_UNKNOWN_PARAMETER	Unknown Parameter

-5	ADJ_ERROR_AUTO_LIMIT_MIN	Adjust value is lower than allowed.
-6	ADJ_ERROR_AUTO_LIMIT_MAX	Adjust value is higher than allowed.
-8	ADJ_ERROR_AUTO_SET_LIMIT_MIN	Given value is lower than allowed.
-9	ADJ_ERROR_AUTO_SET_LIMIT_MAX	Given value is higher than allowed.
-11	ADJ_ERROR_USER_ABORT	Self-alignment terminated by user
-14	ADJ_ERROR_TIME_OUT	Time Out.
-34	ADJ_ERROR_INPUT_VOLTAGE_OUT_OF_RANGE	Input voltage too high.
-35	ADJ_ERROR_YCAL_PP_OUT_OF_RANGE	Interfering signals!
-37	ADJ_ERROR_TRIGGER_HYSTERESES	Trigger hysteresis smaller than permitted
-38	ADJ_ERROR_ACQ	Acquired value is wrong.
-39	ADJ_ERROR_ADJUSTMENT_FAILURE	Alignment unsuccessful
-40	ADJ_ERROR_ADJUSTMENT_NOT_PERFORMED	The Alignment was not completed. Start again.
-41	ADJ_ERROR_START_TEMPERATURE_UNSTABLE	Wait 20 minutes after power up
-42	ADJ_ERROR_TEMPERATURE_UNSTABLE_UNTIL_ADJ	Temperature (max. $\Delta 5^{\circ}\text{C}$) unstable during self-alignment
-43	ADJ_ERROR_SPI_ERROR	Communication error
-44	ADJ_ERROR_CHECK_USER_DB	DDF value and DB values do not match
-45	ADJ_ERROR_AUTO_POD_SET_LIMIT_MIN	Lower limit for default value at self-alignment was reached
-46	ADJ_ERROR_AUTO_POD_SET_LIMIT_MAX	Upper limit for default value at self-alignment was reached
-48	ADJ_ERROR_MEASUREMENT_CLIPPING	Measured value exceeds range (minimum and maximum)
-49	ADJ_ERROR_MEASUREMENT_CLIPPING_MAX	Measured value exceeds range (maximum)
-50	ADJ_ERROR_MEASUREMENT_CLIPPING_MIN	Measured value exceeds range (minimum)
-51	ADJ_ERROR_MEASUREMENT_TOO_SMALL	Measured value is too small (e.g. at difference measurements)

Table 4-2: Overview of Self-alignment Error Messages

4.4.3.4 No Display

Problem: After powering on the TFT does not display anything and remains dark, but the instrument seems to work, because LEDs are lighting and fans rotate.

Solution: In this case, it can be assumed that either the display (including backlight or inverter) or the graphic interface on the mainboard is broken. To isolate the problem, check the following:

1. Connect an external DVI-D monitor to the DVI-D interface on the rear of the instrument.
2. Reboot the instrument.
3. If the external DVI-D monitor shows the R&S RTM screen, then replace the TFT display, otherwise replace the mainboard.

4.4.3.5 Fan

The R&S RTM has temperature controlled fans. One is beside the power supply and the other on the other side of the housing.

If the fan does not rotate, then check the fan as follows:

1. Measure the fan supply voltage at socket J7 (PS fan) or J4 (Fan 2) during boot-up with fans connected. At this time the fan drive stage should supply a maximum voltage of roughly 11V to the fans.
2. If the fan does not rotate and the measured fan voltage is in the range of 5.5 V to 11.5 V , then replace the fan, otherwise replace the power supply.

4.4.3.6 Probe Interface

Use an active probe (e.g. R&S RT-ZS20) to check the probe interface of the instrument.

1. Switch off the channel to be connected.
2. Connect the active probe to the channel input.
3. After the probe has been recognized by the instrument, the corresponding channel is switched on.

Confirm the correct probe recognition by pressing the channel hardkey and the probe softkey. The device name of the connected active probe is displayed on the softkey bar as shown on the screenshot below. (See [Figure 4-25: Active Probe Recognition](#))

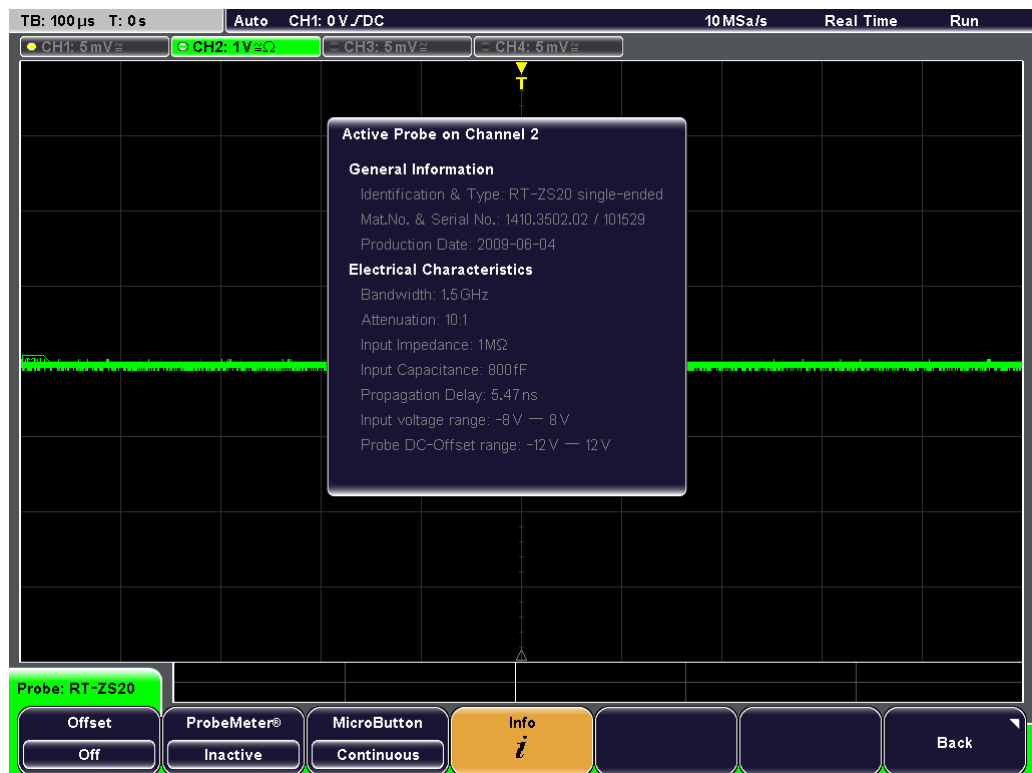


Figure 4-25: Active Probe Recognition

5 Software Update / Installing Options

This chapter describes firmware update and installation of options to the R&S RTM.

5.1 Installing new R&S RTM Software

For information on updating software refer to the release notes. The most recent version is provided on our Internet site at www.rohde-schwarz.com. You can also follow the link on the CD supplied with the instrument.

The R&S RTM application software is packed into one ZIP file. After downloading the ZIP file unpack it to the root directory of a USB stick.

The R&S RTM application software consists of different files:

- the instrument firmware with file extension `.FWU`, e.g. `R&S RTM20x2.FWU` / `RTM20x4.FWU` for 2 and 4 channel R&S RTM20xx instruments
- the instrument firmware with file extension `.hfu`, for R&S RTM21xx instruments and all instruments with bandwidth upgrade to 1 GHz
- the USB and LAN interface firmware with file extension `.FWU`, e.g. `USB_LAN.FWU`

It is recommended that you update the interface firmware first and then the instrument firmware, if both need to be updated.

The screenshot below shows the firmware update dialog box “**SETUP > Update**”



Figure 5-1: Firmware Update

To update the instrument's firmware

1. Plug a USB flash disk into the instrument. The update files need to be located in the root directory of the flash drive
2. Press "**SETUP** > More > Update > Firmware".
The device starts to search and load the corresponding firmware file from the root of the USB flash disk. Checksum verification is performed after the firmware file has been found and loaded.
The currently installed firmware version is displayed as well as all available update versions. If the new firmware version is identical to the installed version, the new firmware is highlighted in red, otherwise it is green. You should only perform the firmware update if the version is green. A firmware version rollback is possible.
3. Press "Execute" to start the firmware update. The device shuts down and flashes the loaded firmware to the flash memory. During this time, a progress bar is displayed. Do not disconnect the power, switch off the device or interrupt the flash process until the device boots up by itself again.
4. The firmware update will include an update of the online help and all user interface languages.

 CAUTION**Risk of making instrument unusable**

Interrupting the update process may impair instrument function. Do not interrupt the firmware flash process and do not switch off the device or unplug the power cord during firmware update.



Figure 5-2: GUI of Instrument Firmware Update

To update the interface firmware

1. Plug a USB flash disk into the instrument. The update file needs to be located in the root directory of the flash disk.
2. Press "SETUP > More > Update > Interface".

The currently installed interface firmware version is displayed, as well as all available update versions. If the new interface version is identical to the installed version, the number of the version is highlighted in red, otherwise it is green. You should only perform the interface firmware update if the version is green.

3. Press "Execute" to install the available interface firmware updates.

5.2 Installing the Options

R&S RTM hardware and software options available for customers are listed in the Data Sheet. In addition, the service option Reset Time Monitoring Data: TIME-CONTROL part no. 1300.5499.00 is provided.

Options for the R&S RTM can be enabled using a license key. To obtain the license key, consult your sales representative. You need the material number and serial number of your instrument to get a license key.

To install an option-key (option key tools)

Installation of option key tools for option management is available via R&S Software Installation Bulb64. A valid privilege key chip card is required for installation.

Details of the key creation and installation procedure can be found in the corresponding manual, installed together with the option-key tools.

To install an option-key (manually)

1. Press the SETUP key and select "More > Update > Licenses" (see picture below)
2. If you received a key in written form, enter the key in the "Input key manually" field. If you received a key in digital form as a file, tap "Read keys from license file" to open the file selection dialog box and select the option key file.
3. If you want to enable several options, repeat step 2 for each option.

The licenses window provides information about active licenses and their validity, inactive licenses, and deactivation keys.

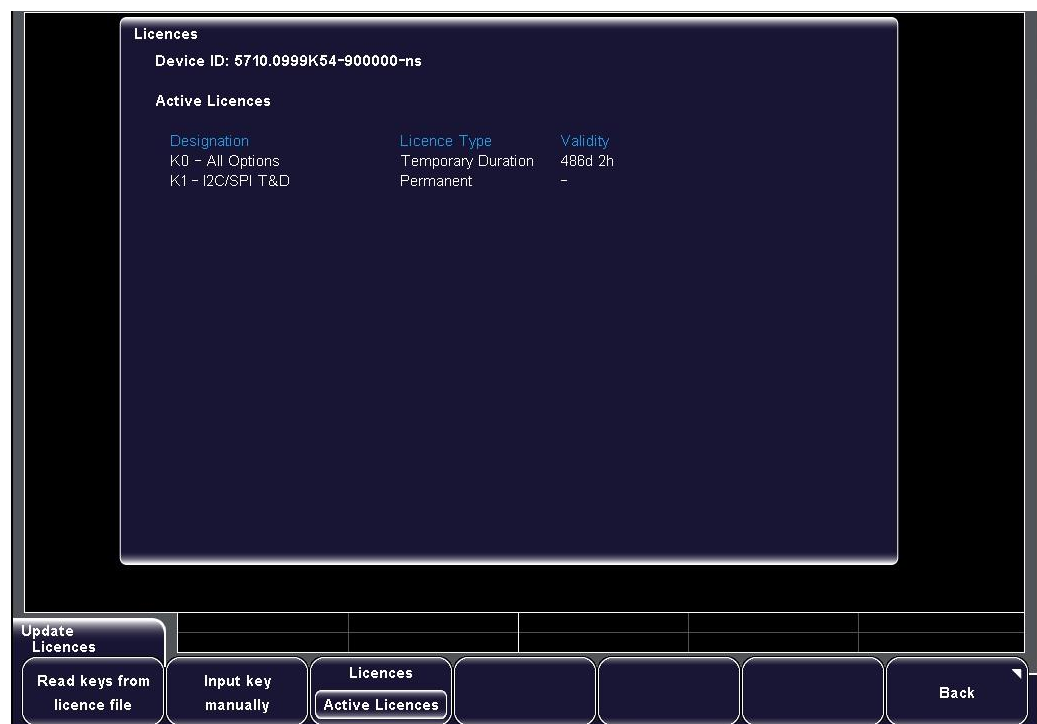


Figure 5-3: List of Active Licenses on R&S RTM

6 Documents

This chapter provides information on the ordering of spare parts and contains the spare part list and the documents for the complete R&S RTM unit.

6.1 Available Power Cables

Stock No.	Earthed-contact connector	Preferably used in
DS 0006.7013.00	BS1363: 1967* 10 A, 250 V complying with IEC 83: 1975 standard B2	Great Britain
DS 0006.7020.00	Type 12, 10 A, 250 V complying with SEV-regulation 1011.1059, standard sheet S 24 507	Switzerland
DS 0006.7036.00	Type 498/13, 10 A, 250 V complying with US-regulation UL 498, or with IEC 83	USA/Canada
DS 0041.4752.00	GB2099, GB1002, 10 A, 250 V approvals CCC	China
DS 0041.6232.00	JIS C 8303, 7A, 125 V AC approvals PSE (JET)	Japan
DS 0006.7107.00	Type SAA3, 10 A, 250 V, complying with AS C112-1964 Ap.	Australia
DS 0025.2365.00 DS 0099.1456.00	DIN 49 441, 10 A, 250 V, angular DIN 49 441, 10 A, 250 V, straight approvals VDE, ÖVE, CEBEC, KEMA, S, D, N, FI, LCIE, IMQ, UCIEE	Europe (except Switzerland)

6.2 Spare Parts

The stock numbers necessary for ordering replacement parts and modules are listed in the following spare part list.

NOTICE

Risk of damaging a module

When shipping a module, observe the instructions provided in the "Procedure in Case of Service and Ordering of Spare Parts" chapter at the beginning of this document.

Pos.-Nr. ItemNo	Menge Quantity	ME Unit	El.Kennz Ref.Des.	Benennung / Bezeichnung Designation	Z	Sachnummer Stock No.	Ersatzteil Subst.part	BA	VH
				ACHTUNG EGB/ATTENTION ESD *VARIANTENERKLÄRUNG +EXPLANATION OF VARIANTS *VAR02=FÜR GERÄTEVARIANTE .02 (2 KANAL, 1GHZ) +VAR02=FOR MODEL .02 (2 CHANNELS, 1GHZ) *VAR04=FÜR GERÄTEVARIANTE .04 (4 KANAL, 1GHZ) +VAR04=FOR MODEL .04 (4 CHANNELS, 1GHZ) *VAR22=FÜR GERÄTEVARIANTE .22 (2 KANAL, 200MHZ) +VAR22=FOR MODEL .22 (2 CHANNELS, 200MHZ) *VAR24=FÜR GERÄTEVARIANTE .24 (4 KANAL, 200MHZ) +VAR24=FOR MODEL .24 (4 CHANNELS, 200MHZ) *VAR32=FÜR GERÄTEVARIANTE .32 (2 KANAL, 350MHZ) +VAR32=FOR MODEL .32 (2 CHANNELS, 350MHZ) *VAR34=FÜR GERÄTEVARIANTE .34 (4 KANAL, 350MHZ) +VAR34=FOR MODEL .34 (4 CHANNELS, 350MHZ) *VAR52=FÜR GERÄTEVARIANTE .52 (2 KANAL, 500MHZ) +VAR52=FOR MODEL .52 (2 CHANNELS, 500MHZ) *VAR54=FÜR GERÄTEVARIANTE .54 (4 KANAL, 500MHZ) +VAR54=FOR MODEL .54 (4 CHANNELS, 500MHZ)					
1	0	S		PH BEMERKUNG NOTE Spare Part List for RTM2xxx, 5710.0999.01		0999.9610.00		B	O
110	1	S		ED FRONTCONTROLLER FC-R40 FRONTCONTROLLER FC-R40	Z	5710.1495.40		M	P
115	1	S		ED KEY KY-R40 KEY KY-R40	Z	5710.1514.40		M	P
120	1	S		SF SCHALTMATTENSATZ 2CH WFBM RUBBER KEYPAD SET 2CH WFBM VAR 02 22 32 52		5710.1366.00		B	B
121	1	S		SF SCHALTMATTENSATZ 4CH WFBM RUBBER KEYPAD SET 4CH WFBM VAR 04 24 34 54		5710.1372.00		B	B
130	1	S		OP FILTER-WASHER. 2.0X146.5X185.5. WFB FILTER-WASHER. 2.0X146.5X185.5. WFB always order together: 1 x ItemNr 130 2 x ItemNr 131 2 x ItemNr 132		5705.6292.00		B	B
131	1	S		OG EPDM 181X4X2 SELBSTKLEB. FUER RTM CELLULAR RUBBER.EPDM.SELF- ADH.181X4X2 always order together: 1 x ItemNr 130 2 x ItemNr 131 2 x ItemNr 132		5705.6311.00		B	B
132	1	S		OG EPDM 142X4X2 SELBSTKLEB. FUER RTM		5705.6305.00		B	B
 ROHDE & SCHWARZ			Benennung/Designation ERSATZTEILLISTE RTMM SPARE PART LIST RTMM			Sprach./Lang de en		Ä.I. / C.I	Blatt/Sheet 1 of 4

Pos.-Nr. ItemNo	Menge Quantity	ME Unit	El.Kennz Ref.Des.	Benennung / Bezeichnung Designation	Z	Sachnummer Stock No.	Ersatzteil Subst.part	BA	VH
				CELLURAR RUBBER.EPDM.SELF-ADH.142X4X2 always order together: 1 x ItemNr 130 2 x ItemNr 131 2 x ItemNr 132					
140	1	S		ND TFT 8.4 XGA LVDS LED XGA LVDS DISPLAY 8.4 INCH		3583.3841.00		B	A
145	1	S		DF LVDS-DATA KABEL. 350 MM. WFBM LVDS-DATA CABLE. 350 MM. WFBM		5810.0502.00		B	B
150	1	S		MM FRONT COVER WFBM 4CH COMPLETE FRONT COVER WFBM 4CH COMPLETE VAR 04 24 34 54		5710.1337.00		B	B
155	1	S		MM FRONTHAUBE WFBM 2CH KOMPLETT FRONT COVER WFBM 2CH COMPLETE VAR 02 22 32 52		5710.1320.00		B	B
160	1	S		MM KNOPF 12 WFA KNOB 12 WFA		1304.6777.00		B	B
165	1	S		MM KNOPF 16 WFA KNOB 16 WFA		1304.6783.00		B	B
170	1	S		OS TYPENSCHILD RTM2022 LABEL RTM2022 VAR 22		1326.0859.00		B	B
175	1	S		OS TYPENSCHILD RTM2024 LABEL RTM2024 VAR 24		1326.0865.00		B	B
180	1	S		OS TYPENSCHILD RTM2032 LABEL RTM2032 VAR 32		1317.4261.00		B	B
185	1	S		OS TYPENSCHILD RTM2034 LABEL RTM2034 VAR 34		1317.4278.00		B	B
190	1	S		OS TYPENSCHILD RTM2052 LABEL RTM2052 VAR 52		1317.4284.00		B	B
195	1	S		OS TYPENSCHILD RTM2054 LABEL RTM2054 VAR 54		1317.4290.00		B	B
200	1	S		OS TYPENSCHILD RTM2102 LABEL RTM2102 VAR 02		1317.4303.00		B	B
205	1	S		OS TYPENSCHILD RTM2104 LABEL RTM2104 VAR 04		1317.4310.00		B	B
210	1	S		MM WFA STUETZE WFA PILLAR		1304.7596.00		B	B
215	1	S		MM WFA DECKEL FUER STUETZE WFA COVER FOR PILLAR		1304.7609.00		B	B
220	1	S		MM GRIFF WFB HANDLE WFB		1173.6541.00		B	B
230	1	S		ZS GERAETEFUSS-SET RTM BASE-SET TO RTM	Z	5703.8130.00		M	P
240	1	S		MM GEHAEUSE WFBM CASE WFBM		3588.9390.00		B	B

ROHDE&SCHWARZ			Benennung/Designation ERSATZTEILLISTE RTMM SPARE PART LIST RTMM			Sprach./Lang de en	Ä.I. / C.I	Blatt/Sheet 2 of 4	

Pos.-Nr. ItemNo	Menge Quantity	ME Unit	El.Kennz Ref.Des.	Benennung / Bezeichnung Designation	Z	Sachnummer Stock No.	Ersatzteil Subst.part	BA	VH
250	1	S		MZ CHASSIS WFBM MAIN FRAME WFBM	Z	5710.1520.00		M	P
252	1	S		MZ ABSCHIRMUNG HINTEN WFBM REAR PANEL SHIELDED WFBM always order together: 1 x ItemNr 252 2 x ItemNr 253	Z	5710.1543.00		M	P
253	1	S		OS RUECKFOLIEN WFBM REAR FOILS WFBM always order together: 1 x ItemNr 252 2 x ItemNr 253		5710.1550.00		B	B
255	1	S		MZ ABSCHIRMUNG UNTEN WFBM BOTTOM COVER WFBM	Z	5710.1537.00		M	G
260	1	S		DX DC-LÜFTER MONTAGE, WFBM DC-FAN ASSEMBLY, WFBM	Z	5710.1214.00		M	P
270	1	S		DY FLACHBANDKABEL, FORM S, 26 PIN FLAT CABLE ASSY. FORM S, 26 PIN CABLE Mainboard-Frontcontroller	Z	5703.4263.00		M	V
271	1	S		DY FLACHBANDKABEL, FORM A, 16 PIN FLAT CABLE ASSY. FORM A, 16 PIN CABLE PowerSupply-Frontend	Z	5703.4305.00		M	W
272	1	S		DF FLEX-STRIP 30P. R=0.5 L=150 FLEX-STRIP 30P. R=0.5 L=150 CABLE Mainboard-Interface		2108.5405.00		B	O
310	1	S		ZE POWER SUPPLY WFBM POWER SUPPLY WFBM	Z	5710.1237.02		M	P
320	1	S		SS SCHMELZS. 3.15A T IEC60127/V FUSE 3.15A T IEC60127/V		0099.6729.00		B	B
330	1	S		SS SMD-SICHERUNG 7A FF FUSE 7A FF		2079.5994.00		B	T
340	1	S		SS SMD-SICHERUNG 2A F 1206 SMD FUSE 2A F 1206		5705.3906.00		B	V
410	1	S		ED MAINBOARD MB-R20 MAINBOARD MB-R20 VAR 22 32 52 For mainbaords with PCI >= 3.0 firmware version 5.4 or higher is requierd	Z	5710.0576.20		M	P
415	1	S		ED MAINBOARD MB-R1G20 MAINBOARD MB-R1G20 VAR 02	Z	5810.1038.20		M	P
420	1	S		ED MAINBOARD MB-R40 MAINBOARD MB-R40 VAR 24 34 54 For mainbaords with PCI >= 3.0 firmware version 5.4 or higher is requierd	Z	5710.0576.40		M	V
425	1	S		ED MAINBOARD MB-R1G40 MAINBOARD MB-R1G40 VAR 04	Z	5810.1038.40		M	V
430	1	S		EB CR2032 BATT(P) LI-MNO2 3.0/0.23 BATTERIES NON-RECHARGEABLE (PRIMARY)		0858.2049.00		B	O
510	1	S		ED FRONTEND FE-C20 FRONTEND FE-C20 VAR 22 32 52	Z	5710.0582.20		M	P
515	1	S		ED FRONTEND FE-D20 FRONTEND FE-D20	Z	5810.0683.20		M	O
 ROHDE & SCHWARZ				Benennung/Designation ERSATZTEILLISTE RTMM SPARE PART LIST RTMM			Sprach./Lang de en	Ä.I. / C.I	Blatt/Sheet 3 of 4

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Pos.-Nr. ItemNo	Menge Quantity	ME Unit	El.Kennz Ref.Des.	Benennung / Bezeichnung Designation	Z	Sachnummer Stock No.	Ersatzteil Subst.part	BA	VH
520	1	S		VAR 02 ED FRONTEND FE-C40 FRONTEND FE-C40 VAR 24 34 54	Z	5710.0582.40		M	P
525	1	S		ED FRONTEND FE-D40 FRONTEND FE-D40 VAR 04	Z	5810.0683.40		M	O
610	1	S		ZE RTM-B11M ETHERNET/USB DUAL SCHNITT. RTM-B11M ETHERNET/USB DUAL INTERF.	Z	5710.1195.03		M	P

7 Mechanical Drawings and Block Diagram

- Housing
- Base unit
- Front unit
- Block diagram

Geräte Kern / base unit

Hinweis: immer gemeinsam bestellen

1 x 252

1 x 253

note: always order together

1 x 252

1 x 253

Hinweis zu Pos 310:

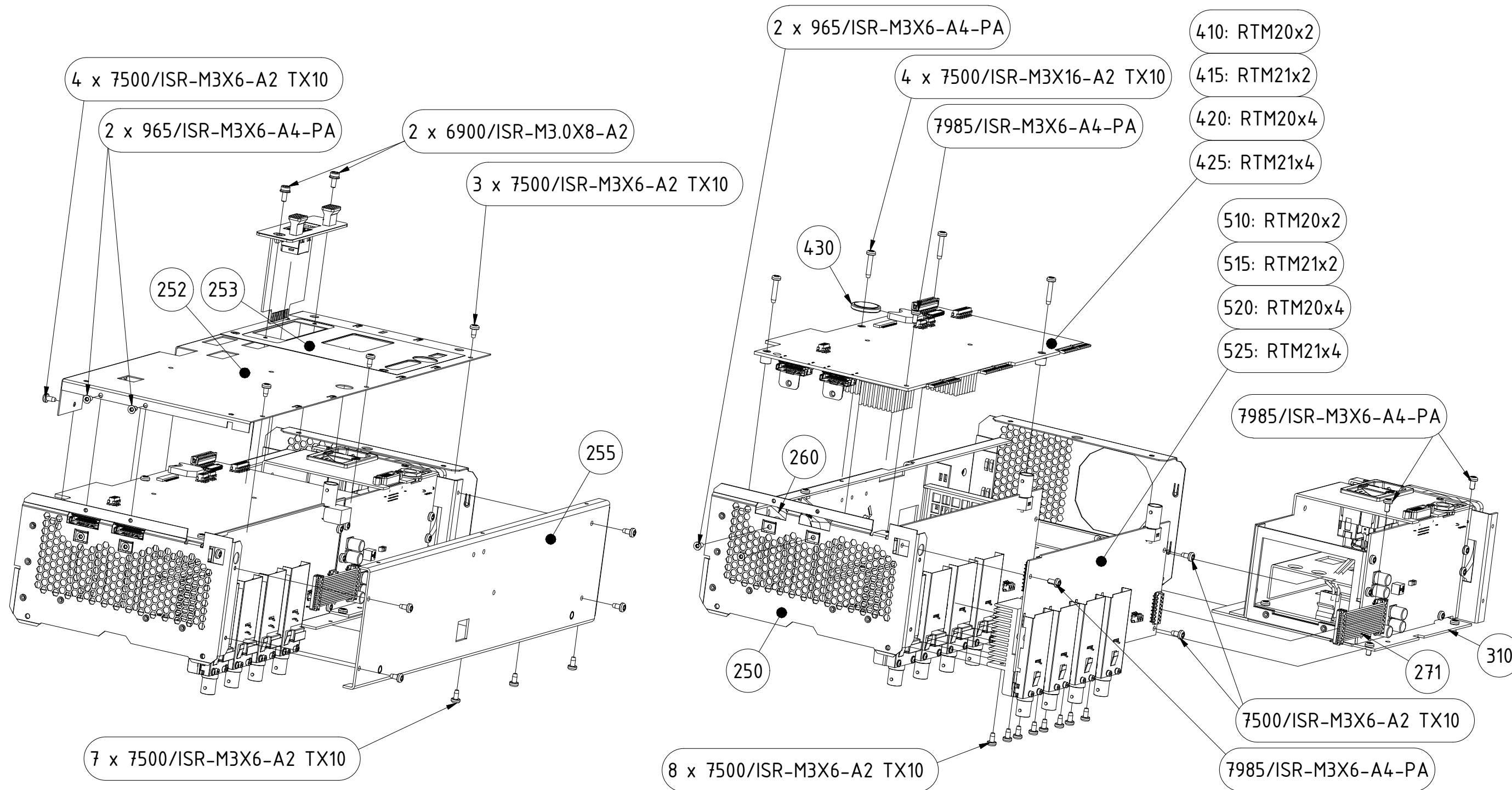
die PowerSupply-Baugruppe enthält auch den Lüfter.

Der Lüfter kann auch separat bestellt werden: Pos 260

note to Pos 310:

the power supply module also contains the fan.

The fan can also be ordered separately: Pos 260



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	RTM2000 DIGITAL OSCILLOSCOPE			Dokument Nr. / Document No.		
Datum/Date	12.02.2015	Abt./Dept.	Name/Name	5710.0999.22/.24/.32/.34/.52/.54		
				5710.0999.02/.04		

Fronteinheit / front unit

18 x DELTA-PT-SCREW 2.5X8 WN5451

Hinweis: immer gemeinsam bestellen

1 x 130

2 x 131

2 x 132

note: always order together

1 x 130

2 x 131

2 x 132

140

115

130

131

132

210

270

110

120: RTM20x2 / RTM21x2

121: RTM20x4 / RTM21x4

155: RTM20x2 / RTM21x2

150: RTM20x4 / RTM21x4

165

160



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Sprach./Lang

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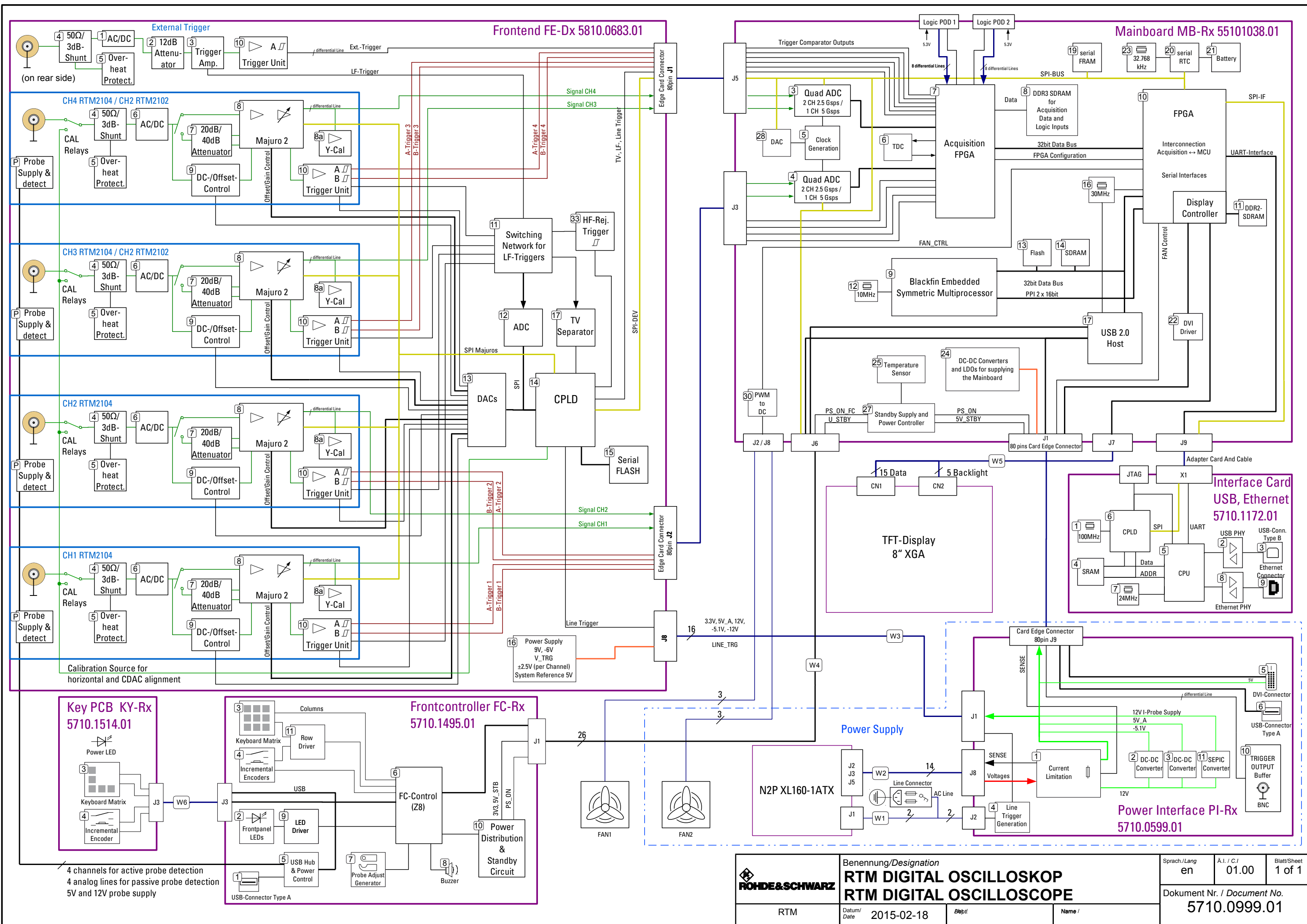
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