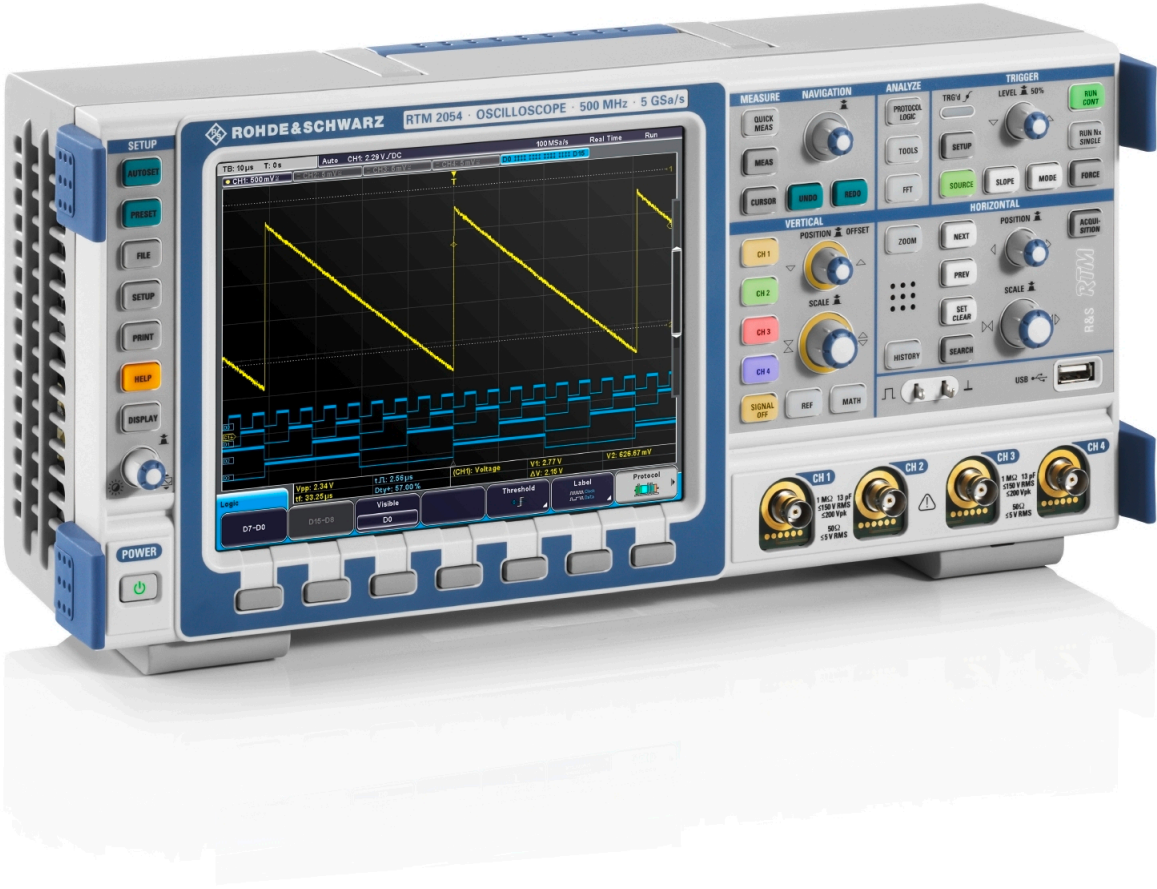


R&S® RTM2000

Digital Oscilloscope

Getting Started



1317.4710.02 – 0101

This document describes the following R&S®RTM models:

- R&S®RTM2032 (5710.0999K32)
- R&S®RTM2034 (5710.0999K34)
- R&S®RTM2052 (5710.0999K52)
- R&S®RTM2054 (5710.0999K54)

The firmware of the instrument makes use of several valuable open source software packages. For information, see the "Open Source Acknowledgement" 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.

© 2013 Rohde & Schwarz GmbH & Co. KG

Mühlhofstr. 15, 81671 München, Germany

Phone: +49 89 41 29 - 0

Fax: +49 89 41 29 12 164

E-mail: info@rohde-schwarz.com

Internet: www.rohde-schwarz.com

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

R&S® is a registered trademark of Rohde & Schwarz GmbH & Co. KG.

Trade names are trademarks of the owners.

The following abbreviations are used throughout this manual: R&S®RTM2000 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.








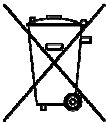

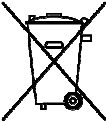

Observing the safety instructions will help prevent personal injury or damage of any kind caused by dangerous situations. Therefore, carefully read through and adhere to the following safety instructions before and when using the product. It is also absolutely essential to observe the additional safety 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

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

Batteries and rechargeable batteries/cells

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

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

Transport

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

Instrucciones de seguridad elementales

Waste disposal/Environmental protection

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

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

Instrucciones de seguridad elementales

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

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

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















Instrucciones de seguridad elementales

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


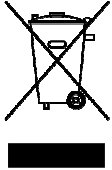

Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto.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

Señalización de seguridad de los productos

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

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

Instrucciones de seguridad elementales

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

Palabras de señal y su significado

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



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



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



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



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

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

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

Estados operativos y posiciones de funcionamiento

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

Instrucciones de seguridad elementales

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

Seguridad eléctrica

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

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

Instrucciones de seguridad elementales

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

Instrucciones de seguridad elementales

Funcionamiento

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

Instrucciones de seguridad elementales

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

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

Transporte

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

Instrucciones de seguridad elementales

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

Eliminación/protección del medio ambiente

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

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

Customer Support

Technical support – where and when you need it

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

Up-to-date information and upgrades

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

Europe, Africa, Middle East

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

North America

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

Latin America

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

Asia/Pacific

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

China

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



Contents

1	Preface	5
1.1	Key Features	5
1.2	Documentation Overview	5
1.3	Conventions Used in the Documentation	6
1.3.1	Typographical Conventions.....	7
2	Preparing for Use	8
2.1	Unpacking and Checking the Instrument	8
2.2	Positioning the instrument	9
2.2.1	Standalone operation.....	9
2.2.2	Rackmounting.....	10
2.3	Starting the Instrument	11
2.3.1	Powering On.....	11
2.3.2	Starting Up and Shutting Down.....	11
2.3.3	Powering Off.....	12
2.3.4	EMI Suppression.....	12
2.4	Connecting External Devices	12
3	Instrument Tour	14
3.1	Front Panel	14
3.1.1	SETUP Controls.....	15
3.1.2	MEASURE Keys.....	16
3.1.3	NAVIGATION Controls.....	16
3.1.4	ANALYZE Keys.....	17
3.1.5	TRIGGER Controls.....	18
3.1.6	VERTICAL Controls.....	19
3.1.7	HORIZONTAL Controls.....	20
3.1.8	Input Channels.....	22
3.1.9	Front Connectors.....	23
3.2	Rear Panel	23
3.3	Right Panel	25
4	Trying Out the Instrument	27

4.1	Displaying a Basic Signal.....	27
4.2	Zooming into the Waveform.....	28
4.3	Using the Virtual Screen.....	31
4.4	Showing Basic Measurement Results.....	32
4.5	Performing Cursor Measurements.....	34
4.6	Using Mathematical Functions.....	36
4.7	Printing Results.....	39
4.8	Storing Data.....	40
5	Operating the Instrument.....	41
5.1	Understanding Display Information.....	41
5.2	Working with Waveforms.....	43
5.3	Accessing the Functionality.....	44
5.4	Entering Data.....	45
5.5	Getting Help.....	46
6	Instrument Setup.....	48
6.1	Defining General Instrument Settings.....	48
6.1.1	Setting Data and Time.....	48
6.1.2	Configuring Sounds.....	48
6.1.3	Setting the Language.....	48
6.2	Performing a Self-Alignment.....	49
6.3	Adjusting Passive Probes.....	49
7	Maintenance.....	51
7.1	Cleaning.....	51
7.2	Storing and Packing.....	52
7.3	Replacing the Fuses.....	52
7.4	Data Security.....	53
	Index.....	54

1 Preface

1.1 Key Features

The R&S RTM digital oscilloscope is a general purpose instrument with excellent performance and measurement accuracy:

- Very good noise performance
- Excellent channel-to-channel isolation prevents crosstalk between channels
- Vertical resolution down to 1 mV/div without bandwidth limitations to get real measurement results

The R&S RTM is easy and quickly to operate because of:

- 8,4" color display with high resolution
- Colour coded channels
- Virtual screen
- Flat menu structure
- Deep undo and redo
- Screenshot at a single key stroke
- Very fast booting
- Light-weight, portable design

The R&S RTM provides a comprehensive functional set. Besides the usual features known from similar scopes, it has some very useful unique functions:

- Digital trigger system: many trigger types to capture closest successive events
- Quick measurements: most important measurement results are available at a single key stroke
- Sophisticated cursor measurements: special measurement types and features for quick and easy cursor positioning
- Acquisition modes: decimation modes like sample mode and peak detect can be combined with waveform arithmetic, for example, average and envelope
- Smoothing: averaging for non-periodic signals
- Various options for protocol analysis
- Optional logic analysis

For a detailed specification refer to the data sheet.

1.2 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 in English

- Documentation CD-ROM with:
 - Getting Started
 - User Manual
 - Service Manual
 - Data sheet and product brochure
 - Links to useful sites on the Rohde & Schwarz 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 at the push of the HELP key.

Getting Started

The English edition of this manual is delivered with the instrument in printed form. The manual is available also in other languages in PDF format on the Documentation CD-ROM. It provides the information needed to set up and start working with the instrument, and describes basic operations and typical measurement examples. The manual includes also safety information.

User Manual

The user manual is available in PDF format on the Documentation CD-ROM. This manual describes all instrument functions in detail. It provides an introduction to remote control and a complete description of the remote control commands with programming examples.

Service Manual

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

Documentation updates

You can download the newest version of the "Getting Started" and "User Manual" from the "Downloads > Manuals" section on the Rohde & Schwarz "Scope of the Art" Web page: <http://www.scope-of-the-art.com/product/rtm.html>.

The current online help is part of the instrument firmware, and it is installed together with the firmware. Firmware updates are available in the "Downloads > Firmware" section on the Rohde & Schwarz "Scope of the Art" product website.

1.3 Conventions Used in the Documentation

This chapter describes the conventions used throughout this documentation.

1.3.1 Typographical Conventions

The following text markers are used throughout this documentation:

Convention	Description
"Graphical user interface elements"	All names of graphical user interface elements on the screen, such as dialog boxes, menus, options, buttons, and softkeys are enclosed by quotation marks.
KEYS	Key names are written in capital letters.
File names, commands, program code	File names, commands, coding samples and screen output are distinguished by their font.
<i>Input</i>	Input to be entered by the user is displayed in italics.
Links	Links that you can click are displayed in blue font.
"References"	References to other parts of the documentation are enclosed by quotation marks.

2 Preparing for Use

This section describes the basic steps to be taken when setting up the R&S RTM for the first time.

NOTICE

Risk of instrument damage

Note that the general safety instructions also contain information on operating conditions that will prevent damage to the instrument. The instrument's data sheet may contain additional operating conditions.

NOTICE

Risk of instrument damage during operation

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

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

2.1 Unpacking and Checking the Instrument

To remove the instrument from its packaging and check the equipment for completeness, proceed as follows:

1. Pull off the polyethylene protection pads from the instrument's rear feet and then carefully remove the pads from the instrument handles at the front.
2. Pull off the corrugated cardboard cover that protects the rear of the instrument.
3. Carefully unthread the corrugated cardboard cover at the front that protects the instrument handles and remove it.
4. Check the equipment for completeness using the delivery note and the accessory lists for the various items.

5. Check the instrument for any damage. If there is damage, immediately contact the carrier who delivered the instrument. Make sure not to discard the box and packing material.

**Packing material**

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

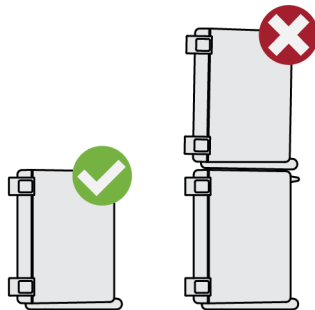
2.2 Positioning the instrument

The instrument is designed for use under laboratory conditions. It can be used in standalone operation on a bench top or can be installed in a rack.

⚠ CAUTION**Risk of injury and instrument damage if stacking instruments**

A stack of instruments may tilt over and cause injury and material damage because the instrument's top surface area is too small.

Never stack instruments on top of each other. If you need to stack instruments, install them in a rack.



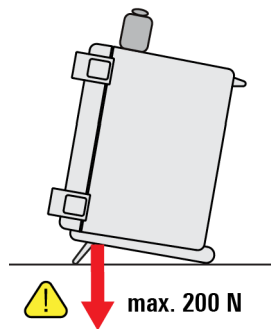
2.2.1 Standalone operation

For standalone operation, place the instrument on a horizontal bench with even, flat surface. The instrument can be used in horizontal position, or with the support feet on the bottom extended.

⚠ CAUTION**Risk of injury if feet are folded out**

The feet may fold in if they are not folded out completely or if the instrument is shifted. This may cause damage or injury.

- Fold the feet completely in or completely out to ensure stability of the instrument. Never shift the instrument when the feet are folded out.
- When the feet are folded out, do not work under the instrument or place anything underneath.
- The feet can break if they are overloaded. The overall load on the folded-out feet must not exceed 200 N.

**2.2.2 Rackmounting**

The instrument can be installed in a 19" rack mount using a rack mount kit. The order number of the rack mount kit is given in the data sheet. The installation instructions are part of the rack mount kit.

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

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

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

2.3 Starting the Instrument

2.3.1 Powering On

The R&S RTM can be used with different AC power voltages and adapts itself automatically to it. The nominal voltage and frequency ranges are displayed on the rear panel and quoted in the data sheet.

⚠ WARNING**Risk of injury and instrument damage**

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

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

The AC power connector and the main power switch are located on the rear panel of the instrument.

1. Connect the instrument to the AC power supply using the AC power cable delivered with the instrument.
2. Switch the main power switch at the rear of the instrument to position I.
The POWER switch in the bottom left corner of the front panel lights up.



You can leave the AC power on permanently to preserve your last instrument settings. Powering off is required only if the instrument must be completely disconnected from all power supplies.

2.3.2 Starting Up and Shutting Down

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

To start up the instrument

1. Make sure that the R&S RTM is connected to the AC power supply and the main power switch on the rear panel is in position I.
2. Press the POWER key on the front panel.

The instrument performs a system check and then starts the R&S RTM firmware. The POWER key turns green and the illuminated keys on the front panel light up. If the previous session was terminated regularly, the oscilloscope uses the last settings.

To shut down the instrument to standby state

- ▶ Press the POWER key again.

All current settings are saved, and the software shuts down. The POWER key turns yellow. Now it is safe to power off the instrument.

2.3.3 Powering Off

Powering off is required only if the instrument must be completely disconnected from all power supplies.

1. If the instrument is running and the POWER key is green, press the POWER key on the front panel to shut down the instrument.
2. Switch the main power switch at the rear of the instrument to position 0.
3. Disconnect the AC power cable from the AC power supply.

NOTICE

Risk of losing data

If you switch off the running instrument using the rear panel switch or by disconnecting the power cord, the instrument loses its current settings. Furthermore, program data may be lost.

Always press the POWER key first to shut down the application properly.

2.3.4 EMI Suppression

Electromagnetic interference (EMI) may affect the measurement results.

To suppress generated Electromagnetic Interference (EMI),

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

2.4 Connecting External Devices

The following interfaces for external devices are provided:

- USB connectors, see also [chapter 3.1.9, "Front Connectors"](#), on page 23
- Monitor connector, see also [chapter 3.2, "Rear Panel"](#), on page 23

Connecting USB devices

The USB interfaces on the front and rear panels of the R&S RTM allow you to connect USB flash drives for easy transfer of data to and from a computer (e.g. firmware updates), a printer to print measurement results, or a computer for remote control of the instrument.

All USB devices can be connected to or disconnected from the instrument during operation. The instrument detects the USB device as soon as it is connected.

Connecting an external monitor

You can connect an external monitor to the DVI-D connector on the instrument's rear panel. You can connect also a VGA monitor using an appropriate adapter.

NOTICE

Connecting a monitor

Before connecting a monitor, make sure that the instrument is switched off. Otherwise, correct operation cannot be assured.

3 Instrument Tour

This chapter provides an overview of the front and rear panels of the instrument.

3.1 Front Panel

The front panel of the R&S RTM is shown in [figure 3-1](#). The function keys are grouped in functional blocks to the left and the right of the display.

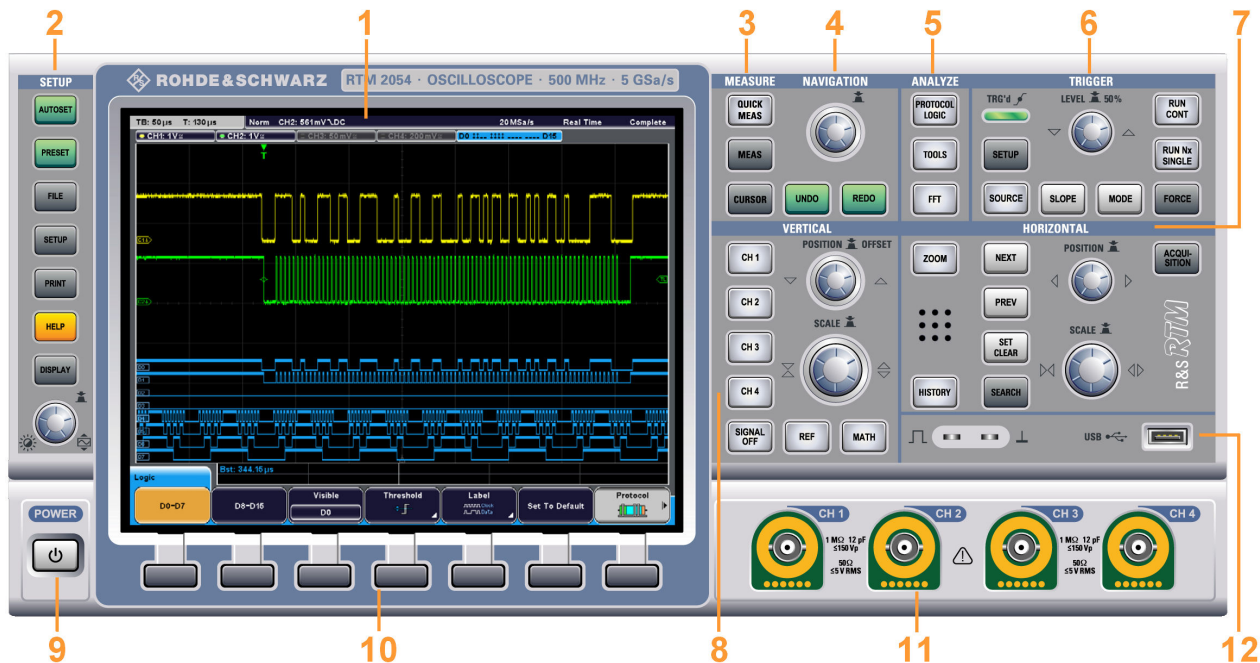


Fig. 3-1: Front panel of RTM 2054 with 4 input channels

- 1 = Display
- 2 = SETUP controls
- 3 = MEASURE keys
- 4 = NAVIGATION controls
- 5 = ANALYZE keys
- 6 = TRIGGER controls
- 7 = HORIZONTAL controls
- 8 = VERTICAL controls
- 9 = POWER key
- 10 = Softkeys
- 11 = Input channels
- 12 = Connectors for USB and probe compensation

The display and its information is described in [chapter 5.1, "Understanding Display Information"](#), on page 41. The keys, rotary knobs and connectors are described in the following chapters.

3.1.1 SETUP Controls

The SETUP keys and knob on the left of the display set the instrument to a defined state, change basic settings, and provide print and help functions.

AUTOSET

Resets the instrument to the default state, analyzes the active channel signals, and obtains appropriate horizontal, vertical, and trigger settings to display stable waveforms.

PRESET

Resets the instrument to the default state, without analyzing the signal.

FILE

Opens the "File" menu, where you can:

- save instrument settings, waveforms, reference waveforms, and math waveforms (formularies)
- restore (load) data which were saved before
- manage the data: browse, copy, and delete files, create folders
- configure screenshot output
- configure the behavior of the PRINT key

SETUP

Opens the "Setup" menu, where you can:

- Set time reference, language, date and time, and sound feedback
- Configure the printer
- Configure USB, LAN and GBIP interfaces
- Perform self calibration and probe adjustment
- Install updates
- Get information on hardware in case of service
- Set up the trigger out pulse

PRINT

Starts printing or saving screenshots, waveforms or settings according to the configuration in FILE > "Print-Key".

HELP

Opens the online help. The appropriate help topic appears when you press a key or turn a knob. To close the online help, press the HELP key again.

DISPLAY

Opens the "Display" menu to configure the appearance of the waveforms, grid, persistence, and also the XY-diagram.

Here you can also enable the virtual screen.



Intensity / Virtual screen

Adjusts the intensity of the waveforms on the screen or moves the displayed part of the virtual screen. Press the knob to toggle the settings. The controlled parameter and its value are shown in a temporary label in the upper right corner of the screen.

Intens: 48 %**VirtualScreen: -0.2 DIV**

The virtual screen has 20 vertical divisions, 8 of them are displayed. If many waveforms are active, you can distribute the waveforms over 20 divisions and turn the knob to scroll the virtual screen. You can disable the virtual screen in the "Display" menu. The virtual screen is available in the usual time domain window and in the zoom window.

3.1.2 MEASURE Keys

The MEASURE functional block provides the automatic and manual measurement functions.

QUICK MEAS

Displays the results of basic automatic measurements for the selected channel in the result table and directly on the waveform. For voltage measurements, these are: Vp+, Vp-, Vpp, V RMS, mean, rise time tr, falling time tf, period T and frequency f.

Press the key again to hide the results.

Note: When you activate quick measurements, cursor measurements are automatically deactivated, as well as the reference and math menus. Deactivate quick measurements before selecting these functions. Channels other than the selected one are switched off in quick measurement mode.

MEAS

Opens the "Measurement" menu, where you can configure up to 4 parallel measurements. Available measurement types depend on the type of the selected waveform.

CURSOR

Opens the "Cursor" menu, where you can set up various manual measurements by means of cursors.

3.1.3 NAVIGATION Controls

The rotary knob and the navigation keys support the data entry in various ways.



NAVIGATION

The function of this universal rotary knob depends on the usage context:

- If a softkey with numerical entry or selection menu is selected, turn the knob to set a value.
- Pressing the knob closes the selection menu.
- If the cursors are on, press the key to select a cursor line. Turn the knob to change the position of the selected cursor line.
- If an input editor is open – on-screen keypad or on-screen keyboard – turn the knob until the required character is highlighted, then press the knob to apply it.

UNDO

Reverses the last setting actions step by step. The "Undo" is not possible after preset, load and recall actions, and creating a reference waveform.

REDO

Recovers the undo steps in reverse order.

3.1.4 ANALYZE Keys

The keys in the ANALYZE functional block open various menus for signal analysis.



PROTOCOL LOGIC

Opens the "Protocol" and "Logic" menus, where you can select and configure serial interfaces and bus systems, and configure digital channels for analysis.

If the "Protocol" menu is selected, the key toggles the bus.

The "Logic" menu and digital channels are only available if option R&S RTM-B1 (MSO) is installed.

TOOLS

Opens the "Tools" menu to configure and perform a mask test on the selected waveform. Masks are used for error detection and compliance tests of digital signals.

You can:

- run mask tests,
- configure new masks based on channel signals,
- configure actions triggered by mask violation.

FFT

The FFT key activates and deactivates a Fast Fourier Transformation (FFT) for the most recently selected channel and provides functions to configure and display FFTs.

If activated, the FFT key lights up. Two windows are displayed: the signal vs. time window at the top, and the result window of the FFT analysis at the bottom.

When deactivated, the previous display is restored.

To display the FFT for a different channel, press the corresponding channel key.

3.1.5 TRIGGER Controls

The keys and the rotary knob in the TRIGGER functional block adjust the trigger and start or stop acquisition.

**RUN CONT**

Starts and stops the continuous acquisition. A green light indicates a running acquisition. A red light shows that acquisition is stopped.

The status is shown also at the right end of the information bar: "Run" or "Complete".

RUN Nx SINGLE

Starts a defined number of acquisitions. Press the key again to stop running acquisitions.

To set the number of acquisitions, press the ACQUISITION key and enter "Nx Single".

FORCE

If the acquisition is running in normal mode and no valid trigger occurs, forcing the trigger provokes an immediate single acquisition. Thus you can confirm that a signal is available and use the waveform display to determine how to trigger on it.

MODE

Toggles the trigger mode between Auto and Normal. The trigger mode determines the behavior of the instrument if no trigger occurs. The current setting is shown in the information bar.

LEVEL

The rotary knob changes the trigger threshold voltage for all trigger types that require one trigger level. Some trigger types require two trigger levels, for example, the rise time/fall time trigger. These levels can be set in the trigger setup menu.

Turn clockwise to move the trigger level up. Press the knob to set the level to 50% of the signal amplitude.

If a B-trigger is enabled, the knob can set the level for both the A- and B-trigger. To assign the level to the A- or B-trigger, use "Trigger Level" in the "Trigger" menu.

SETUP

Opens the "Trigger" menu.

SOURCE

Opens the "Trigger Source" menu for the A-trigger. Press the key repeatedly until the required source is selected. The key lights up in the color of the selected trigger channel. The selected source is shown in the information bar.

SLOPE

If you have selected "Edge" trigger as trigger type with an analog trigger source, the SLOPE key toggles the trigger slope. The current setting is shown by an icon in the information bar.

If a B-trigger is enabled, the key can set the slope for both the A- and B-trigger. To assign the slope to the A- or B-trigger, use "Trigger Level" in the "Trigger" menu.

3.1.6 VERTICAL Controls

The keys and knobs in the VERTICAL functional block select a signal and adjust the vertical scale and position of the selected waveform.



CH N

Each channel key turns on an analog channel, selects it, and opens the "Channel" menu with the vertical settings of the selected channel. The key is illuminated in the channel color, if the channel is active.

The effect of the keypress depends on state of the channel:

- If channel is off: Pressing the key turns on the channel and selects it. The rotary knobs alongside light up in the channel color.
- If the channel is on: Pressing the key selects the channel waveform and opens its channel setup menu.

POSITION / OFFSET

The rotary knob adjusts the vertical position or the DC offset (if enabled). It lights up in the color of the selected waveform. Pressing the key toggles the parameter, the current parameter and its value are shown in a temporary label marked with the channel color.

At zero-crossing, the knob shortly snaps in and the setting is kept constant to simplify the zero-setting.

Note: By default, offset is disabled. Press "Offset" in the "Channel" menu to enable the offset.

SCALE

Sets the vertical scale in Volts per division to change the amplitude of the selected channel, math, or reference waveform. The current value is shown in the waveform label above the grid. The knob lights up in the color of the selected waveform.

Turn SCALE clockwise to stretch the waveform. Doing so, the scale value V/div decreases. Press the knob to toggle between fine and rough adjustment.

SIGNAL OFF

Turns off the selected signal and selects the next channel, math or reference waveform.

The key lights up in the color of the selected signal and changes the light according to the new selection.

REF

Provides functions for working with reference waveforms on the instrument.

MATH

Provides functions to create equations and display calculated data.

3.1.7 HORIZONTAL Controls

In the HORIZONTAL section you find the knobs for horizontal positioning and scaling, the acquisition settings, zoom and search settings, and timestamp markers.



POSITION

In a normal waveform window, the rotary knob changes the trigger offset. The trigger offset is the horizontal position of the trigger point in relation to the reference point - the zero point of the grid. Thus, you can set the trigger point even outside the diagram and analyze the signal some time before or after the trigger.

Turn clockwise to move the position to the right, and press the knob to reset the value. At zero-crossing, the knob shortly snaps in and the setting is kept constant to simplify the zero-setting.

If a zoom or FFT window is displayed, the knob can change other specific horizontal parameters as well. To toggle the parameters, press the SCALE rotary knob.

SCALE

In a normal waveform window, the rotary knob adjusts the time scale of the horizontal axis for all signals, also known as time base. Turn clockwise to stretch the waveforms - the scale value time/div decreases. The current value is shown in the information bar, it is the left-most value indicated by "TB:".

If a zoom or FFT window is displayed, press the knob to toggle between the windows and their horizontal parameters, then turn the knob to adjust the selected scale value. Pressing the SCALE knob toggles also the parameter changed by the POSITION knob.

ZOOM

Provides functions for configuring the ZOOM display for detailed signal observation.

HISTORY

Reserved for future applications.

NEXT

Moves the next (right) marker to the reference point of the display or zoom area. If a search is enabled, the key navigates the search result markers.

Note: If another marker is available at the right, but currently not visible on the screen, a small red arrow is displayed at the right edge of the display.

PREV

Moves the previous (left) marker to the reference point of the display or zoom area. If a search is enabled, the key navigates the search result markers.

Note: If another marker is available at the left, but currently not visible on the screen, a small red arrow is displayed at the left edge of the display.

SET CLEAR

Sets a new marker at the reference point of the display, or deletes an existing marker at this point. Use the NEXT and PREV keys to move the markers to the reference point.

In the display of search results, the marker is set to or removed from the search result that is selected in the "Event Table".

SEARCH

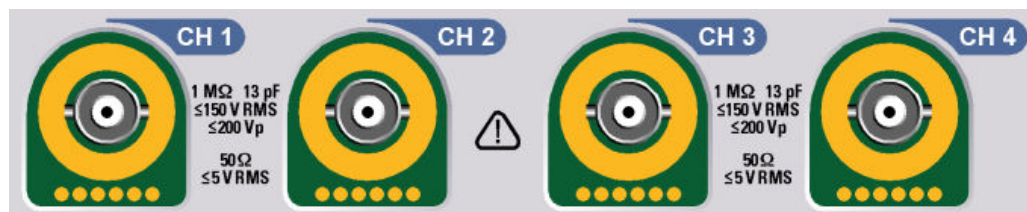
Opens the "Search" menu, where you can perform a search for various events in an acquisition - for example, peaks or specific width conditions - and analyze the search results.

ACQUISITION

Opens the "Acquisition" menu. Here you control the data processing - how the waveform is built from the captured ADC samples. The current acquisition mode is shown in the top information bar; it is the second value from right.

3.1.8 Input Channels

Input channels are the connectors for active and passive probes. The input impedance is selectable, the values are 50 Ω and 1 M Ω .

**CAUTION****Risk of injury**

If the input voltages are higher than 30 V RMS or 42 V peak or 60 V DC, use appropriate protective measures to preclude direct contact with the measurement setup.

CAUTION**Risk of injury and instrument damage**

The instrument complies with measuring category I; make sure that the input voltage does not exceed 200 V peak, 150 V RMS at 1 M Ω input impedance and 5 V RMS at 50 Ω input impedance.

Transient overvoltages must not exceed 200 V peak.

When performing measurements in circuits with transient overvoltages higher than category I, make sure that no such overvoltages reach the R&S RTM input. Therefore, use only probes that comply with DIN EN 61010-031. When performing measurements in category II, III or IV circuits, it is mandatory to insert a probe that appropriately reduces the voltage so that no overvoltages higher than category I are applied to the instrument. For detailed information, refer to the documentation and safety information of the probe manufacturer.

Explanation: Measuring circuits as defined in section 6.7.4 of EN 61010-1: Measuring category I is intended for measurements on circuits which are not connected to the mains system.

3.1.9 Front Connectors

The most important connectors are placed at the front panel.

**PROBE COMPENSATION**

Probe compensation terminal to support adjustment of passive probes to the oscilloscope channel.



Square wave signal for probe compensation with 1 kHz or 1 MHz frequency. You can adjust the signal in SETUP > "Probe Adjust".



Ground connector for probes.

USB

USB type A interface to connect a printer, or a USB flash device for storing and reloading instrument settings and measurement data, and to update the firmware. Another connector of this type is located at the rear panel.

3.2 Rear Panel

Figure 3-2 shows the rear panel of the R&S RTM with its connectors.



Fig. 3-2: Rear panel view of R&S RTM

- 1 = AC power supply connector and main power switch
- 2 = LAN connector
- 3 = USB connector, type B
- 4 = USB connector, type A
- 5 = Trigger output
- 6 = DVI-D connector for external monitor
- 7 = External trigger input
- 8 = Kensington lock slot to secure the instrument against theft

AC Supply: mains connector and main power switch

The instrument supports a wide range power supply. It automatically adjusts to the correct range for the applied voltage. There is no line voltage selector.

The AC main power switch disconnects the instrument from the AC power line.

LAN

8-pin connector RJ-45 used to connect the instrument to a Local Area Network (LAN). It supports up to 100 Mbit/s.

USB TYPE B

USB (universal serial bus) interface of type B (device USB) to be used for remote control of the instrument.

Note: Electromagnetic interference (EMI) can affect the measurement results. To avoid any impact, do use only USB connecting cables with a maximum length of 1 m.

USB TYPE A

USB interface of type A (host USB) to connect a printer, or a USB flash device for file transfer. Another connector of this type is located at the front panel.

MONITOR (DVI-D)

Digital connector for an external monitor.

EXT TRIGGER INPUT

The female connector for external trigger input is used to control the measurement with an external signal. The input impedance is 1 M Ω . The trigger level can be set from -5 V to 5 V. The maximum input voltage is 150 V peak.

TRIGGER OUTPUT

The BNC connector for external trigger output is used to provide the internal trigger signal of the oscilloscope to trigger other instruments for synchronized measurements. When a trigger occurs, the R&S RTM creates a pulse of 5 V with a source impedance of 50 Ω and delivers it to the external trigger output.

If the connector is terminated with 50 Ω , the signal level is 2.5 V (50 mA). With 1 M Ω termination, the level is 5 V. A short-circuit of the connector to ground creates current of 100 mA.

By default, the trigger output is off. To enable the trigger out signal, select SETUP > "Trigger Output" > "Output". Here you can adjust also the polarity and the length of the pulse. The default is a positive pulse of 1 μ s.

GBIP Interface (Option RTM-B10)

Interface for remote control with GBIP. The option replaces the LAN / USB type B interface module on the rear panel. Thus, remote control is possible either with LAN connection, or with GBIP.

3.3 Right Panel

At the right side of the instrument you find the connectors for digital probes, POD 1 and POD 2. The hardware module and digital probe come with the Mixed Signal Option R&S RTM-B1. The module provides connectors for two logical probes with 8 digital channels each (D0 to D7 and D8 to D15).

The maximum input voltage is 40 V peak at 100 k Ω input impedance. The maximum input frequency for a signal with the minimum input voltage swing of 500 mV (V_{pp}) is 400 MHz.



Fig. 3-3: Right panel view of R&S RTM

4 Trying Out the Instrument

This chapter introduces the most important functions and settings of the R&S RTM step by step. The complete description of the functionality and its usage is given in the "User Manual".

Prerequisites

- The instrument is set up, connected to the mains system, and started up as described in [chapter 2, "Preparing for Use"](#), on page 8.
- A passive probe is connected to the probe compensation pins of the instrument. The frequency of the adjustment signal is set to 1 MHz, and the probe is compensated as described in [chapter 6.3, "Adjusting Passive Probes"](#), on page 49.

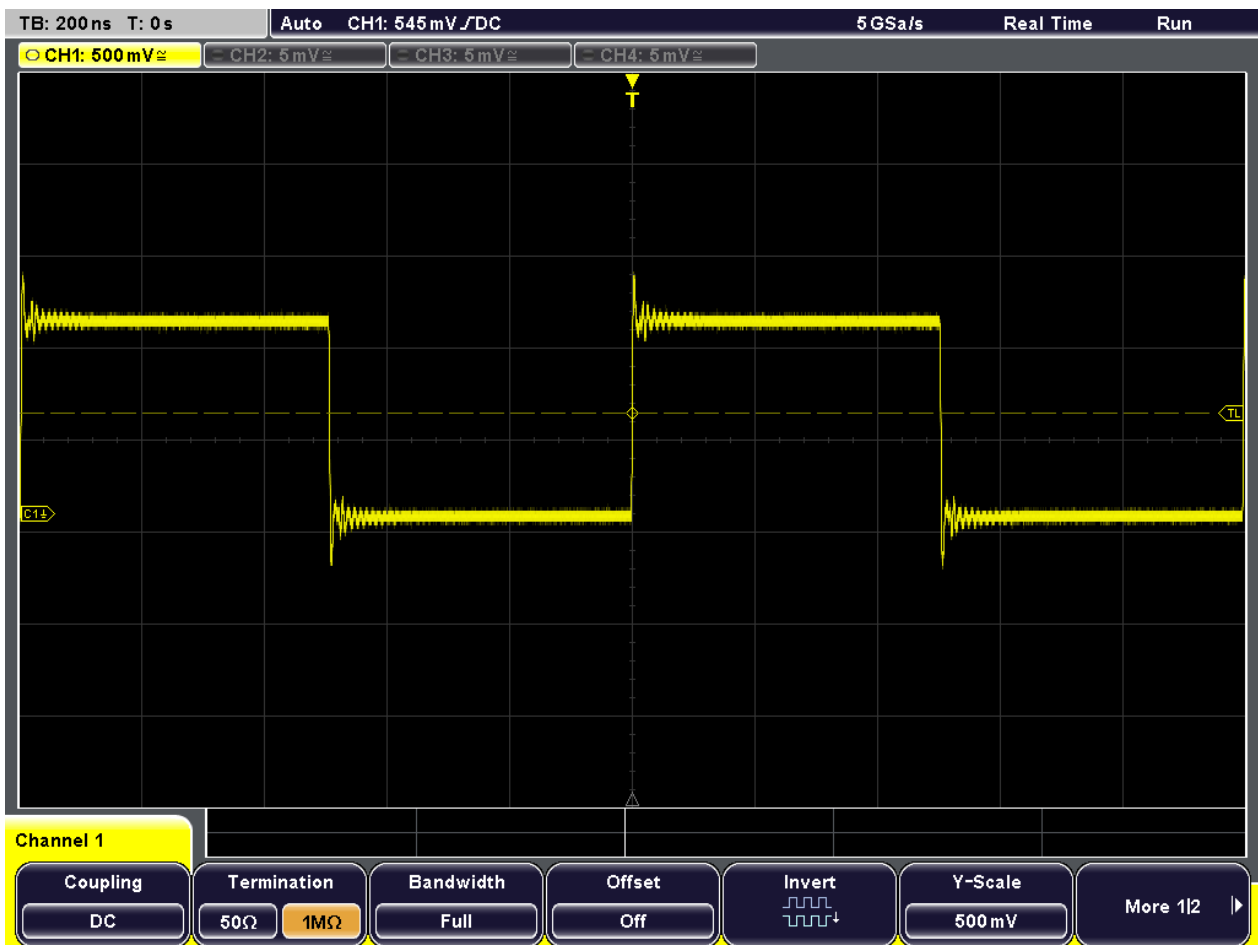
For configuration and measurements described in this chapter, you use the internal calibration signal, so you do not need any additional signal source or instruments. Try out the following:

• Displaying a Basic Signal	27
• Zooming into the Waveform	28
• Using the Virtual Screen	31
• Showing Basic Measurement Results	32
• Performing Cursor Measurements	34
• Using Mathematical Functions	36
• Printing Results	39
• Storing Data	40

4.1 Displaying a Basic Signal

When you connect the probe to the input connector CH 1, the instrument recognizes the probe and turns channel 1 on (the "CH1" key lights up).

- ▶ Press the AUTOSET key on the left of the screen.
Autoset finds appropriate horizontal and vertical scales and trigger conditions to present a stable waveform.
A square wave signal is displayed.

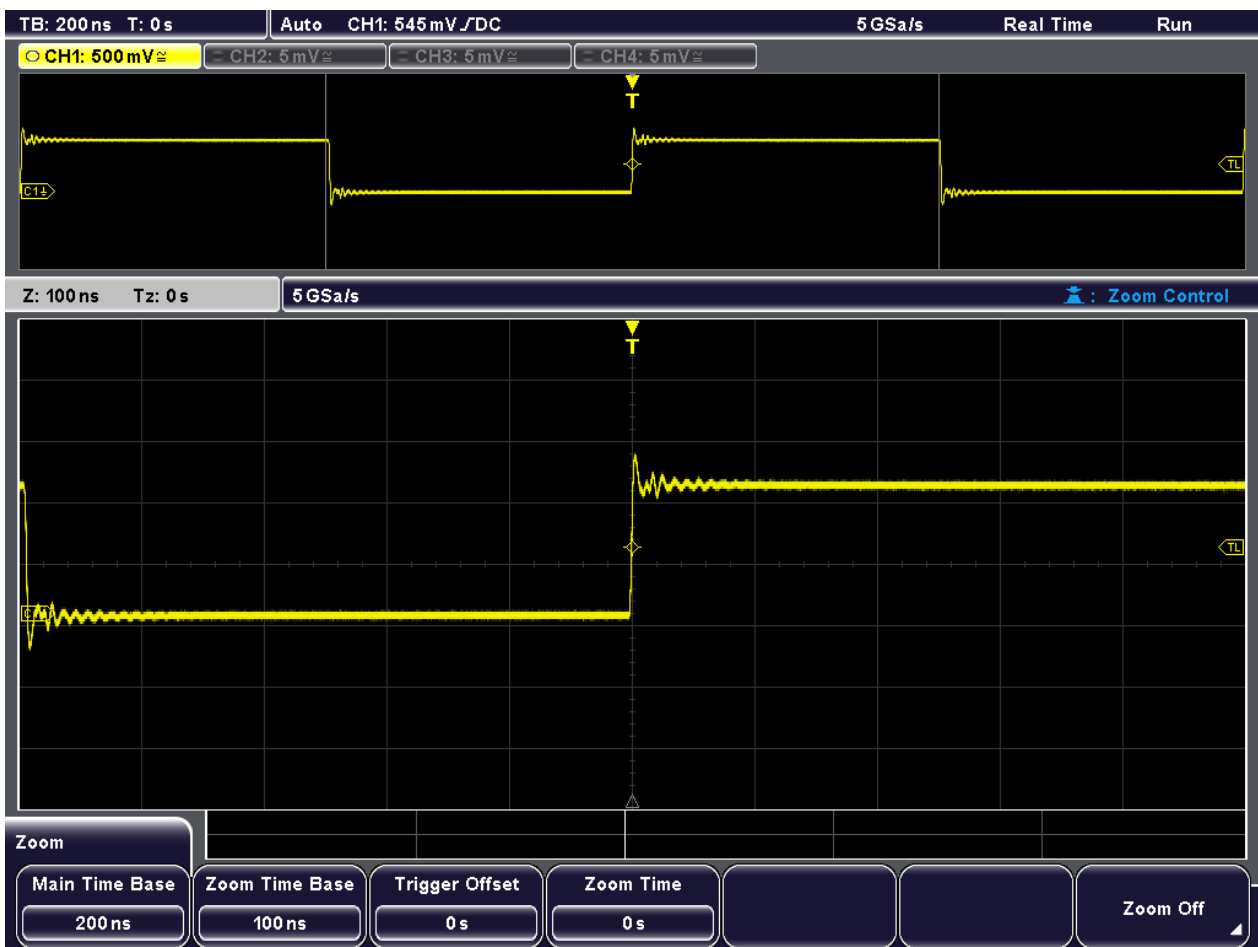


4.2 Zooming into the Waveform

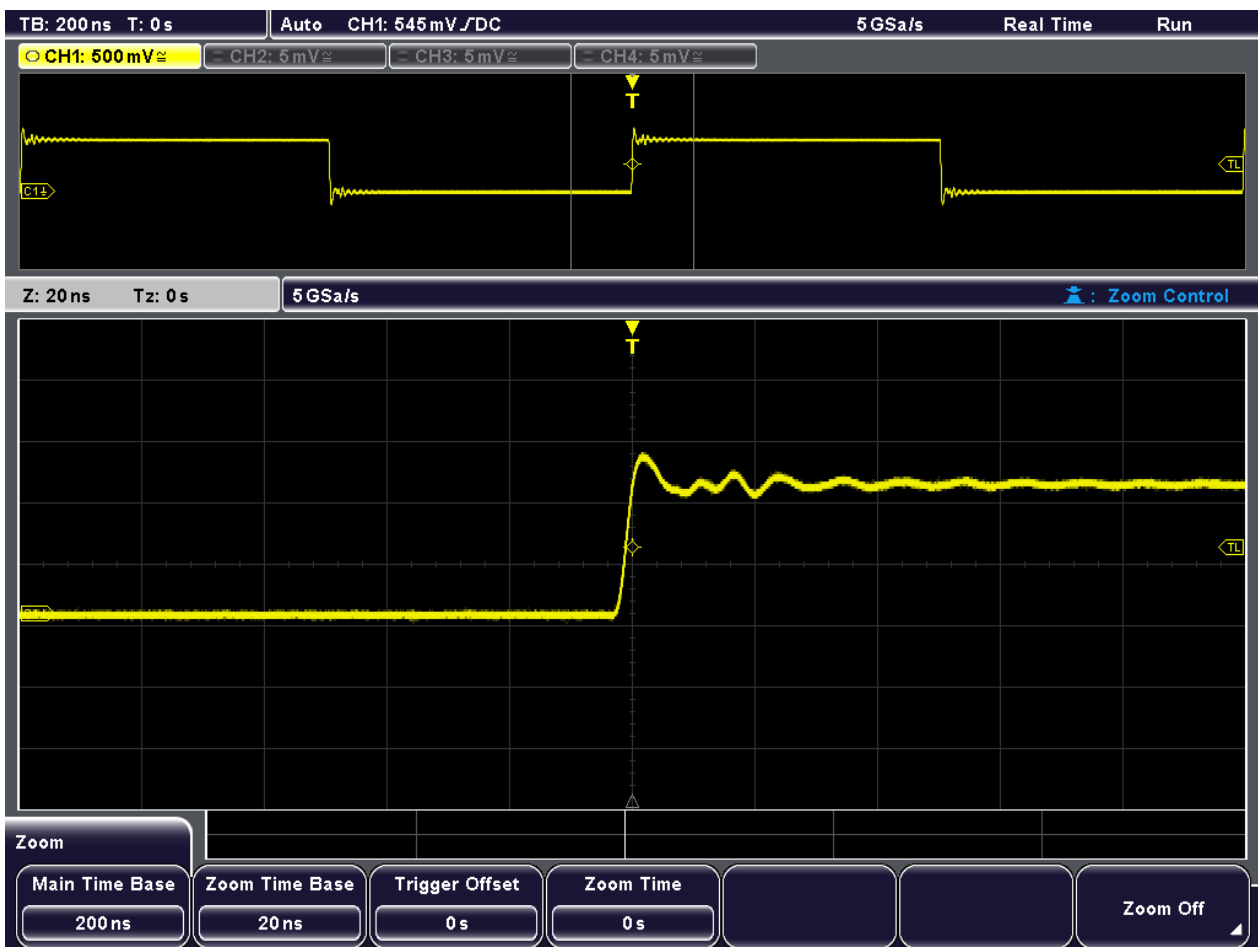
Using the SCALE rotary knobs you can change the scaling of the time base and signal amplitudes in order to enlarge the waveform. If you want to see more details, use the zoom function.

1. Press the ZOOM key.

The key lights up and two windows are displayed: the original signal vs. time at the top, the zoom window at the bottom. In the title line of the zoom window, "Zoom Control" mode is displayed.



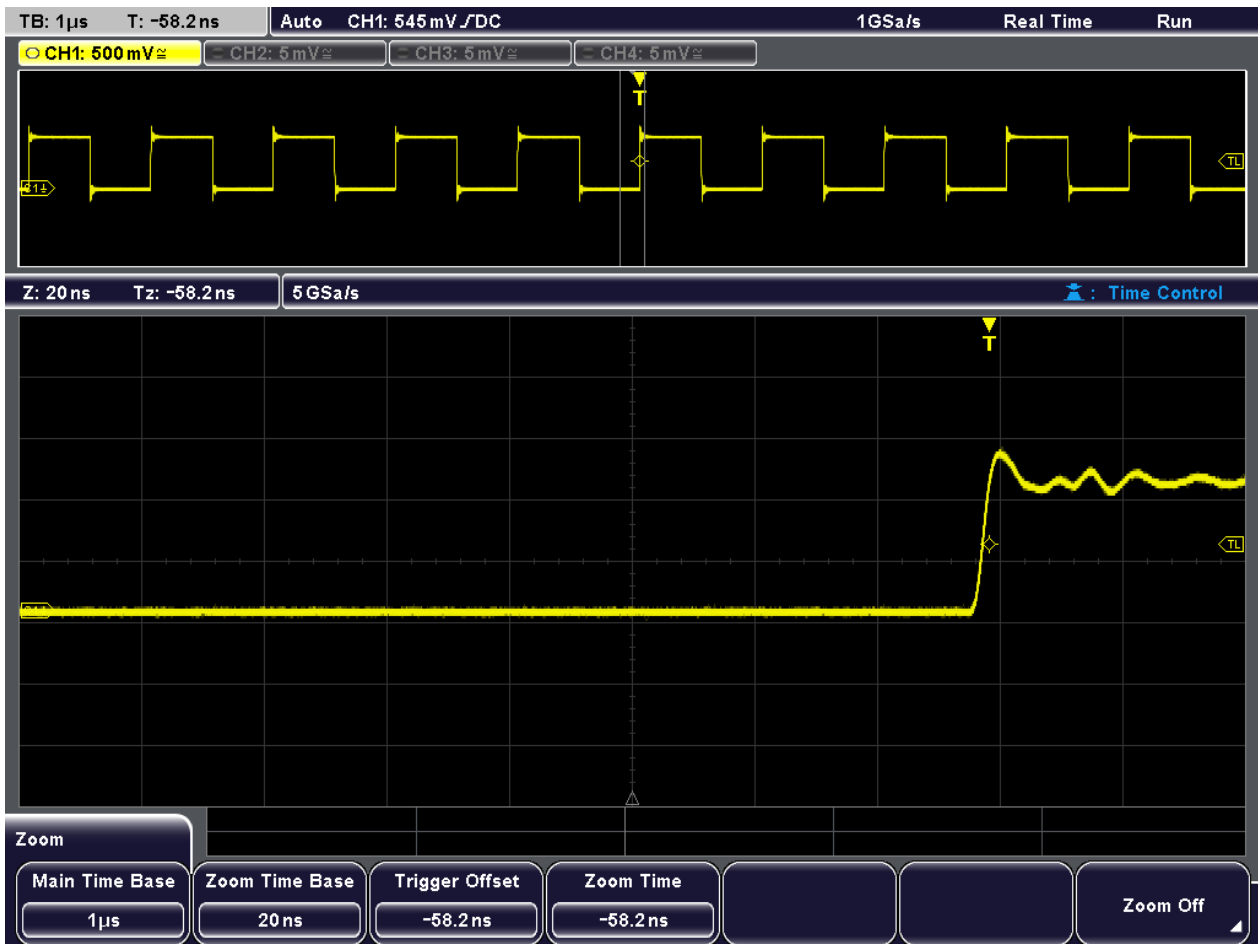
2. Turn the horizontal SCALE knob clockwise to see more details.
Note the zoom area that is marked in the upper window.



3. Press the horizontal SCALE knob until "Time Control" mode is displayed.

4. Turn the horizontal SCALE and POSITION knobs.

The time base of the channel 1 waveform changes, and the position of the zoom area, too. The zoom scale remains unchanged.



5. Press the ZOOM key again.
The zoom window closes.

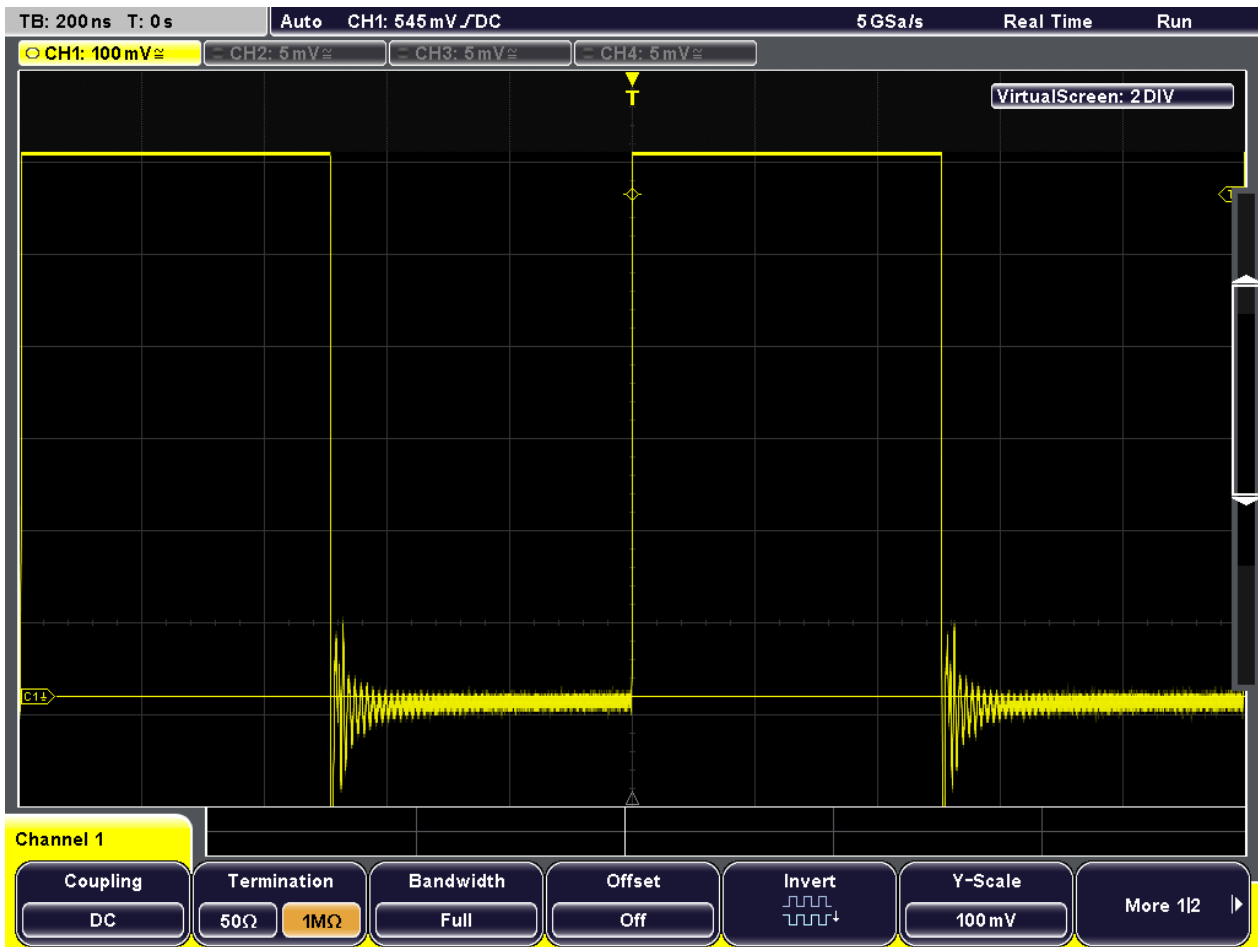
4.3 Using the Virtual Screen

The virtual screen allows you to distribute the waveforms over 20 divisions. 8 of these divisions are visible. You can scroll the divisions to select the visible part.

1. Press the AUTOSET key.
2. Turn the vertical SCALE knob clockwise until the vertical scale is 100 mV/div.
The scale value is displayed in the colored channel label on top of the window.
3. Press the "Intensity / Virtual screen" knob on the left until the "Virtual Screen" label is displayed.



4. Turn the knob clockwise until the complete waveform is visible.

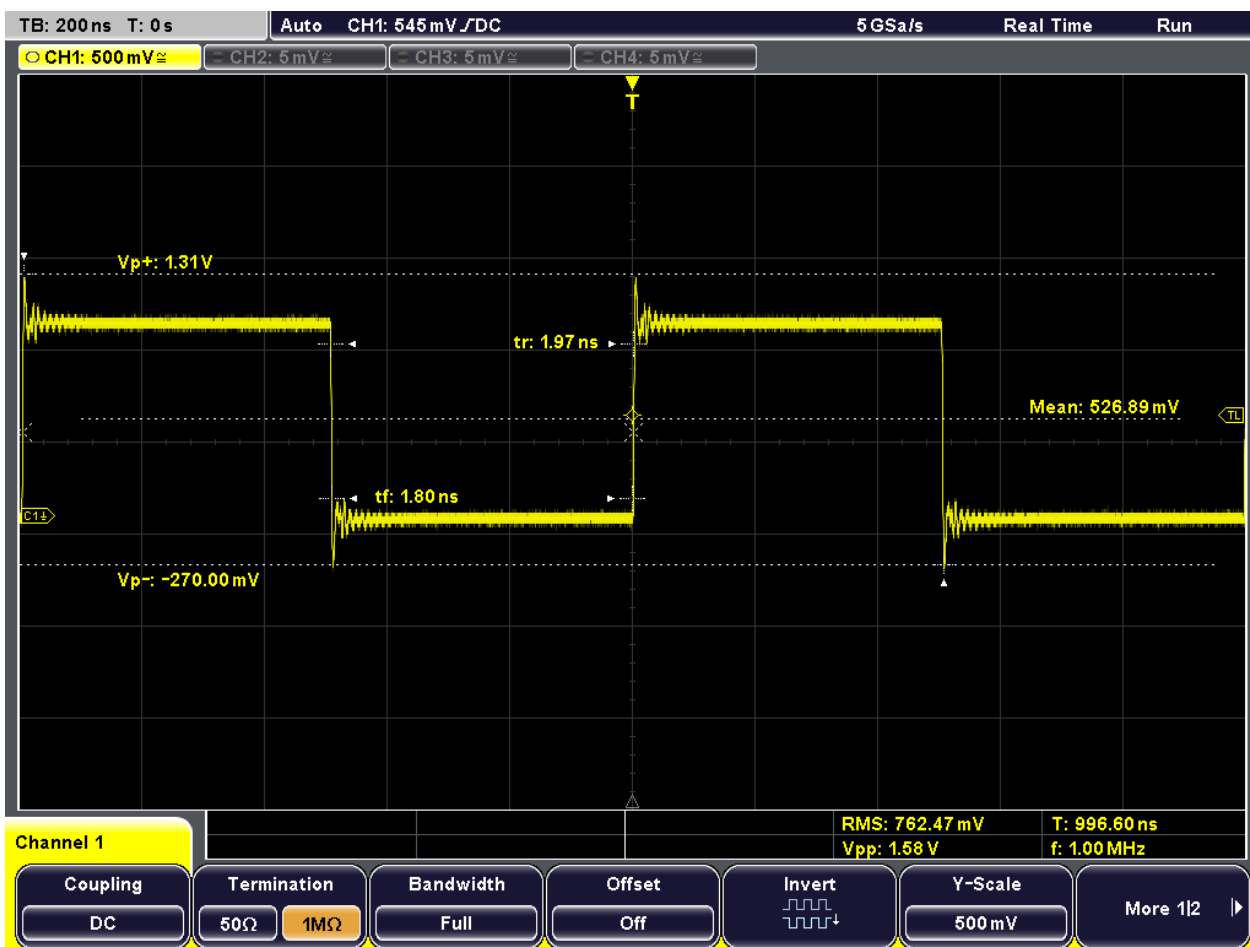


4.4 Showing Basic Measurement Results

All available basic measurement results for the selected channel can be displayed by pressing a single key - QUICK MEAS. The results are displayed either directly next to the waveform or in the result table beneath the diagram. The results include mean and peak values, as well as edge times and period length, where available.

Quick measurements

1. Press the AUTOSSET key.
2. Press the QUICK MEAS key.



Automatic measurements

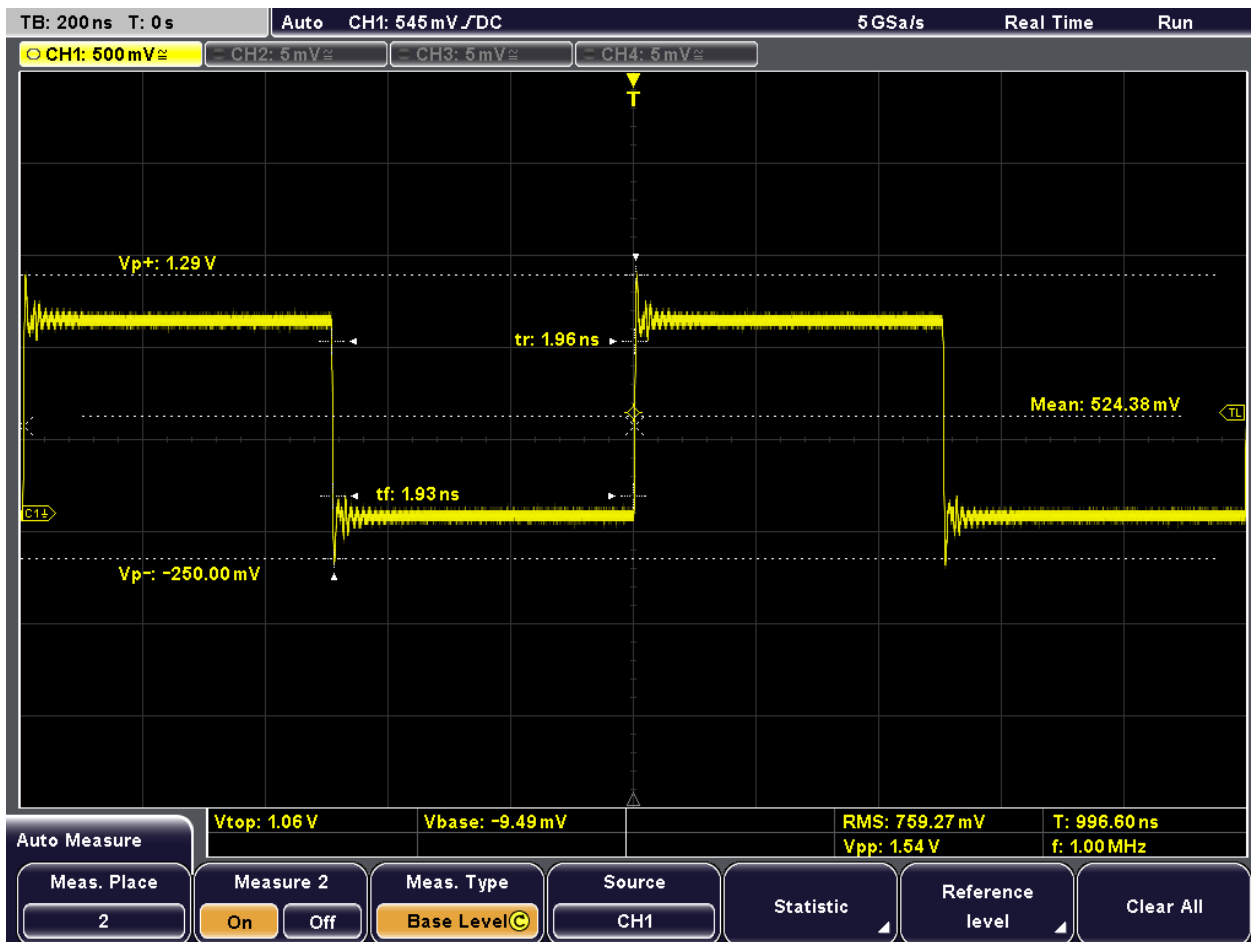
To obtain more complex measurement results, or results from several channels simultaneously, you can configure up to four amplitude and time measurements or pulse counts, based on the active signal or math waveforms.

For example, you can compare the amplitudes of an active signal waveform with those of a reference waveform. In the following example you will determine the top and base levels of the first pulse in the signal. The results are displayed in the result table below the diagram.

1. Press the MEAS key.
2. Press "Meas. Place" until 1 is highlighted to select the first of the four measurement positions.
3. Press "Measure 1" until "On" is highlighted.
4. Press "Meas. Type" until "Top Level" is highlighted.
5. Press "Source" until "CH1" is highlighted.
6. Press "Meas. Place" until 2 is highlighted to configure the second measurement position.

7. Press "Measure 2" until "On" is highlighted.
8. Press "Meas. Type" until "Base Level" is highlighted.
9. Press "Source" until "CH1" is highlighted.

The top and base level values of the active signal are displayed in the result table.



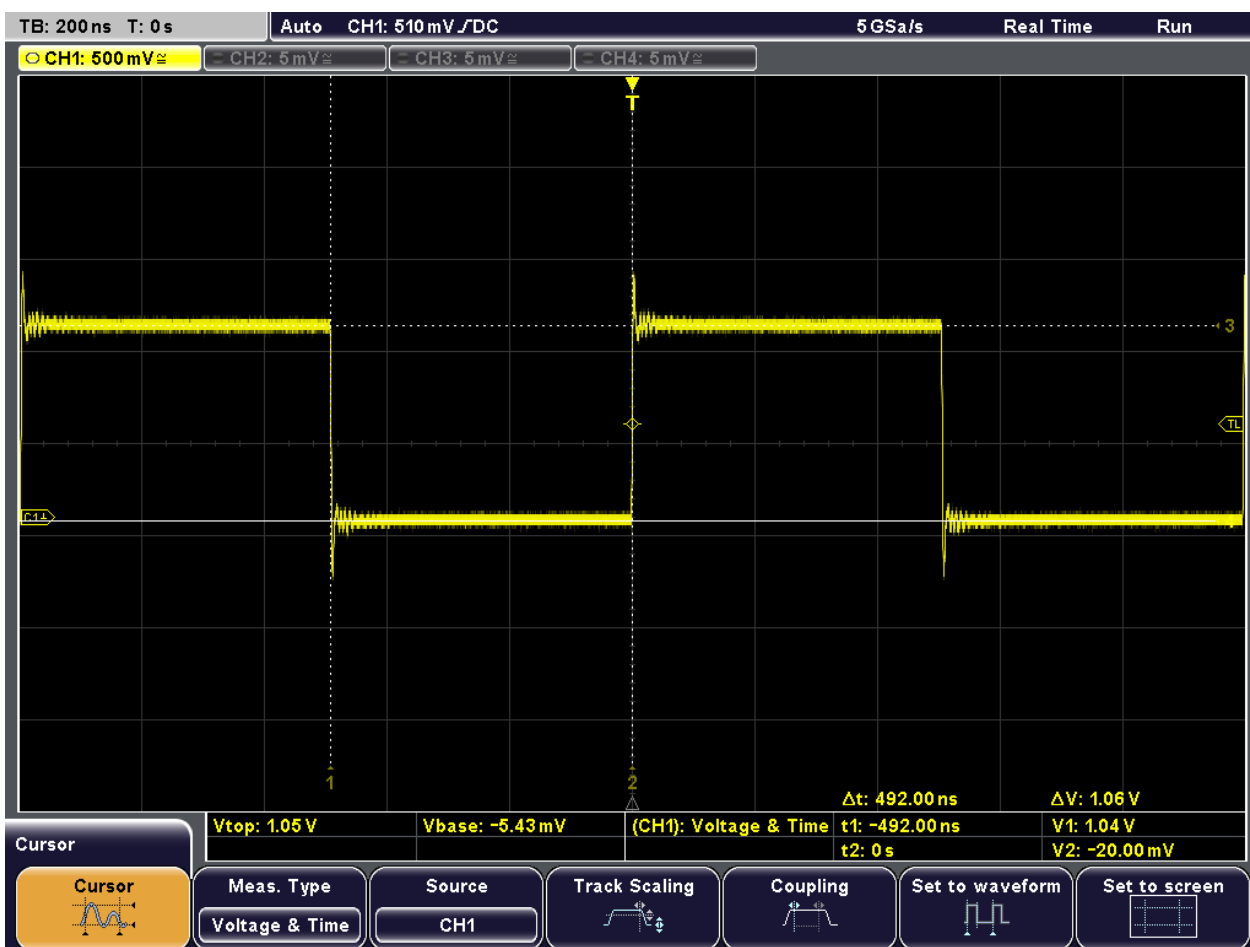
10. Press QUICK MEAS to turn off the quick measurement mode.

4.5 Performing Cursor Measurements

While the quick and automatic measurements provide results for the entire (visible) waveform or at pre-defined points, a cursor measurement allows you to specify at which points in the diagram you require results. Depending on the type of measurement, two or three cursors are positioned on the screen and the results for those points are displayed.

For example, using the voltage & time cursor measurement, you can position two vertical cursors at the pulse edges and the horizontal cursors at the levels. Thus the pulse width as well as top and base level voltages are measured.

1. Press the CURSOR key.
The cursor lines are switched on.
2. Press "Meas. Type" until "Voltage & Time" is highlighted.
3. Press "Source" until "CH1" is highlighted.
4. Press the NAVIGATION rotary knob to select the first cursor. Turn the rotary knob to move the cursor line to the beginning of a pulse.
5. Press the NAVIGATION rotary knob again to select the second cursor. Turn the rotary knob to move the cursor line to the end of the pulse.



6. Repeat the step to position the horizontal cursors.
The following results are displayed in the result table.
 - Δt : pulse width
 - $t1$, $t2$: time of the cursor positions, measured from the trigger point
 - ΔV : difference between top and base level
 - $V1$: top level voltage
 - $V2$: base level voltage

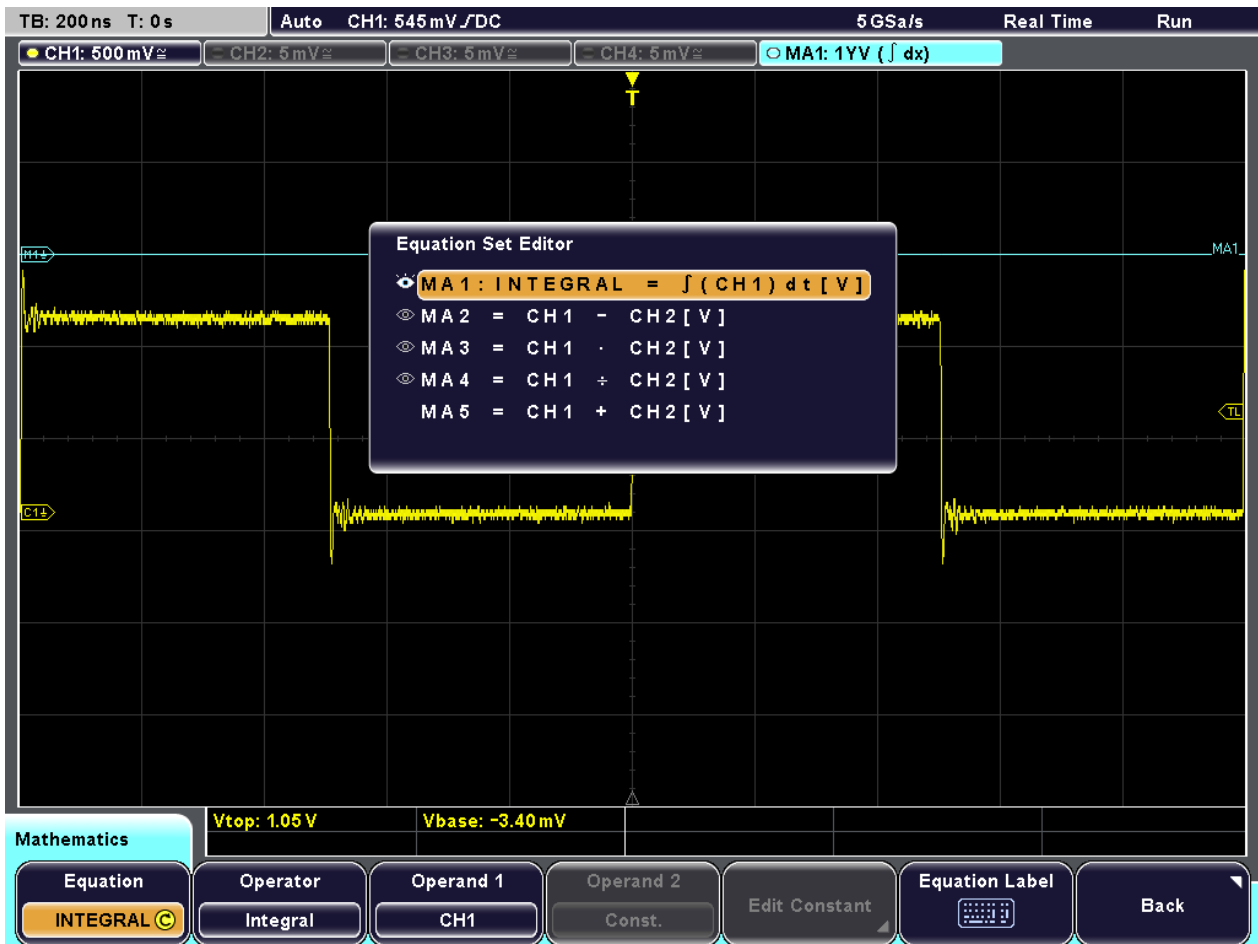
7. Press "Cursor" to turn off the cursor lines.

4.6 Using Mathematical Functions

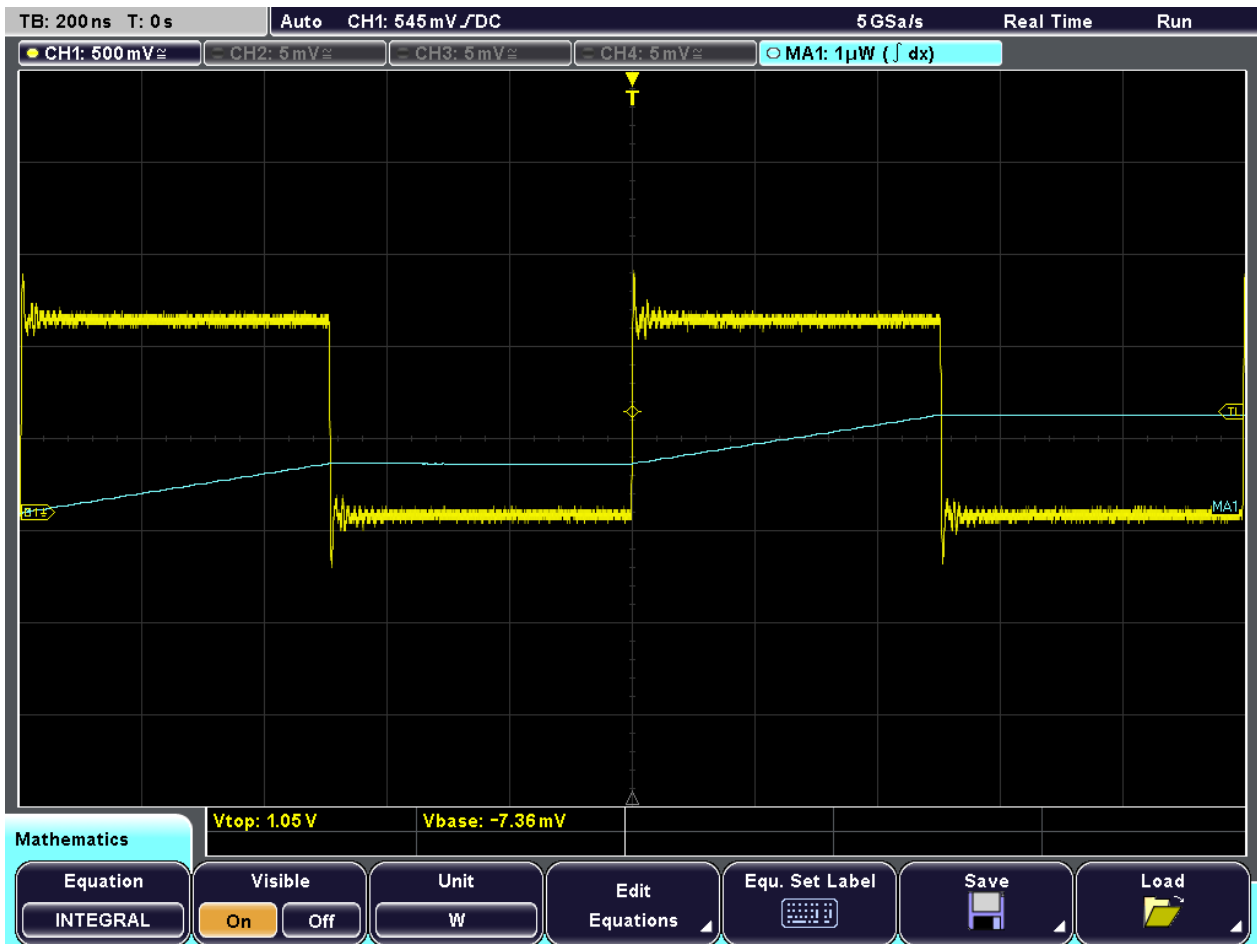
In addition to the measured waveforms, you can display calculated data to compare the current measurement result with. Five mathematical waveforms are available that can be configured to perform various calculations on the available source signals.

For example, you can determine the power of a pulse signal by calculating the integral of the waveform. To determine the power of a single pulse, use a V-marker cursor on the math waveform.

1. Press MATH to display the "Mathematics" menu.
2. Press "Equation" until "MA1" is displayed to configure the first math waveform.
3. Press "Edit Equations".
The "Equation Set Editor" is displayed, where you can see the configuration for each mathematical waveform. The active equation is highlighted.
4. Press "Equation" until "MA1" is displayed to configure the first equation. This equation is assigned to the first measurement channel (MA1).
5. Press "Operator" until "Integral" is highlighted.
6. Press "Operand1" until "CH1" is highlighted to select the first signal channel as the source of the calculation.
7. Press "Equation Label" to define a name for the equation, e.g. "Integral". Use the NAVIGATION rotary knob to select the individual characters, then press "Accept".
This label is displayed on the "Equation" softkey and in the "Equation Set Editor".



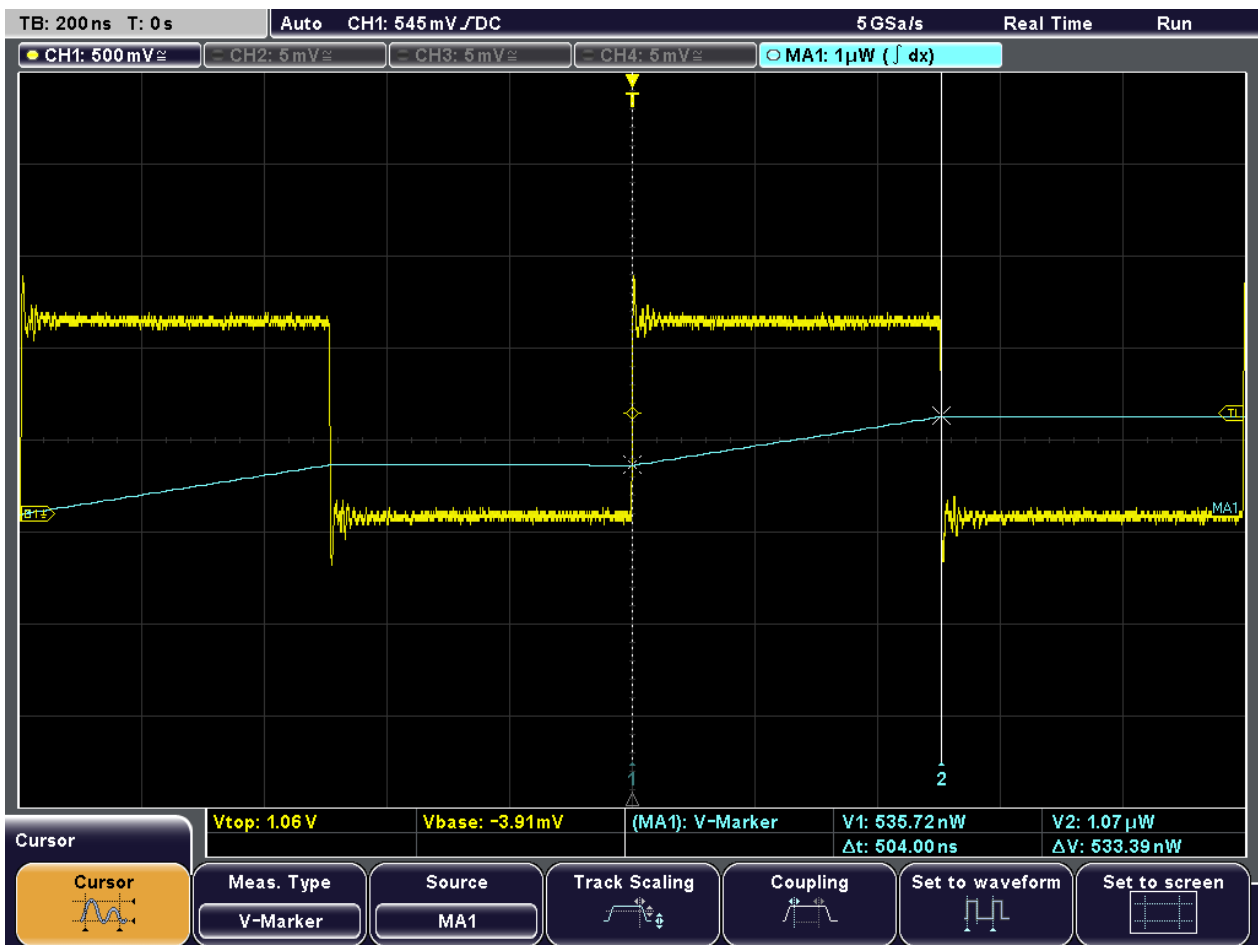
8. Press "Back" to exit the editor and return to the main "Mathematics" menu. The integral values of the signal channel are displayed as an additional waveform. If necessary, change the vertical scaling of the math waveform to improve the display using the vertical SCALE rotary knob.
9. Press "Unit" until W (Watt) is highlighted to define the unit for the calculated power of the signal.



- To display the integral of a single pulse, configure a V-marker cursor whose source is the first math waveform ("MA1" or "Integral") and position the cursors at the beginning and at the end of the pulse.

The procedure is described in the previous example, [chapter 4.5, "Performing Cursor Measurements"](#), on page 34.

The integral between the two cursors is displayed as " ΔV " in the result table.



4.7 Printing Results

You can print screenshots of the current display to document your results. For improved readability, you can invert the colors displayed on the screen for printing, i.e. a dark waveform is printed on a white background.

1. Attach a printer to the USB interface on the front or rear panel.
2. Press the FILE key.
3. Press the "Screenshots" softkey.
4. Press "Color Mode" until "Inverted" is highlighted to print inverted colors.
5. Press "Print".

A screenshot of the current display is printed with a white background and black data.



For your convenience, you can configure print settings initially and then print screenshots simply by pressing the PRINT key at any time during your measurement. This procedure is described in "Quick Access with PRINT Key" in the "User Manual".

4.8 Storing Data

After a measurement with the R&S RTM, you can save the results for further evaluation or comparison. The following kind of data can be stored:

- Data from measured, reference or calculated (math) waveforms
- Instrument settings
- Mathematical equations
- Screen displays

Waveform data and screen displays can only be stored on USB storage devices, while the other data can be stored also in the internal storage device of the instrument.

In the following example, you will save the device settings of the current measurement, then reset the device and load the device settings again to repeat the initial measurement.

1. Press the FILE key, then "Device Settings".
2. Press "Save".
3. Press "Storage" until "Internal" is selected to save the settings on the device.
4. Press "File Name" and enter the name "Example01".
5. Press "Accept".

The device settings are stored in a file named `Example01.SET` on the device.

6. Press PRESET to reset the R&S RTM to its default settings.
7. In order to repeat the initial measurement, load the stored device settings. Press the FILE key, then "Device Settings".
8. Press "Load".
9. Press "Storage" until "Internal" is selected to load the settings file from the internal storage location.
10. Select the file named `Example01.SET` using the NAVIGATION rotary knob.
11. Press "Load".

The device settings are restored, and you can repeat the initial measurement.



For your convenience, you can configure storage settings initially and then save data or settings simply by pressing the PRINT key at any time during your measurement. This procedure is described in "Quick Access with PRINT Key" in the "User Manual".

5 Operating the Instrument

There are two ways to operate the R&S RTM:

- Manual operation: Use the function keys, rotary knobs and softkeys on the front panel to control the instrument. The principles of manual operation are explained in this section.
- Remote control: Create programs to automatize repeating settings, tests and measurements. The instrument is connected to a computer that is running the program. This way of operation is described in the "User Manual", in the "Remote Control" chapter.

5.1 Understanding Display Information

Besides the waveforms, the display of the instrument shows also information, measurement results and softkey menus. Figure 5-1 shows an overview of the display elements.

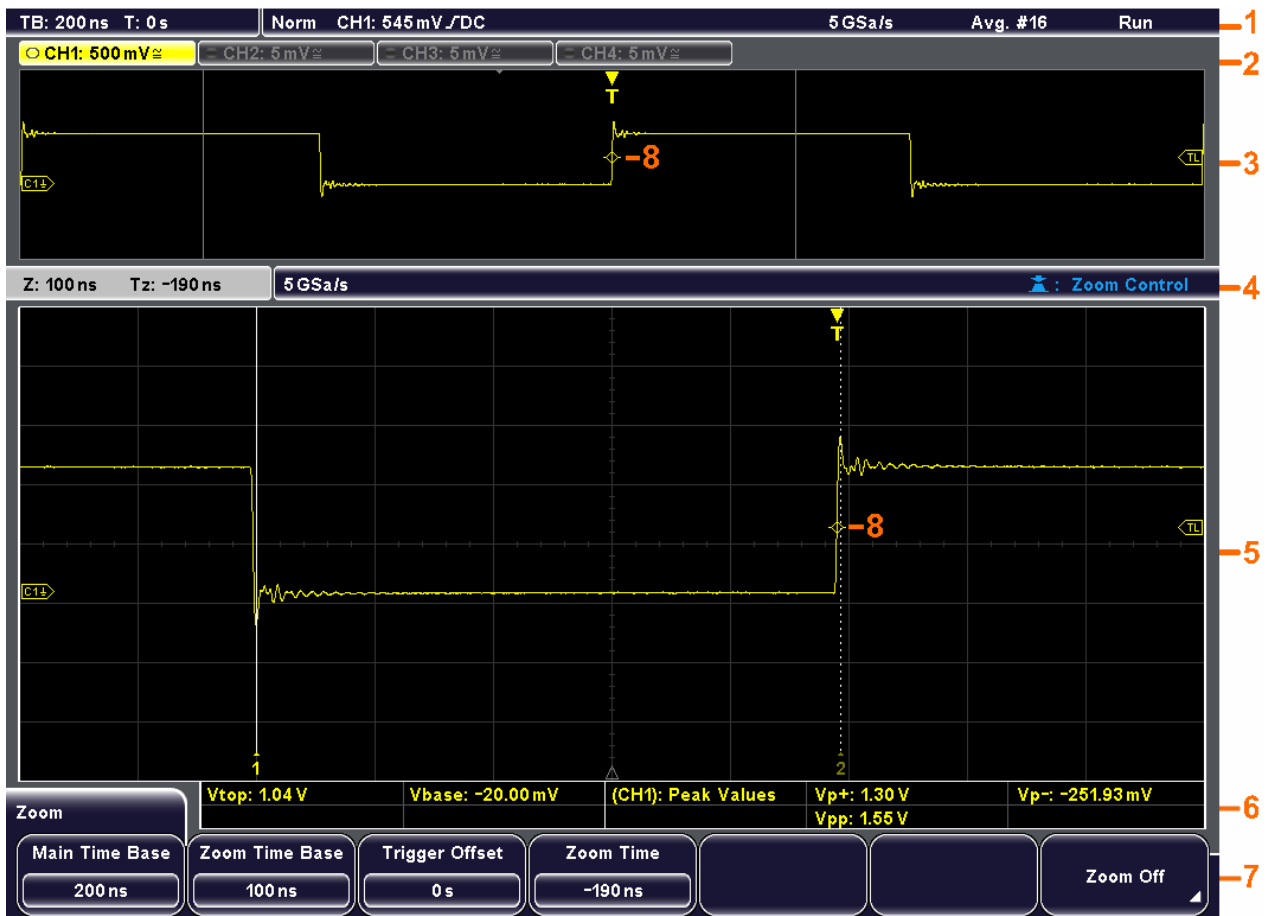


Fig. 5-1: Display overview

- 1 = Information bar
- 2 = Waveform labels
- 3 = Waveform window
- 4 = Information bar of the Zoom window
- 5 = Zoom window
- 6 = Results table
- 7 = Menu
- 8 = Trigger position

Information bar

The upper part of the display shows the information bar with main settings:



- 1 = Time base (horizontal scale)
- 2 = Trigger offset (horizontal position)
- 3 = Trigger mode
- 4 = Trigger settings: Trigger source, trigger type settings (for Edge trigger: level, slope, coupling, filter)
- 5 = Sample rate
- 6 = Acquisition mode
- 7 = Acquisition state

Zoom and FFT windows have their specific information bars which are described in the correspondent chapters in the "User Manual".

Waveform labels

The labels for channel, math and reference waveforms show the vertical scale value and the coupling. The label of the selected waveform is highlighted with the waveform color.



Windows

The main window shows one or more waveforms: channel waveforms, reference and math waveforms. The grid marks the vertical and horizontal divisions. If zoom, FFT or XY-view is selected, the display shows two or more windows. The zoom, FFT or XY-trace appear in the large main window. The basic waveforms are shown in smaller windows for overview.

Results table

Results of automatic and cursor measurements are shown in the results table. Results of configured measurements appear in the two left columns. Cursor and Quick Meas results are shown in the three columns on the right.

Vtop: 617.17 mV	Vbase: -34.04 mV	(CH1): V-Marker	V1: 908.00 mV	V2: -348.00 mV
t _{FL} : 126.50 ns	Cnt FL: 2		Δt: 126.00 ns	ΔV: 1.25 V

Menu

Shows the current functions of the softkeys.

Trigger position

The trigger position marker and the trigger level marker have the color of the trigger source waveform.

5.2 Working with Waveforms

The R&S RTM can acquire, create and display several waveform types:

- Channel waveforms from input signals
- Reference waveforms:
Four reference waveforms can be used as references for comparison and analysis.
- Math waveforms:
Five mathematic waveforms can be created with mathematic operations performed on channel, reference and other math waveforms. Four math waveforms can be displayed on the screen.
- Zoom waveforms show the details of the active waveforms
- XY-waveform: this waveform is build from the voltage values of two channel waveforms. The intensity of the xy-waveform can be defined by a third channel waveform.
- Digital channels (logic signals) if Mixed Signal Option R&S RTM-B1 is installed

The color system helps to distinguish the various waveforms. The color of the vertical rotary knobs and the waveform label indicate the selected waveform - the waveform that is focused.

Waveform states

Depending on its display and the effect of settings, a waveform has one of the following states:

- Off
- Active: The waveform is shown
- Selected: One of the active waveforms that has the focus. All waveform-specific settings are applied to the selected waveform. The POSITION and SCALE knobs and the SIGNAL OFF key light up in the color of the selected waveform, and the waveform label is highlighted. If several waveforms are displayed, the selected waveform appears "on top".

To switch on a channel waveform

A channel waveform is activated as soon as you connect the probe. You can switch it on and off according to your needs.

- ▶ To switch on a channel waveform, press its channel key.
The waveform appears in the window; it is active and selected.

To switch off a channel waveform

- ▶ Select the waveform by pressing its channel key, and then press SIGNAL OFF.

5.3 Accessing the Functionality

You control the instrument with function keys and softkeys. Softkeys are located below the screen; their current functionality is shown in the menu.

Function keys (hardkeys)

Depending on the function behind, the function keys have different effects:

- Most of the function keys open the associated menu - for example, FILE, MEAS, ACQUISITION.
- Another group of function keys directly start an action or change a parameter - for example, AUTOSET, PRINT, RUN CONT, MODE.
- The FFT and ZOOM keys start the corresponding display mode and open the associated menu.

To leave the display mode:

- If the main menu of the mode is shown, press the function key once.
- If a submenu of the mode is shown, press the function key twice - first to return to the main menu and second to close the display mode.
- Press the "Off" softkey in the main menu of the mode.

Using menus

A menu can have several menu levels. If a lower menu level is available, it is indicated by a small arrow on the softkey. If a menu level has more than 7 functions, they are arranged on two or more pages. The "More" key on the right switches the menu page. It shows the overall number of pages on the current menu level and the number of the selected page.

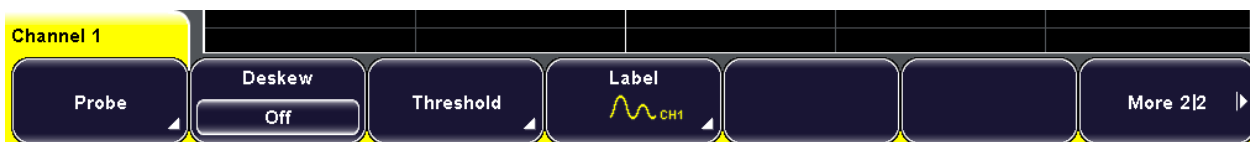


Fig. 5-2: Channel menu: "Probe", "Threshold" and "Label" open submenus, "More" switches the menu pages

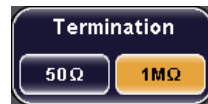
1. Press the function key.
The associated menu opens.
2. If the required function is not in the menu, press the "More" softkey on the right to browse the menu pages.
3. To return to a higher menu level, press the "Back" softkey on the right.



Selecting a value

Many parameters are set by selecting a parameter value. If there are only two or three values available, they are shown directly on the softkey. More values are provided in a selection menu.

1. To select a value on the softkey, press the key until the required value is highlighted.



2. To select a value from a selection menu, use one of these ways:
 - Press the key until the required value is highlighted.
 - Turn the NAVIGATION knob until the required value is highlighted.



3. To close a selection menu immediately, press the NAVIGATION knob. Otherwise, the selection menu closes automatically when the "Menu Off" time is expired ("Setup" menu).

5.4 Entering Data

Numeric values are set with the NAVIGATION knob. For scale and position settings, use the corresponding rotary knobs.

Some numeric parameters - for example, "DC Offset" - provide the choice between "Off" and a value. These values can be set only with the NAVIGATION knob.

Other parameters - for example, in the "Zoom" menu - always have a numeric value. These values can be set with the NAVIGATION knob or with the on-screen keypad.

To open the on-screen keypad

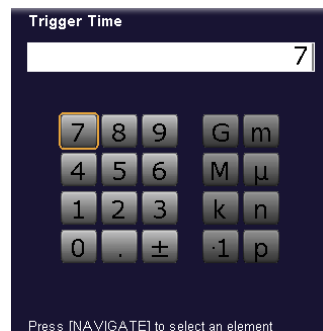
1. Press the softkey of the numeric parameter.

The NAVIGATION knob is enabled, its icon appears on the softkey.



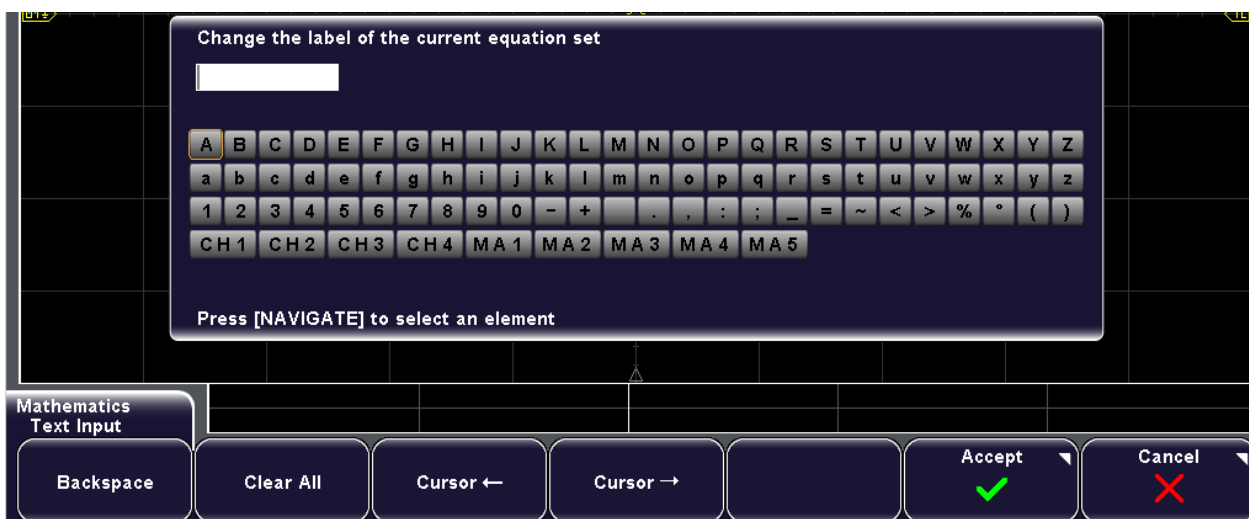
2. Press the softkey again.

The on-screen keypad opens.



To enter data with the on-screen keypad or keyboard

On-screen keypad and keyboard are used in the same way. When text input is required, the on-screen keyboard is displayed automatically.



1. For each character to be entered, turn the NAVIGATE knob until the required character is highlighted, then press the knob.
2. To delete the character to the left of the cursor in the input line, press "Backspace".
3. To move the cursor within the input line, press "Cursor ←" or "Cursor →".
4. To delete the entire entry, press "Clear All".
5. When you have completed your entry, press "Accept" to store the input on the instrument.

5.5 Getting Help

The integrated help system provides the description of all function keys, rotary knobs and softkeys.

To show Help

1. Press the yellow HELP key on the left of the display.
The help window opens.
2. Press the key or softkey for which you need information.
The content of the help window shows the description of the last used control.

To hide Help

- ▶ Press the HELP key again.

6 Instrument Setup

6.1 Defining General Instrument Settings

This chapter describes how to define general instrument settings.

6.1.1 Setting Data and Time

Year, month, day, hour and minute can be set individually.

1. Press SETUP > "Date & Time".
2. Press "Year".
3. Select the current year using the NAVIGATION knob.
4. Press "Month".
5. Select the current month using the "Navigation" knob.
6. Set "Day", "Hour", and "Minute" in the same way.
7. Press "Accept" to save the changed date and time on the instrument.

6.1.2 Configuring Sounds

You can define the event types for which a sound is to be generated by the instrument.

1. Press SETUP > "Sound".
2. Press the softkey for the event types for which a sound is to be generated. Active sounds are highlighted. The following event types are available:
 - **Control Beep**: Generates a sound for general control events, e.g. reaching the rotary encoder end or changing the measuring mode in the "Auto Measure" menu.
 - **Error Beep**: Generates a a sound if an error occurs in the instrument, e.g. when the input exceeds 50 Ω or a false value is entered in a dialog.
 - **Trigger Beep**: Generates a sound when the trigger condition is fulfilled.

6.1.3 Setting the Language

You can change the language of the softkey labels and other information displayed on the screen with a single softkey. A reboot of the instrument is not necessary.

Supported languages are listed in the data sheet.

To set a language

1. Press SETUP > "Language".
2. Press the key for the required language.



If the online help is not available for the selected language, the English help is displayed.

To reset the language to English, press the HELP key while the instrument is starting up.

6.2 Performing a Self-Alignment

The self-alignment aligns the data from several input channels vertically and horizontally in order to synchronize the time bases, amplitudes and positions. The self-alignment process includes a basic hardware check.

Recommendation on performing the self-alignment:

- when putting the instrument into operation for the first time
- once a week
- when major temperature changes occur (> 5°)

NOTICE

Warm-up the instrument

Make sure that the instrument has been running and warming up before you start the self-alignment. The minimum warm-up time is indicated in the data sheet.

1. Remove all signal lines from the channel connectors and external inputs.
2. Press SETUP > "Self Alignment".
3. Press "Start" to start the internal alignment.

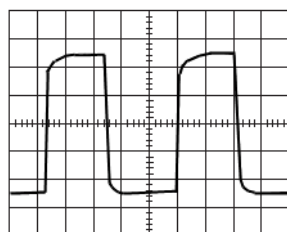
6.3 Adjusting Passive Probes

R&S RTM-ZP10 passive probes are already pre-compensated to the R&S RTM front-end characteristics, and a compensation procedure is not required.

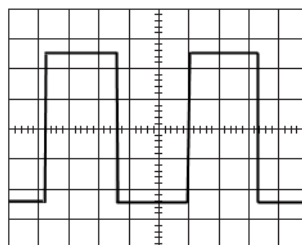
If you use other passive probes, the R&S RTM allows you to compensate it when it is connected to the instrument the first time. Compensation matches the probe cable capacitance to the oscilloscope input capacitance to assure good amplitude accuracy from DC to upper bandwidth limit frequencies. A poorly compensated probe reduces the performance of the probe-oscilloscope system and introduces measurement errors resulting in distorted waveforms and inaccurate results.

Two connector pins are located on the front panel. The right pin is on ground level. The left pin supplies a square wave signal for the adjustment. You can choose between two frequencies for usual low frequency compensation and additional high frequency compensation. The rise time does not differ between the settings.

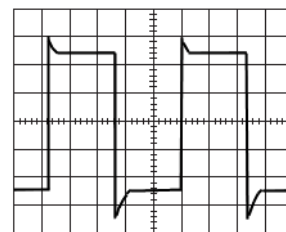
1. Connect the BNC connector of the probe to input CH1.
2. Connect the probe's ground connector to the right compensation pin, and the tip with the left pin.
3. Select SETUP > "Probe Adjust".
4. Select the frequency for the adjustment signal by pressing the corresponding soft-key. The following frequencies are available:
 - **1kHz**: A square wave with a frequency of $f = 1$ kHz is generated at the probe compensation pin. Use this setting to adjust the LF band of the probe.
 - **1MHz**: A square wave with a frequency of $f = 1$ MHz is generated at the probe compensation pin. Use this setting to adjust the HF band of the probe.
 - **Automatic**: A square wave is generated at the probe compensation pin. The frequency of the square wave depends on the defined time base. If the time base becomes too small to display the 1 kHz wave, it is automatically switched to a 1 MHz wave. It is recommended that you do not use this setting for probe compensation.
5. Press AUTOSSET.
A square wave appears on the display.
6. Adjust the compensation trimmer of the probe to optimum square wave response. For details, refer to the documentation of your probe.



undercompensated



optimum



overcompensated

7 Maintenance

The instrument does not need a periodic maintenance. Only the cleaning of the instrument is essential.

To protect the front panel and to transport the instrument to another workplace safely and easily, two accessories are provided:

- Soft case (R&S RTM-Z3, order number 1305.0289.02)
- Front cover (R&S RTM-Z1, order number 1305.0272.02)

Follow the instructions in the service manual and the safety instructions when exchanging modules or ordering spares. The order no. for spare parts is included in the service manual. The service manual includes further information particularly on troubleshooting, repair, exchange of modules and alignment.

The addresses of Rohde & Schwarz support centers can be found at www.customer-support.rohde-schwarz.com. A list of all service centers is available at www.services.rohde-schwarz.com.

7.1 Cleaning

The outside of the instrument can be cleaned sufficiently using a soft, lint-free dust cloth. Make sure that the fan openings are not obstructed.

WARNING

Shock hazard

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

NOTICE

Instrument damage caused by cleaning agents

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

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

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

NOTICE**Risk of instrument damage due to obstructed fans**

If the instrument is operated in dusty areas, the fans may become obstructed by dust or other particles in the process of time. Make sure to check and, if necessary, clean the fans regularly to ensure they operate properly at all times. If the instrument is run with obstructed fans for a longer period, it may become overheated which may cause damage.

7.2 Storing and Packing

The storage temperature range of the instrument is given in the data sheet. If the instrument is to be stored for a longer period of time, it must be protected against dust.

Repack the instrument as it was originally packed when transporting or shipping. The two protective foam plastic parts prevent the control elements and connectors from being damaged. The antistatic packing foil avoids any undesired electrostatic charging to occur.

If you do not use the original packaging, use a sturdy cardboard box of suitable size and provide for sufficient padding to prevent the instrument from slipping inside the package. Wrap antistatic packing foil around the instrument to protect it from electrostatic charging.

7.3 Replacing the Fuses

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

Type of fuses: Size 5x20 mm, 250 V~, T 3.15 H (slow-blow), IEC 60127-2/5

⚠ 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.

1. Pull the fuse holder out of its slot on the rear panel.
2. Exchange the two fuses.
3. Insert the fuse holder carefully back in its slot until it is latched.

7.4 Data Security

If you have to send the instrument to the service, or if the instrument is used in a secured environment, consider the document "Instrument Security Procedures" that is delivered on the documentation CD-ROM and on the R&S RTM internet web page.

You can delete all current instrument configuration data and user data with SETUP > "More > More > Secure Erase > OK".

Index

A

Acquisition	
Limited number	18
Start and stop	18
ACQUISITION	22
Active waveform	43
AUTOSET	15

B

Bench top operation	9
---------------------------	---

C

Channel	
Connector	23
Keys	20
Channel waveforms	43
Cleaning	51
Compensation, passive probes	49
Connecting	
Printer	13
USB flash drive	13
Controls	
Intensity	15
Position / Offset (vertical)	20
Scale (vertical)	20
CURSOR	16

D

Date	48
Display	
Language	48
DISPLAY	15
Display information	41
DVI connector	24

E

EMI suppression	12
External trigger input	25

F

FFT	18
FILE	15
FORCE	18

H

HELP	15
Help, usage	46

I

Information bar	42
Information on display	41
Intensity	15
Interface	
Language	48

K

Kensington lock	23
Keys	
ACQUISITION	22
AUTOSET	15
CH N	20
CURSOR	16
DISPLAY	15
FFT	18
File	15
HELP	15
MATH	20
MEAS	16
NEXT	21
PRESET	15
PREV	22
PRINT	15
QUICK MEAS	16
REDO	17
REF	20
SETUP	15
SIGNAL OFF	20
UNDO	17
ZOOM	21

L

LAN	
Connector	24
Language	48
LEVEL	19

M

Markers	
Go to next	21
Go to previous	22
MATH	20
Math waveforms	43
MEAS	16
MODE	18
Monitor	13
Monitor connector	24

N

NEXT	21
------------	----

O

Offset	20
Operation concepts	41

P

Packing	52
Position	
Horizontal	21
Vertical	20
Power	24
Power off	
Instrument	12

Power on		
Instrument	11	
PRESET	15	
PREV	22	
PRINT	15	
Printer	13	
Probes		
Compensation connectors	23	
passive, compensation	49	
PROTOCOL LOGIC	17	
Q		
QUICK MEAS	16	
R		
Rackmounting	10	
Ready state	11	
REDO	17	
REF	20	
Reference waveforms	43	
Remote control	41	
RUN CONT	18	
RUN Nx SINGLE	18	
S		
Scale		
Horizontal	21	
vertical	20	
SEARCH	22	
Selected waveform	43	
Self Alignment	49	
SET CLEAR	22	
SETUP (instrument)	15	
SETUP (trigger)	19	
Shut down	11	
SIGNAL OFF	20	
SLOPE	19	
Sounds	48	
SOURCE (trigger)	19	
Standby state	11	
Start up	11	
Storing	52	
Switch off		
Instrument	12	
Switch on		
Instrument	11	
Switching off		
Waveform	43	
Switching on		
Waveform	43	
T		
Time	48	
TOOLS	17	
Trigger		
Auto/normal	18	
Edge trigger, slope	19	
External input	25	
Force	18	
Level	19	
Mode	18	
Output	25	
Setup	19	
Source	19	
U		
UNDO	17	
USB		
Connecting	13	
Connector	23, 24	
Flash drive	13	
V		
Virtual screen	15	
W		
Waveforms		
Channel	43	
Display intensity	15	
Math	43	
Overview and usage	43	
Reference	43	
States	43	
switch off	20	
Switching off	43	
Switching on	43	
XY	43	
Zoom	43	
Windows	42	
X		
XY waveforms	43	
Z		
Zoom		
Example	28	
ZOOM	21	
Zoom waveforms	43	