

R&S® ZVH

Remote Control via LAN or USB

Software Manual



1173.9005.12 – 01

The Software Manual describes the following R&S® ZVH models and options

- R&S ZVH-K40 (1309.7013.02)

for the R&S® ZVH models:

- R&S ZVH4 (1309.6800.24)
- R&S ZVH8 (1309.6800.28)

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

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The following abbreviations are used throughout this manual:

R&S® ZVH is abbreviated as R&S ZVH.

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 attached 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 intention 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 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.





Symbols and safety labels

						
Observe product documentation	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Attention! Electrostatic sensitive devices

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.

Tags 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 the possibility of incorrect operation which can result in damage to the product.

In the product documentation, the word ATTENTION is used synonymously.

These tags 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 tags described here are always used only in connection with the related product documentation and the related product. The use of tags in connection with unrelated products or documentation can result in misinterpretation and in personal injury or material damage.

Operating states and operating positions

The product may be operated only under the operating conditions and in the positions specified by the manufacturer. 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. The R&S ZVH is protected against dripping water and dust (IP degree 51). 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, pollution severity 2, overvoltage category 2, use only in enclosed spaces, max. operation altitude 4600 m above sea level, max. transport altitude 12000 m above sea level. A tolerance of $\pm 10\%$ shall apply to the nominal voltage and of $\pm 5\%$ to the nominal frequency.

2. 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 death.

Electrical Safety

If the information on electrical safety is not observed either at all 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. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 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, a disconnecting device must be provided at the system level.
3. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
4. The product may be operated only from TN/TT supply networks fused with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
5. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks that result in fire and/or injuries may occur.
6. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
7. For measurements in circuits with voltages $V_{\text{rms}} > 30 \text{ V}$, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
8. 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.
9. 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.

10. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused 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.
11. 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.
12. 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.
13. 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.
14. 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.
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", 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.

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

Batteries and rechargeable batteries/cells

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

1. Cells must not be taken apart or crushed.
2. Cells or batteries must not be exposed to heat or fire. Storage in direct sunlight must be avoided. Keep cells and batteries clean and dry. Clean soiled connectors using a dry, clean cloth.
3. Cells or batteries must not be short-circuited. Cells or batteries must not be stored in a box or in a drawer where they can short-circuit each other, or where they can be short-circuited by other conductive materials. Cells and batteries must not be removed from their original packaging until they are ready to be used.
4. Keep cells and batteries out of the hands of children. If a cell or a battery has been swallowed, seek medical aid immediately.
5. Cells and batteries must not be exposed to any mechanical shocks that are stronger than permitted.
6. 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.
7. 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.

8. Cells and batteries must be recycled and kept separate from residual waste. Rechargeable batteries and normal batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

Transport

1. 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.
2. 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.

Waste disposal

1. 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.

Informaciones Elementales de Seguridad








Es imprescindible leer y observar 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 adjunto 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.





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.

Símbolos y definiciones de seguridad

						
Ver documentación de producto	Peligro de golpe de corriente	¡Advertencia! Superficie caliente	Conexión a conductor protector	Conexión a tierra	Conexión a masa conductora	¡Cuidado! Elementos de construcción con peligro de carga electrostática

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.

Palabras de señal y su significado

 PELIGRO	PELIGRO identifica un peligro inminente con riesgo elevado que provocará muerte o lesiones graves si no se evita.
 ADVERTENCIA	ADVERTENCIA identifica un posible peligro con riesgo medio de provocar muerte o lesiones (graves) si no se evita.
 ATENCIÓN	ATENCIÓN identifica un peligro con riesgo reducido de provocar lesiones leves o moderadas si no se evita.
 AVISO	AVISO indica la posibilidad de utilizar mal el producto y, como consecuencia, dañarlo. 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.

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento. R&S ZVH está protegido contra roción y polvo (modo de protección IP 51). 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, grado de suciedad 2, categoría de sobrecarga eléctrica 2, uso solamente en estancias interiores, utilización hasta 4600 m sobre el nivel del mar, transporte hasta 12000 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.
2. 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. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
3. 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.
4. 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).
5. 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.
6. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
7. 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.).
8. 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.
9. 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.
10. 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.

11. 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.
12. 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.
13. 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.
14. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".
3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio

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. Mantener baterías y celdas fuera del alcance de los niños. En caso de ingestión de una celda o batería, avisar inmediatamente a un médico.
5. Las celdas o baterías no deben someterse a impactos mecánicos fuertes indebidos.
6. 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.
7. 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).

8. 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. 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.
2. 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

1. 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.

Qualitätszertifikat

Certificate of quality

Certificat de qualité

Certified Quality System
ISO 9001

Certified Environmental System
ISO 14001

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde&Schwarz-Produktes entschieden. Hiermit erhalten Sie ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unseres Qualitätsmanagementsystems entwickelt, gefertigt und geprüft. Das Rohde&Schwarz-Qualitätsmanagementsystem ist u.a. nach ISO 9001 und ISO 14001 zertifiziert.

Der Umwelt verpflichtet

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

Dear Customer,

You have decided to buy a Rohde&Schwarz product. You are thus assured of receiving a product that is manufactured using the most modern methods available. This product was developed, manufactured and tested in compliance with our quality management system standards. The Rohde&Schwarz quality management system is certified according to standards such as ISO 9001 and ISO 14001.

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

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Vous avez choisi d'acheter un produit Rohde&Schwarz. Vous disposez donc d'un produit fabriqué d'après les méthodes les plus avancées. Le développement, la fabrication et les tests respectent nos normes de gestion qualité. Le système de gestion qualité de Rohde&Schwarz a été homologué, entre autres, conformément aux normes ISO 9001 et ISO 14001.

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- ▮ Produits à efficacité énergétique
- ▮ Amélioration continue de la durabilité environnementale
- ▮ Système de gestion de l'environnement certifié selon ISO 14001

75 Years of
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Documentation Overview

The user documentation for the R&S <Product type> is divided as follows:

Quick Start Guide

The Quick Start Guide provides basic information on the instrument's functions.

It covers the following topics:

- overview of all elements of the front and rear panels
- basic information on how to set up the R&S ZVH
- information on how to operate the R&S ZVH in a network
- instructions on how to perform measurements

Operating Manual

The Operating Manual provides a detailed description on the instrument's functions

It covers the following topics:

- instructions on how to set up and operate the R&S ZVH in its various operating modes
- instructions on how to perform measurements with the R&S ZVH
- instructions on how to work with the available software options and applications

Service Manual

The Service Manual provides information on maintenance.

It covers the following topics:

- instructions on how to perform a performance test
- instructions on how to repair the R&S ZVH including a spare parts list
- mechanical drawings

Release Notes

The release notes describe the installation of the firmware, new and modified functions, eliminated problems, and last minute changes to the documentation. The corresponding firmware version is indicated on the title page of the release notes. The current release notes are provided on the internet.

Internet Site

The internet site at: [R&S ZVH Cable and Antenna Analyzer](#) provides the most up to date information on the R&S ZVH. The most recent manuals are available as printable PDF files in the download area.

Also provided for download are firmware updates including the corresponding release notes, instrument drivers, current data sheets, application notes and image versions.

Conventions Used in the Documentation

The following conventions are used throughout the R&S <Product type> <Manual type>:

Typographical conventions

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

Other conventions

- **Remote commands:** Remote commands may include abbreviations to simplify input. In the description of such commands, all parts that have to be entered are written in capital letters. Additional text in lower-case characters is for information only.

1 Introduction

With the software application R&S ZVH-K40 installed on the instrument, it is possible to operate your R&S ZVH via remote control. In this manual you will find all information necessary to remotely control the R&S ZVH.

Enabling the Option

The Remote Control Option R&S ZVH-K40 is enabled by entering a key code. The key code is based on the unique serial number of the instrument. To retrofit an option, enable it with a key code.

- ▶ Press the SETUP key.
- ▶ Press the "Installed Options" softkey
- ▶ Select "Install Option..." under the "Option Administration" header.
- ▶ Confirm with ENTER.

An entry box in the lower right corner of the screen is displayed.

- ▶ Type in the the appropriate option key.
- ▶ Confirm with ENTER.

If the correct key code is entered, the R&S ZVH displays

Installation successful !

If an invalid key code is entered, the R&S ZVH displays

Invalid key code!

2 Interfaces and Protocols

The R&S ZVH supports two different interfaces for remote control.

- **LAN Interface:** The protocol is based on TCP/IP and supports the VXI-11 standard.
- **USB Interface**

The connectors are located at the side of the instrument and permit a connection to a controller for remote control via a local area network (LAN) or directly via USB.

SCPI

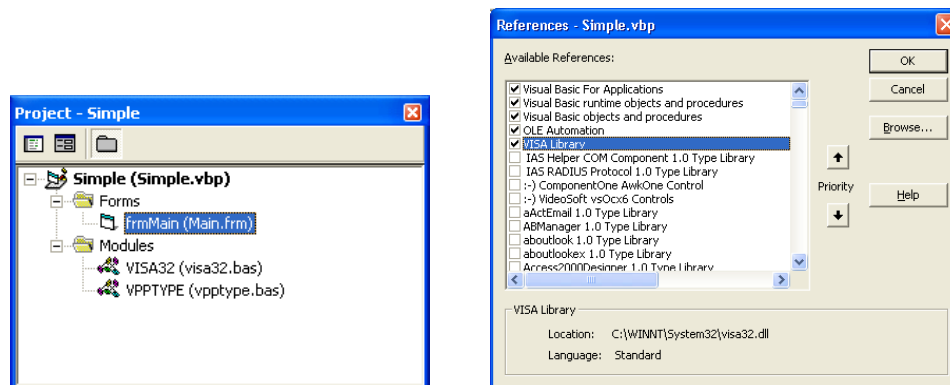
SCPI (Standard Commands for Programmable Instruments) commands - messages - are used for remote control. Commands that are not taken from the SCPI standard follow the SCPI syntax rules. The instrument supports the SCPI version 1999. The SCPI standard is based on standard IEEE 488.2 and aims at the standardization of device-specific commands, error handling and the status registers. The tutorial "Automatic Measurement Control - A tutorial on SCPI and IEEE 488.2" from John M. Pieper (R&S order number 0002.3536.00) offers detailed information on concepts and definitions of SCPI.

The requirements that the SCPI standard places on command syntax, error handling and configuration of the status registers are explained in detail in the following sections. Tables provide a fast overview of the bit assignment in the status registers. The tables are supplemented by a comprehensive description of the status registers.

VISA

VISA is a standardized software interface library providing input and output functions to communicate with instruments. The I/O channel (LAN or USB) is selected at initialization time by means of a channel-specific resource string. For more information about VISA refer to its user documentation.

The programming examples for remote control are all written in Microsoft® VISUAL BASIC®. Access to the VISA functions require the declaration of the functions and constants prior to their use in the project. This can be accomplished either by adding the modules VISA32.BAS and VPPTYPE.BAS or a reference to the VISA32.DLL to the project.



The modules visa32.bas and vpptype.bas can be found in the <VXIpnPath>WinNT\include (typically C:\VXIpnPath\WinNT\include).



Resetting the R&S ZVH

Manual operation is designed for maximum possible operating convenience. In contrast, the priority of remote control is the "predictability" of the device status. Therefore, control programs should always define an initial device status (e.g. with the command *RST) and then implement the required settings.

2.1 LAN Interface

To be integrated in a LAN, the instrument is equipped with a standard LAN interface, consisting of a connector, a network interface and protocols (VXI-11).

Instrument access via VXI-11 is usually achieved from high level programming platforms by using VISA as an intermediate abstraction layer. VISA encapsulates the low level VXI-11 (LAN) or USB function calls and thus makes the transport interface transparent for the user. The necessary VISA library is available as a separate product. For details contact your local R&S sales representative.

2.2 USB Interface

For remote control via the USB connection, the PC and the instrument must be connected via the USB interface. A USB connection requires the VISA library to be installed. VISA detects and configures the instrument automatically when the USB connection is established. You do not have to enter an address string or install a separate driver.

2.3 Protocols

VXI-11 Basics

The VXI-11 standard is based on the ONC-RPC protocol which in turn relies on TCP/IP as the network/transport layer. The TCP/IP network protocol and the associated network services are preconfigured. TCP/IP ensures connection-oriented communication, where the order of the exchanged messages is adhered to and interrupted links are identified. With this protocol, messages cannot be lost.

Remote control of an instrument via a network is based on standardized protocols which follow the OSI reference model (see Fig. below).

Application	SCPI
Presentation	XDR (VXI-11)
Session	ONC-RPC
Transport	TCP / UDP
Network	IP
Data Link	Ethernet/802.3
Physical	802.3/10BASE-T

Figure 2-1: Example for LAN remote control based on the OSI reference model

Based on TCP/UDP, messages between the controller and the instrument are exchanged via open network computing (ONC) - remote procedure calls (RPC). With XDR (VXI-11), legal RPC messages are known as VXI-11 standard. Based on this standard, messages are exchanged between the controller and the instrument. The messages are identical with SCPI commands. They can be organized in four groups:

- program messages (control command to the instrument)
- response messages (values returned by the instrument)
- service request (spontaneous queries of the instrument)
- low-level control messages (interface messages).

A VXI-11 link between a controller and an instrument uses three channels: core, abort and interrupt channel. Instrument control is mainly performed on the core channel (program, response and low-level control messages). The abort channel is used for immediate abort of the core channel; the interrupt channel transmits spontaneous service requests of the instrument. Link setup itself is very complex. For more details refer to the VXI-11 specification.

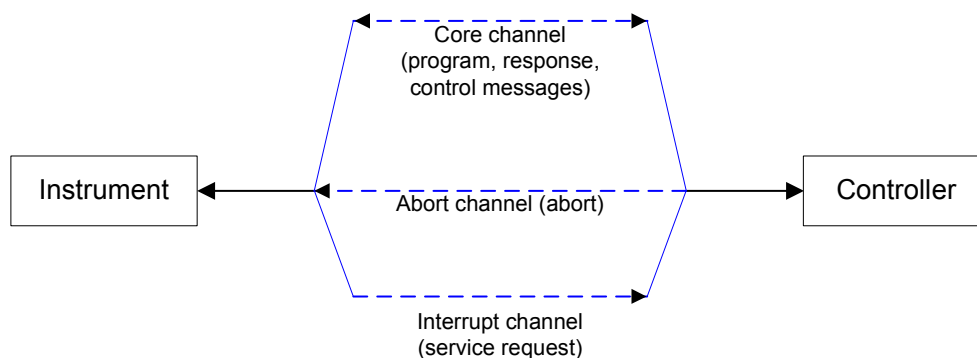


Figure 2-2: VXI-11 channels between instrument and controller

The number of controllers that can address an instrument is practically unlimited in the network. In the instrument, the individual controllers are clearly distinguished. This distinction continues up to the application level in the controller, i.e. two applications on a computer are identified by the instrument as two different controllers.

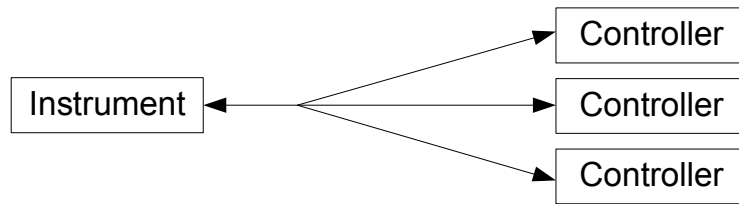


Figure 2-3: Remote control via LAN from several controllers

The controllers can lock and unlock the instrument for exclusive access. This regulates access to the instrument of several controllers.

3 Setting Up the Remote Control Connection

3.1 Preparing for Remote Control

The short and simple operating sequence below shows how to put the instrument into operation and quickly set its basic functions. The current IP address for LAN operation is shown in the SETUP – Instrument Setup Menu. In case of USB connection the IP address is fixed to 172.16.10.10.

Refer to the Quick Start Guide for instructions on how to change the IP address.

- ▶ Connect the instrument to the LAN or directly to the controller via USB.
- ▶ Switch on the instruments.
- ▶ Write and start the following program on the controller:

```

status = viOpenDefaultRM(defaultRM)           ' Open default resource manager
status = viOpen(DefaultRM,                    ' in case of USB connection
"TCPIP::172.16.10.10", 0, 0, vi)
status = viOpen(DefaultRM,                    'in case of a LAN connection, with xxx.xxx.xxx.xxx = IP
"TCPIP::xxx.xxx.xxx.xxx", 0, 0, vi)          address
cmd = "*RST;*CLS"                             ' Reset instrument and clear status registers
status = viWrite(vi, Cmd, Len(Cmd), retCount)
cmd = "FREQ:CENT 100MHz"                       ' Set center frequency to 100 MHz
status = viWrite(vi, Cmd, Len(Cmd), retCount)
cmd = "FREQ:SPAN 10MHz"                       ' Set span to 10 MHz
status = viWrite(vi, Cmd, Len(Cmd), retCount)
cmd = "DISP:TRAC:Y:RLEV -10dBm"              ' Set reference level to -10 dBm
status = viWrite(vi, Cmd, Len(Cmd), retCount)
viclose vi
viclose default RM

```

The instrument now performs a sweep in the frequency range of 95 MHz to 105 MHz.

Changing the IP Address

In order to operate the instrument via remote control, it must be accessed via LAN (IP address) or USB. If the factory-set remote control address does not fit in the network environment, it can be changed. Refer to the Quick Start Guide, chapter "Setting up a LAN or USB Connection to a PC", for instructions on how to change the IP address.

4 Instrument Model and Command Processing

The block diagram in Fig. 1-2 shows how SCPI commands are serviced in the instrument. The individual components work independently and simultaneously. They communicate with each other by means of so-called "messages".

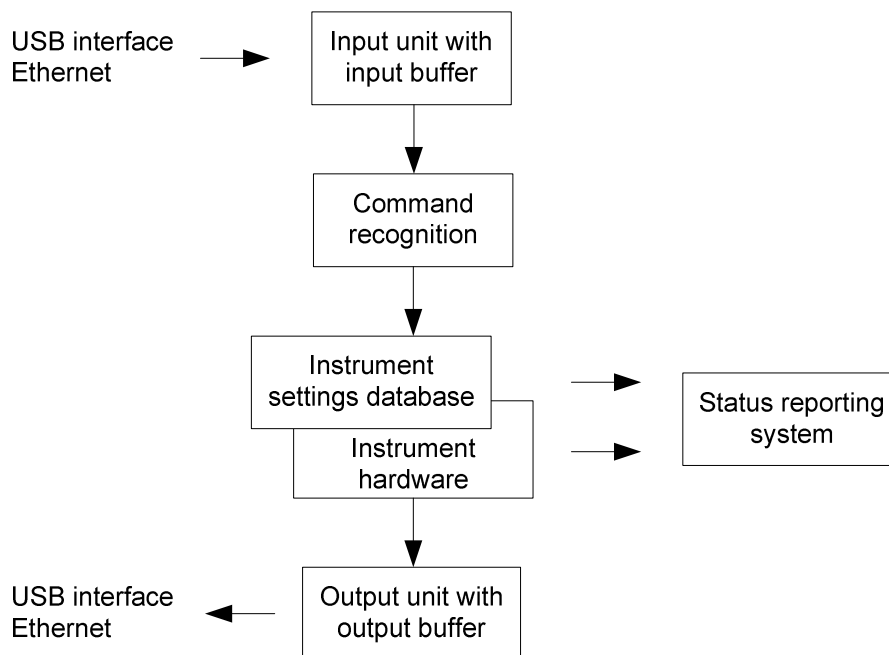


Figure 4-1: Instrument model in the case of remote control

4.1 Input unit

The input unit receives commands character by character from the controller and collects them in the input buffer. The input unit sends a message to the command recognition as soon as the input buffer is full or as soon as it receives a delimiter, <PROGRAM MESSAGE TERMINATOR>, as defined in IEEE 488.2, or the interface message DCL.

If the input buffer is full, the traffic is stopped and the data received up to then are processed. Subsequently the traffic is continued. If, however, the buffer is not yet full when receiving the delimiter, the input unit can already receive the next command during command recognition and execution. The receipt of DCL clears the input buffer and immediately resets the command recognition.

4.2 Command recognition

The command recognition analyses the data received from the input unit. It proceeds in the order in which it receives the data. Only DCL is serviced with priority, for example GET (Group Execute Trigger) is only executed after the commands received before. Each recognized command is immediately transferred to the internal instrument settings data base but not executed immediately.

The command recognition detects syntax errors in the commands and transfers them to the status reporting system. The rest of a program message after a syntax error is analyzed further if possible and serviced. After the syntax test, the value range of the parameter is checked, if required.

If the command recognition detects a delimiter, it passes the command to an execution unit that performs the instrument settings. In the meantime, the command recognition is ready to process new commands (overlapping execution). A DCL command is processed in the same way.

4.3 Data base and instrument hardware

Here the expression "instrument hardware" denotes the part of the instrument fulfilling the actual instrument function - signal generation, measurement etc. The controller is not included. The term "data base" denotes a database that manages all the parameters and associated settings required for setting the instrument hardware.

Setting commands lead to an alteration in the data set. The data set management enters the new values (e.g. frequency) into the data set, however, only passes them on to the hardware when requested by the command recognition. This only takes place at the end of a program message.

The data are checked for compatibility with the current instrument settings before they are transmitted to the instrument hardware. If the execution is not possible, an "execution error" is signaled to the status reporting system. The corresponding settings are discarded.

Before passing on the data to the hardware, the settling bit in the STATus:OPERation register is set (refer to section "STATus:OPERation Register"). The hardware executes the settings and resets the bit again as soon as the new state has settled. This fact can be used to synchronize command servicing.

Queries induce the data set management to send the desired data to the output unit.

4.4 Status reporting system

For detailed information refer to section "[Status Reporting System](#)".

4.5 Output unit

The output unit collects the information requested by the controller, which it receives from the data base management. It processes it according to the SCPI rules and makes it available in the output buffer.

If the instrument is addressed as a talker without the output buffer containing data or awaiting data from the data base management, the output unit sends error message "Query UNTERMINATED" to the status reporting system. No data are sent to the controller, the controller waits until it has reached its time limit. This behavior is defined by IEEE 488.2 and SCPI.

5 SCPI Command Structure and Syntax

SCPI (Standard Commands for Programmable Instruments) describes a standard command set for programming instruments, irrespective of the type of instrument or manufacturer. The goal of the SCPI consortium is to standardize the device-specific commands to a large extent. For this purpose, a model was developed which defines the same functions inside a device or for different devices. Command systems were generated which are assigned to these functions. Thus it is possible to address the same functions with identical commands. The command systems are of a hierarchical structure.

SCPI is based on standard IEEE 488.2, i.e. it uses the same syntactic basic elements as well as the common commands defined in this standard. Part of the syntax of the device responses is defined with greater restrictions than in standard IEEE 488.2 (see section "Responses to Queries").



Remote command examples

Not all commands used in the following examples are implemented in the instrument.

5.1 Structure of a Command

The commands consist of a so-called header and, in most cases, one or more parameters. Header and parameter are separated by a "white space" (ASCII code 0 to 9, 11 to 32 decimal, e.g. blank). The headers may consist of several key words. Queries are formed by directly appending a question mark to the header.

5.1.1 Common commands

Common commands consist of a header preceded by an asterisk "*" and one or several parameters, if any.

Examples

*RST	RESET, resets the device
*ESE 253	EVENT STATUS ENABLE, sets the bits of the event status enable register
*ESR?	EVENT STATUS QUERY, queries the contents of the event status register.

5.1.2 Device-Specific Commands

5.1.2.1 Hierarchy

Device-specific commands are of hierarchical structure (see **Error! Reference source not found.**). The different levels are represented by combined headers. Headers of the highest level (root level) have only one key word. This key word denotes a complete command system.

Example

```
SENSe
```

This key word denotes the SENSE command system.

For commands of lower levels, the complete path has to be specified, starting on the left with the highest level, the individual key words being separated by a colon ":".

Example

```
SENSe:FREQuency:SPAN 10MHZ
```

This command lies in the third level of the SENSE system. It sets the frequency span.

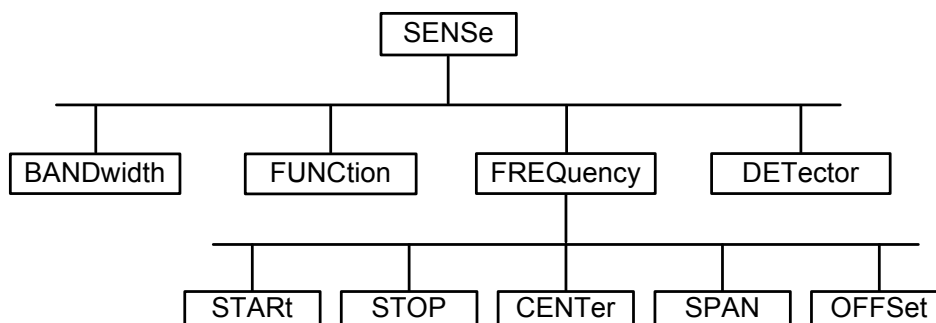


Figure 5-1: Tree structure the SCPI command systems using the SENSE system as example

5.1.2.2 Multiple Keywords

Some key words occur in several levels within one command system. Their effect depends on the structure of the command, i.e. at which position in the header of a command they are inserted.

Examples

```
SOURce:FM:POLarity NORMal
```

This command contains key word POLarity in the third command level. It defines the polarity between modulator and modulation signal.

```
SOURce:FM:EXTernal:POLarity NORMal
```

This command contains key word POLarity in the fourth command level. It defines the polarity between modulation voltage and the resulting direction of the modulation only for the external signal source indicated.

5.1.2.3 Optional Keywords

Some command systems permit certain key words to be inserted into the header or omitted. These key words are marked by square brackets in the description. The full command length must be recognized by the instrument for reasons of compatibility with the SCPI standard. Some commands are considerably shortened by these optional key words.

Example

```
[SENSE]:BANDwidth[:RESolution]:AUTO
```

This command couples the resolution bandwidth of the instrument to other parameters. The following command has the same effect:

```
BANDwidth:AUTO
```



Optional keywords with numeric suffixes

Do not omit an optional keyword if it includes a numeric suffix that is relevant for the effect of the command.

Example

```
DISPlay[:WINDow<1...4>]:MAXimize <Boolean>
```

Command `DISP:MAX ON` refers to window 1.

In order to refer to a window other than 1, you must include the optional `WINDow` parameter with the suffix for the required window.

`DISP:WIND2:MAX ON` refers to window 2.

5.1.2.4 Long and Short Form

The key words feature a long form and a short form. Either the short form or the long form can be entered, other abbreviations are not permitted.

Example

```
STATus:QUEStionable:ENABle 1
```

is equivalent to

```
STAT:QUES:ENAB 1
```



Upper and lower case notation of commands

Upper-case and lower-case notation only serves to distinguish the two forms in the manual, the instrument itself does not distinguish upper-case and lower-case letters.

5.1.2.5 Parameter

The parameter must be separated from the header by a "white space". If several parameters are specified in a command, they are separated by a comma ",". A few queries permit the parameters MINimum, MAXimum and DEFault to be entered. Refer to "[Parameters](#)" for a detailed description of the various parameters.

Example

```
SENSe:FREQuency:STOP? MAXimum
```

```
Response: 3.5E9
```

This query requests the maximal value for the stop frequency.

5.1.2.6 Special Characters

- | A vertical stroke in parameter definitions indicates alternative possibilities in the sense of "or". The effect of the command differs, depending on which parameter is used.

Example

```
DISPlay:FORMat SINGLE | SPLit
```

If parameter `SINGLE` is selected, full screen is displayed, in the case of `SPLIT`, split screen is displayed.

A selection of key words with an identical effect exists for several commands. These keywords are indicated in the same line; they are separated by a vertical stroke. Only one of these keywords needs to be included in the header of the command. The effect of the command is independent of which of the keywords is used.

Example

```
SENSe:BANDwidth|BWIDth[:RESolution]
```

The two following commands with identical meaning can be created. They set the frequency of the fixed frequency signal to 1 kHz:

```
SENSe:BAND 1
```

```
SENSe:BWID 1
```

- [] Key words in square brackets can be omitted when composing the header. The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards.

Example

```
[SENSe:]BANDwidth|BWIDth[:RESolution]
```

```
SENS:BAND:RES
```

is equivalent to

```
BAND
```

Parameters in square brackets can be incorporated optionally in the command or omitted as well.

Example

```
MMEMory:NETWork:MAP
<string>, <string>[, <string>, <string>, <boolean>]
```

Entries in square brackets are optional or can be omitted.

{ } Parameters in curly brackets are optional and can be inserted once or several times, or omitted.

Example

```
SENSe:LIST:FREQuency <numeric_value>{, <numeric_value>}
```

The following are valid commands:

```
SENS:LIST:FREQ 10
SENS:LIST:FREQ 10, 20
SENS:LIST:FREQ 10, 20, 30, 40
```

5.1.2.7 Numeric suffix

If a device features several functions or features of the same kind, e.g. inputs, the desired function can be selected by a suffix added to the command. Entries without suffix are interpreted like entries with the suffix 1. Optional keywords must be specified if they select a function with the suffix.

Example

```
SYSTem:COMMunicate:SERial2:BAUD 9600
```

This command sets the baud rate of a second serial interface.

**Suffix counting**

In case of remote control, suffix counting may differ from the numbers of the corresponding selection used in manual operation. SCPI prescribes that suffix counting starts with 1. Suffix 1 is the default state and used when no specific suffix is specified.

Some standards define a fixed numbering, starting with 0. With GSM, for instance, slots are counted from 0 to 7. In the case of remote control, the slots are selected with the suffixes 1 to 8. If the numbering differs in manual operation and remote control, it is indicated with the respective command.

5.1.3 Overview of Syntax Elements

The following table offers an overview of the syntax elements.

- : The colon separates the key words of a command. In a program message the separating semicolon marks the uppermost command level.
- ; The semicolon separates two commands within a program message. It does not alter the path.
- , The comma separates several parameters of a command.
- ? The question mark forms a query.
- * The asterisk marks a common command.
- " Quotation marks introduce a string and terminate it.
- # The hash symbol # introduces binary, octal, hexadecimal and block data.
 - Binary: #B10110
 - Octal: #O7612
 - Hexa: #HF3A7
 - Block: #21312

A "white space" (ASCII-Code 0 to 9, 11 to 32 decimal, e.g. blank) separates header and parameter.

5.2 Parameters

For most commands a parameter needs to be supplemented. The parameter has to be separated from the header by a "white space". Possible parameters are:

- Numeric values
- Special numeric values
- Boolean parameters
- Text
- Character strings
- Block data.

The type of parameter required for each command and the allowed range of values are specified in the command description.

5.2.1 Numeric Values

Numeric values can be entered in any form, i.e. with sign, decimal point and exponent. Values exceeding the resolution of the instrument are rounded up or down. The mantissa may comprise up to 255 characters, the exponent must lie inside the value range -32000 to 32000. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not permissible. In the case of physical quantities, the unit can be entered. Permissible unit prefixes are G (giga), MA (mega), MOHM and MHZ are also possible), K (kilo), M (milli), U (micro) and N (nano). If the unit is missing, the basic unit is used.

Example

```
SENSe:FREQuency:STOP 1.5GHz = SENSe:FREQuency:STOP 1.5E9
```

5.2.2 Special Numeric Values

The texts MINimum, MAXimum, DEFault, UP and DOWN are interpreted as special numeric values. In case of a query, the numeric value is returned.

- MIN/MAX

MINimum and MAXimum denote the minimum and maximum value.

- DEF

DEFault denotes a preset value which has been stored in the EPROM. This value conforms to the default setting, as it is called by the *RST command

- UP/DOWN

UP, DOWN increases or reduces the numerical value by one step. The step width can be specified via an allocated step command for each parameter which can be set via UP, DOWN.

- INF/NINF

INFINITY, Negative INFINITY (NINF) Negative INFINITY (NINF) represent the numerical values -9.9E37 or 9.9E37, respectively. INF and NINF are only sent as device responses.

- NAN

Not A Number (NAN) represents the value 9.91E37. NAN is only sent as device response. This value is not defined. Possible causes are the division of zero by zero, the subtraction of infinite from infinite and the representation of missing values.

Example:

Setting command: SENSe:FREQuency:STOP MAXimum

Query: SENSe:FREQuency:STOP?, Response: 3.5E9

5.2.3 Boolean Parameters

Boolean parameters represent two states. The ON state (logically true) is represented by ON or a numerical value unequal to 0. The OFF state (logically untrue) is represented by OFF or the numerical value 0. The numerical values are provided as response for query.

Example

Setting command: `CALCulate:MARKer:STATe ON`

Query: `CALCulate:MARKer:STATe?`, Response: 1

5.2.4 Text

Text parameters observe the syntactic rules for key words, i.e. they can be entered using a short or long form. Like any parameter, they have to be separated from the header by a white space. In the case of a query, the short form of the text is provided.

Example

Setting command: `INPut:COUPling GROund`

Query: `INPut:COUPling?`, Response: GRO

5.2.5 Strings

Strings must always be entered in quotation marks (' or ").

Example

`SYSTem:LANGUage "SCPI" OR SYSTem:LANGUage 'SCPI'`

5.2.6 Block data

Block data are a transmission format which is suitable for the transmission of large amounts of data. A command using a block data parameter has the following structure:

Example

`HEADer:HEADer #45168xxxxxxxx`

ASCII character # introduces the data block. The next number indicates how many of the following digits describe the length of the data block. In the example the 4 following digits indicate the length to be 5168 bytes. The data bytes follow. During the transmission of these data bytes all end or other control signs are ignored until all bytes are transmitted.

5.3 Structure of a Program Message

A program message may consist of one or several commands. It is terminated by the program message terminator which is the NL (New Line) character for LAN and USB connections.

Several commands in a program message must be separated by a semicolon ";". If the next command belongs to a different command system, the semicolon is followed by a colon. A colon ":" at the beginning of a command marks the root node of the command tree.

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:CENTer  
100MHz;:INPut:ATTenuation 10")
```

This program message contains two commands. The first one is part of the SENSe command system and is used to determine the center frequency of the instrument. The second one is part of the INPut command system and sets the input signal attenuation.

If the successive commands belong to the same system, having one or several levels in common, the program message can be abbreviated. For that purpose, the second command after the semicolon starts with the level that lies below the common levels (see also Fig. 1-1). The colon following the semicolon must be omitted in this case.

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:START  
1E6;:SENSe:FREQuency:STOP 1E9")
```

This program message is represented in its full length and contains two commands separated from each other by the semicolon. Both commands are part of the SENSe command system, subsystem FREQuency, i.e. they have two common levels.

When abbreviating the program message, the second command begins with the level below SENSe:FREQuency. The colon after the semicolon is omitted. The abbreviated form of the program message reads as follows:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:START 1E6;STOP 1E9")
```

However, a new program message always begins with the complete path.

Example:

```
CALL InstrWrite(analyzer, "SENSe:FREQuency:START 1E6")  
CALL InstrWrite(analyzer, "SENSe:FREQuency:STOP 1E9")
```

5.4 Responses to Queries

A query is defined for each setting command unless explicitly specified otherwise. It is formed by adding a question mark to the associated setting command. According to SCPI, the responses to queries are partly subject to stricter rules than in standard IEEE 488.2.

- The requested parameter is transmitted without header.

Example

```
INPut:COUPling?
```

```
Response: DC
```

- Maximum values, minimum values and all further quantities, which are requested via a special text parameter are returned as numerical values.

Example

```
SENSe:FREQuency:STOP? MAX
```

```
Response: 3.5E9
```

- Numerical values are output without a unit. Physical quantities are referred to the basic units or to the units set using the Unit command.

Example

```
SENSe:FREQuency:CENTer?
```

```
Response: 1E6 (for 1 MHz)
```

- Truth values <Boolean values> are returned as 0 (for OFF) and 1 (for ON).

Example

```
SENSe:BANDwidth:AUTO?
```

```
Response: 1 (for ON)
```

- Text (character data) is returned in a short form.

Example

```
SYSTem:COMMunicate:SERial:CONTrol:RTS?
```

```
Response STAN (for standard)
```

6 Command Sequence and Command Synchronization

What has been said above makes clear that all commands can potentially be carried out overlapping. In order to prevent an overlapping execution of commands, one of the commands *OPC, *OPC? or *WAI must be used. All three commands cause a certain action only to be carried out after the hardware has been set. By suitable programming, the controller can be forced to wait for the respective action to occur. For more information see Table 6-1.

Table 6-1: Synchronization using *OPC, *OPC? and *WAI

Command	Action	Programming the controller
*OPC	Sets the Operation Complete bit in the ESR after all previous commands have been executed.	<ul style="list-style-type: none"> – Setting bit 0 in the ESE – Setting bit 5 in the SRE – Waiting for service request (SRQ)
*OPC?	Stops command processing until 1 is returned. This is only the case after the Operation Complete bit has been set in the ESR. This bit indicates that the previous setting has been completed.	Sending *OPC? directly after the command whose processing should be terminated before other commands can be executed.
*WAI	Stops further command processing until all commands sent before *WAI have been executed.	Sending *WAI directly after the command whose processing should be terminated before other commands are executed.

For a couple of commands the synchronization to the end of command execution is mandatory in order to obtain the desired result. The affected commands require either more than one measurement in order to accomplish the desired instrument setting (e.g. auto range functions), or they require a longer period of time for execution. If a new command is received during execution of the corresponding function this may either lead to either to an aborted measurement or to incorrect measurement data.

The following list includes the commands, for which a synchronization via *OPC, *OPC? or *WAI is mandatory:

Table 6-2: Commands with mandatory synchronization (overlapping commands)

Command	Purpose
INIT	start measurement (sweep)
INIT:CONT OFF	Set to single sweep
CALC:MARK:FUNC:xx?	All Marker function queries

7 Remote Control – Commands

The following chapters provide a detailed description of all remote control commands currently available for the R&S ZVH and its firmware options.

Each section describes the commands for one of the operating modes available in the R&S ZVH, beginning with the description of common commands required to operate the instrument. The structure is based on that of the operating manual.

- [Common Commands](#) on page 27
- [Remote Commands in Cable and Antenna Test Mode](#) on page 30
- [Remote Commands in Power Meter Mode](#) on page 54

Each section is subdivided into various tasks required to perform measurements with the R&S ZVH, also based on the structure of the operating manual. Some commands like those for controlling markers or configuring the frequency axis are available for all operating modes. In that case you will find a list of these commands in the corresponding section. However, a detailed description is provided only in the analyzer commands section.



Availability of commands

The spectrum analysis and network analysis modes are implemented in the basic unit. For the other modes, the corresponding options are required.

Following the remote control commands required to perform specific measurements, you will find a description of general commands used to set up and control basic instrument functions. These commands are independent of the operating mode. Therefore they are listed separately.

- [Saving and Restoring Instrument Settings and Measurement Results](#) on page 61
- [Configuring the Instrument](#) on page 69
- [Remote Commands of the Status Reporting System](#) on page 96

All chapters begin with a list of commands available in the context of that chapter. Following that list you will find a detailed description of all commands.

All individual descriptions contain:

- the complete notation and syntax of the command
- the description of the effects of the command
- a list of all parameters available for that command
- an example of how a program message would look like
- the *RST value
- information on SCPI conformity

7.1 Common Commands

The common commands are taken from the IEEE 488.2 (IEC 625-2) standard. A particular command has the same effect on different devices. The headers of these commands consist of an asterisk "*" followed by three letters. Some of the common commands refer to the "[Status Reporting System](#)".

List of Common Commands

- [*CLS](#) (p. 27)
- [*ESE](#) (p. 27)
- [*ESR?](#) (p. 27)
- [*IDN?](#) (p. 28)
- [*IST?](#) (p. 28)
- [*OPC](#) (p. 28)
- [*OPT?](#) (p. 28)
- [*RST](#) (p. 28)
- [*SRE](#) (p. 29)
- [*STB?](#) (p. 29)
- [*TRG](#) (p. 29)
- [*TST?](#) (p. 29)
- [*WAI](#) (p. 29)

*CLS

`CLEAR STATUS` sets the status byte (STB), the standard event register (ESR) and the EVENT part of the QUESTIONable and the OPERATION register to zero. The command does not alter the mask and transition parts of the registers. It clears the output buffer.

*ESE

`EVENT STATUS ENABLE` sets the event status enable register to the value indicated. The query form `*ESE?` returns the contents of the event status enable register in decimal form.

Parameter

0 to 255

*ESR?

`STANDARD EVENT STATUS QUERY` returns the contents of the event status register in decimal form (0 to 255) and subsequently sets the register to zero.

Parameter

0 to 255

***IDN?**

IDENTIFICATION QUERY queries the instrument identification.

Return values (example)

Example for R&S ZVH:

Rohde&Schwarz,FSH4,100005/024,1.30

FSH4	device name
100005/024	serial number/model index
1.00	firmware version

***IST?**

INDIVIDUAL STATUS QUERY returns the contents of the IST flag in decimal form. The IST flag is the status bit which is sent during a parallel poll.

Parameter

0 | 1

***OPC**

OPERATION COMPLETE sets bit 0 in the event status register after all preceding commands have been executed. This bit can be used to initiate a service request.

***OPT?**

OPTION IDENTIFICATION QUERY queries the options included in the instrument and returns a list of the options installed. The options are separated from each other by means of commas.

Parameter

K<number> software options

For a list of all available options and their description refer to the CD-ROM.

Example

K40, K41, K42, K45

***RST**

RESET sets the instrument to a defined default status. The command essentially corresponds to pressing the PRESET key.

***SRE**

SERVICE REQUEST ENABLE sets the service request enable register to the indicated value. Bit 6 (MSS mask bit) remains 0. This command determines under which conditions a service request is generated. The query form *SRE? reads the contents of the service request enable register in decimal form. Bit 6 is always 0.

Parameter

0 to 255

***STB?**

READ STATUS BYTE QUERY reads out the contents of the status byte in decimal form.

***TST?**

SELF TEST QUERY initiates the self test of the instrument and outputs an error code in decimal form.

Parameter

0 = no error

***WAI**

WAIT TO CONTINUE permits servicing of subsequent commands only after all preceding commands have been executed and all signals have settled.

7.2 Remote Commands in Cable and Antenna Test Mode

This section provides a detailed description of all remote control commands required to configure and perform measurements in Cable and Antenna Test (CAT) mode.

7.2.1 Configuring the Horizontal Axis

The following commands configure the horizontal axis of the active display.



Commands independent of the operating mode

Note that some of the commands for configuring the horizontal parameters are also valid for other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

List of commands

- [\[SENSe:\]FREQUency:CENTer](#) (p. 31)
- [\[SENSe:\]FREQUency:SPAN](#) (p. 31)
- [\[SENSe:\]FREQUency:SPAN:AUTO](#) (p. 32)
- [\[SENSe:\]FREQUency:STARt](#) (p. 32)
- [\[SENSe:\]FREQUency:STOP](#) (p. 32)
- [CALCulate:DTF:DISTance:STARt](#) (p. 30)
- [CALCulate:DTF:DISTance:STOP](#) (p. 31)

CALCulate:DTF:DISTance:STARt

This command defines the start distance of the cable measurement in meter or feet.

Parameter

3 m (10 ft) to 1500 m (4921 ft)

Example

```
CALC:DTF:DIST:STAR 50m
```

Sets the starting point of the measurement to 50 m.

Characteristics

*RST value: 3 m (10 ft)

SCPI: device-specific

CALCulate:DTF:DISTance:STOP

This command defines the end point of the cable measurement in meter or feet.

Parameter

3 m (10 ft) to 1500 m (4921 ft)

Example

```
CALC:DTF:DIST:STAR 500m
```

Sets the end point of the measurement to 500 m.

Characteristics

*RST value: 1500 m (4921 ft)

SCPI: device-specific

[SENSe:]FREQuency:CENTer

This command defines the center frequency.

Parameter

100 kHz to f_{\max}

f_{\max} is specified in the data sheet.

Example

```
FREQ:CENT 100MHz
```

Sets the center frequency to 100 MHz.

Characteristics

*RST value: $f_{\max} / 2$ with f_{\max} = maximum frequency

SCPI: conform

[SENSe:]FREQuency:SPAN

This command defines the frequency span.

Parameter

100 kHz to f_{\max}

f_{\max} is specified in the data sheet.

Example

```
FREQ:SPAN 10MHz
```

Sets the span to 10 MHz

Characteristics

*RST value: f_{\max} with f_{\max} = maximum frequency

SCPI: conform

[SENSe:]FREQuency:SPAN:AUTO

This command activates and deactivates automatic setting of the span. If "Auto Span" is active, the R&S ZVH automatically sets the span to best fit the measured signal.

Parameter

ON | OFF

Example

```
FREQ:SPAN:AUTO ON  
Activates the Auto Span function
```

Characteristics

*RST value: OFF
SCPI: device-specific

[SENSe:]FREQuency:STARt

This command defines the start frequency of the R&S ZVH for measurements in the frequency domain.

Parameter

100 kHz to f_{\max}

f_{\max} is specified in the data sheet.

Example

```
FREQ:STAR 20MHz
```

Characteristics

*RST value: 0
SCPI: conform

[SENSe:]FREQuency:STOP

This command defines the stop frequency of the R&S ZVH for measurements in the frequency domain.

Parameter

100 kHz to f_{\max}

f_{\max} is specified in the data sheet.

Example

```
FREQ:STOP 2000MHz
```

Characteristics

*RST value: f_{\max}
SCPI: conform

7.2.2 Configuring the Vertical Axis

The following commands configure the horizontal axis of the active display.



Commands independent of the operating mode

Note that some of the commands for configuring the vertical axis are also valid for other operating modes. If a command is available in another mode, it is indicated by the list in the respective section.

List of commands

- [DISPlay\[:WINDow\]:TRACe<1|2>:Y\[:SCALe\]:ADJust](#) (p. 33)
- [DISPlay<1|2>:LOSS:REFerence](#) (p. 33)
- [DISPlay<1|2>:LOSS:REFerence:POSition](#) (p. 34)
- [DISPlay<1|2>:LOSS:Y:SCALe](#) (p. 34)
- [DISPlay<1|2>:MAGNitude:REFerence](#) (p. 34)
- [DISPlay<1|2>:MAGNitude:REFerence:POSition](#) (p. 35)
- [DISPlay<1|2>:MAGNitude:Y:SCALe](#) (p. 35)
- [DISPlay<1|2>:MAGNitude:Y:SPACing](#) (p. 35)
- [DISPlay<1|2>:VSWR:Y:SCALe](#) (p. 36)
- [INPut:ATTenuation](#) (p. 36)
- [SOURce:TG:ATTenuation](#) (p. 37)

DISPlay[:WINDow]:TRACe<1|2>:Y[:SCALe]:ADJust

This command automatically sets the scaling of the vertical axis to best fit the measurement results of the indicated trace.

This command is an event and therefore has no query and no *RST value.

Example

```
DISP:TRAC:Y:ADJ
Adjusts the y-axis.
```

Characteristics

*RST value: -
SCPI: device-specific

DISPlay:LOSS:REFerence

This command sets the reference value for cable loss measurements.

Parameter

<numeric_value>

Example

```
DISP:LOSS:REF 10
Sets the reference level to 10 dB
```

Characteristics

*RST value: 0 dB
SCPI: device-specific

DISPlay:LOSS:REFerence:POSition

This command defines the position of the reference value on the display for cable loss measurements. Each step shifts the reference position one grid line up or down.

Parameter

1 to 10

Example

```
DISP:LOSS:REF:POS 5
```

Sets the reference to the fifth grid line from the bottom.

Characteristics

*RST value: 10
SCPI: device-specific

DISPlay:LOSS:Y:SCALE

This command defines the display range of the vertical axis with logarithmic scaling for cable loss measurements.

Parameter

<numeric value>

Example

```
DISP:LOSS:Y:SCAL 20
```

Sets the display range to 20 dB

Characteristics

*RST value: 100 dB
SCPI: device-specific

DISPlay:MAGNitude:REFerence

This command sets the reference value for the magnitude measurement format.

Parameter

<numeric_value>

Example

```
DISP:MAGN:REF -10
```

Sets the reference level to -10 dB

Characteristics

*RST value: 0 dB
SCPI: device-specific

DISPlay:MAGNitude:REFerence:POSition

This command defines the position of the reference value on the display for the magnitude measurement format. Each step shifts the reference position one grid line up or down.

Parameter

1 to 10

Example

```
DISP:MAGN:REF:POS 5
```

Sets the reference to the center of the display (i.e. the fifth grid line from the bottom).

Characteristics

*RST value: 10
SCPI: device-specific

DISPlay:MAGNitude:Y:SCALe

This command defines the display range of the y-axis with logarithmic scaling for the Magnitude measurement format.

Use the "[DISPlay<1|2>:MAGNitude:Y:SPACing](#)" command to switch to logarithmic scaling.

Parameter

<numeric value>

Example

```
DISP:MAGN:Y:SCAL 50 DB
```

Sets the display range of the y-axis to 50 dB

Characteristics

*RST value: 100 dB
SCPI: device-specific

DISPlay:MAGNitude:Y:SPACing

This command sets the scaling of the y-axis for the Magnitude measurement format to either linear or logarithmic.

Parameter

LINear | LOGarithmic

Example

```
DISP:MAGN:Y:SPAC LIN
```

Switches the y-axis to linear scaling

Characteristics

*RST value: LOGarithmic
SCPI: device-specific

DISPlay:VSWR:Y:SCALE

This command defines the display range of the y-axis for the VSWR measurement format.

Parameter

1...1.1 | 1.5 | 2 | 6 | 11 | 21 | 71

Note: The number you enter is rounded up to the next possible display range. For example, if you enter 5, the R&S ZVH automatically sets the display range to 1...6.

Example

```
DISP:VSWR:Y:SCALE 50
```

Sets the range to 1...71.

Characteristics

*RST value: 1...21
SCPI: device-specific

INPut:ATTenuation

This command sets the input or receiver attenuation.

The attenuation can be set in 5 dB steps. If the defined reference level cannot be set for the set RF attenuation, the reference level will be adjusted accordingly.

Parameter

<numeric_value> in dB; range specified in data sheet

Example

```
INP:ATT 30dB
```

Sets the attenuation on the attenuator to 30 dB and switches off the coupling to the reference level.

Characteristics

*RST value: 0 dB (AUTO is set to ON)
SCPI: conform

SOURce:TG:ATTenuation

This command sets the output level of the tracking generator.

You can set the output level by selecting an attenuation value. The range is from 0 dB to 50 dB.

Setting the attenuation to 0 dB results in an output level of 0 dBm. If you set the attenuation to 50 dB, the resulting output level is -50 dBm.

Parameter

0 to 50 dB

Example

```
SOUR: TG: ATT 50
```

Sets the attenuation to 50 dB and therefore an output level of -50 dBm

Characteristics

*RST value: 0 dB

SCPI: device-specific

7.2.3 Setting the Bandwidth

The following commands define the bandwidth to use for the measurement.

List of commands

- [\[SENSe:\]BANDwidth|BWIDth\[:RESolution\]](#) (p. 38)
- [\[SENSe:\]BANDwidth|BWIDth\[:RESolution\]:AUTO](#) (p. 38)

[SENSe:]BANDwidth|BWIDth[:RESolution]

This command defines the measurement bandwidth.

Analog resolution filters of 100 Hz to 100 kHz in 1 - 3 - 10 steps are available.

Parameter

100 Hz to 100 kHz

Example

```
BAND 100 kHz  
Sets the bandwidth to 100 kHz
```

Characteristics

*RST value: – (AUTO is set to ON)
SCPI: conform

[SENSe:]BANDwidth|BWIDth[:RESolution]:AUTO

This command couples the resolution bandwidth to the span or cancels the coupling.

Parameter

ON | OFF

Example

```
BAND:AUTO OFF  
Switches off the coupling of the resolution bandwidth to the span.
```

Characteristics

*RST value: ON
SCPI: conform

7.2.4 Performing and Triggering Measurements

7.2.4.1 Performing the Measurement

In CAT mode, the R&S ZVH always performs measurements in continuous sweep mode. The measurement starts as soon as you enter the CAT mode and can not be stopped. Therefore you can always query current results.

7.2.4.2 Triggering Measurements

The following commands set up trigger conditions if you are using a trigger for the measurement.

List of commands

- [TRIGger\[:SEQuence\]:HOLDoff\[:TIME\]](#) (p. 39)
- [TRIGger\[:SEQuence\]:SLOPe](#) (p. 39)
- [TRIGger\[:SEQuence\]:SOURce](#) (p. 40)

TRIGger[:SEQuence]:HOLDoff[:TIME]

This command defines the length of the trigger delay.

Parameter

0 s to +100 s

Example

```
TRIG:HOLD 500us
```

Sets the trigger delay to 500 µs.

Characteristics

*RST value: 0 s
SCPI: conform

TRIGger[:SEQuence]:SLOPe

This command selects the slope of the trigger signal. The selected trigger slope applies to all trigger signal sources.

Parameter

POSitive | NEGative

Example

```
TRIG:SLOP NEG
```

Characteristics

*RST value: POSitive
SCPI: conform

TRIGger[:SEQuence]:SOURce

This command selects the trigger source for the start of a sweep.

Parameter

IMMediate (Free Run) | EXTern

For more information on trigger modes, see the R&S ZVH operating manual.

Example

```
TRIG:SOUR EXT
```

Selects the external trigger input as source of the trigger signal

Characteristics

*RST value: IMMediate

SCPI: conform

7.2.5 Working with Traces

The following commands set up the trace and the various functions associated with it, e.g. trace mathematics or the selection of the detector.

List of commands

- [CALCulate:MATH<1...2>:COPY:MEMory](#) (p. 41)
- [DISPlay\[:WINDow\]:TRACe<1|2>:MEMory\[:STATe\]](#) (p. 41)
- [TRACe<1...2>:DATA](#) (p. 42)

CALCulate:MATH<1...2>:COPY:MEMory

This command stores the current trace into the memory trace of the R&S ZVH.

This command is an event and therefore has no query and no *RST value.

Example

```
CALC:MATH:COPY:MEM
```

Copies the trace into the memory.

Characteristics

*RST value: -

SCPI: device-specific

DISPlay[:WINDow]:TRACe<1|2>:MEMory[:STATe]

This command activates and deactivates the trace stored in the memory of the R&S ZVH. The suffix at TRACe selects the memory slot the trace is stored in.

Parameter

ON | OFF

Example

```
DISP:TRAC:MEM ON
```

Activates memory trace 1.

Characteristics

*RST value: OFF

SCPI: device-specific

TRACe<1...2>:DATA

This command reads out and returns the current trace data of the trace selected with the suffix at TRACe. The return values depend on the measurement format.

Parameter

TRACE1

Return values

For all measurements of the cable and antenna tester (incl. transmission measurements that are available with option R&S ZVH-K39), the command returns 631 value, one for each horizontal pixel of the display.

Example

```
TRAC:DATA? TRACE1  
Queries the data of trace 1.
```

Characteristics

*RST value: -
SCPI: conform

7.2.6 Using Markers

The following commands are for setting and controlling markers and deltamarkers. If not otherwise noted, the numeric suffix <1...6> at MARKer or DELTmarker select the marker to be controlled.

In CAT mode, the numeric suffix <1|2> at CALCulate is irrelevant.

List of commands

- [CALCulate<1|2>:DELTmarker<1...6>\[:STATe\]](#) (p. 43)
- [CALCulate<1|2>:DELTmarker<1...6>:AOFF](#) (p. 43)
- [CALCulate<1|2>:DELTmarker<1...6>:MAXimum\[:PEAK\]](#) (p. 44)
- [CALCulate<1|2>:DELTmarker<1...6>:MAXimum:NEXT](#) (p. 44)
- [CALCulate<1|2>:DELTmarker<1...6>:MINimum\[:PEAK\]](#) (p. 44)
- [CALCulate<1|2>:DELTmarker<1...6>:X](#) (p. 45)
- [CALCulate<1|2>:DELTmarker<1...6>:X:RELative](#) (p. 45)
- [CALCulate<1|2>:DELTmarker<1...6>:Y?](#) (p. 46)
- [CALCulate<1|2>:MARKer<1...6>\[:STATe\]](#) (p. 46)
- [CALCulate<1|2>:MARKer<1...6>:AOFF](#) (p. 47)
- [CALCulate<1|2>:MARKer<1...6>:MAXimum\[:PEAK\]](#) (p. 47)
- [CALCulate<1|2>:MARKer<1...6>:MAXimum:NEXT](#) (p. 47)
- [CALCulate<1|2>:MARKer<1...6>:MINimum\[:PEAK\]](#) (p. 48)
- [CALCulate<1|2>:MARKer<1...6>:X](#) (p. 48)
- [CALCulate<1|2>:MARKer<1...6>:X:SLIMits\[:STATe\]](#) (p. 48)
- [CALCulate<1|2>:MARKer<1...6>:X:SLIMits:LEFT](#) (p. 49)
- [CALCulate<1|2>:MARKer<1...6>:X:SLIMits:RIGHT](#) (p. 49)
- [CALCulate<1|2>:MARKer<1...6>:Y?](#) (p. 50)

CALCulate:DELTmarker<1...6>[:STATe]

This command switches the delta marker indicated by the suffix on or off.

The suffix 1 is interpreted as delta marker 2 because the first marker has to be a normal marker. Therefore, using no suffix indicates delta marker 2. If more than one marker (2 to 6) is already active, the command turns these marker into delta markers. If no delta marker is active yet, the command activates the delta marker and positions it on the trace maximum.

Parameter

ON | OFF

Example

```
CALC:DELT3 ON
```

Switches marker 3 to delta marker mode.

Characteristics

RST value: OFF

SCPI: device-specific

CALCulate:DELTamarker<1...6>:AOFF

This command switches off all active delta markers.

Example

```
CALC:DELT:AOFF
```

Switches off all delta markers.

Characteristics

RST value: –
SCPI: device-specific

CALCulate:DELTamarker<1...6>:MAXimum[:PEAK]

This command positions the delta marker indicated by the suffix to the current trace maximum. If necessary, the corresponding delta marker is activated first.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT3:MAX
```

Sets delta marker 3 to the maximum value of the associated trace.

Characteristics

RST value: –
SCPI: device-specific

CALCulate:DELTamarker<1...6>:MAXimum:NEXT

This command positions the delta marker indicated by the suffix to the next smaller maximum value of the trace. The corresponding delta marker is activated first, if necessary.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT2:MAX:NEXT
```

Sets delta marker 2 to the next smaller maximum value.

Characteristics

RST value: –
SCPI: device-specific

CALCulate:DELTamarker<1...6>:MINimum[:PEAK]

This command positions the delta marker indicated by the suffix to the current trace minimum. The corresponding delta marker is activated first, if necessary.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:DELT3:MIN
```

Sets delta marker 3 to the minimum value of the associated trace.

Characteristics

RST value: –

SCPI: device-specific

CALCulate:DELTamarker<1...6>:X

This command positions the delta marker indicated by the suffix to the specified position on the horizontal axis. Depending on the measurement this can be frequency, time or cable distance. The corresponding delta marker is activated first, if necessary.

Note that it is possible to place the marker outside the visible trace. In that case, this value is invalid.

Parameter

0 to MAX (frequency, time or distance)

Example

```
CALC:DELT:MOD REL
```

Switches the input for all delta markers to relative to marker 1.

```
CALC:DELT2:X 10.7MHz
```

Positions delta marker 2 10.7 MHz to the right of marker 1.

```
CALC:DELT:X?
```

Outputs the absolute frequency/time of delta marker 1.

```
CALC:DELT:X:REL?
```

Outputs the relative frequency/time of delta marker 1.

Characteristics

RST value: –

SCPI: device-specific

CALCulate:DELTamarker<1...6>:X:RELative

This command positions the delta marker indicated by the suffix to the specified relative position on the horizontal axis. Depending on the measurement this can be frequency, time or cable distance. The reference is marker 1. The command activates the corresponding delta marker, if necessary.

Parameter

Frequency in Hz (span > 0) or length in feet or meter (DTF measurements).

In spectrum mode, time is also possible (if span = 0)

Example

```
CALC:DELT3:X:REL 5 kHz
```

Sets the delta marker at a distance of 5 kHz to the reference position.

Characteristics

RST value: –

SCPI: device-specific

CALCulate:DELTaMarker<1...6>:Y?

This command queries the measured value of the delta marker indicated by the suffix. The output is always a relative value referred to marker 1. The corresponding delta marker will be activated, if necessary.

To obtain a correct query result, a complete sweep with synchronization to the sweep end must have been performed between the activation of the delta marker and the query of the y value. This is only possible in single sweep mode.

Return value

In cable and antenna test mode, the return value depends on the selected measurement format.

For measurement format "Magnitude", the command returns the results in dB.

For measurement format "VSWR", the return value is a ratio without unit.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:DELT2 ON
```

Switches on delta marker 2.

```
INIT;*WAI
```

Starts a sweep and waits for its end.

```
CALC:DELT2:Y?
```

Outputs measurement value of delta marker 2.

Characteristics

RST value: –

SCPI: device-specific

CALCulate:MARKer<1...6>[:STATe]

This command switches the marker indicated by the suffix on or off.

If no suffix is added, marker 1 is selected automatically. If marker 2 to 6 is selected and used as a delta marker, it is switched to marker mode.

Parameter

ON | OFF

Example

```
CALC:MARK3 ON
```

Switches on marker 3 or switches to marker mode.

Characteristics

*RST value: OFF
SCPI: device-specific

CALCulate:MARKer<1...6>:AOFF

This command switches off all active markers and all delta markers and active marker/delta marker measurement functions.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:MARK:AOFF
```

Switches off all markers.

Characteristics

*RST value: –
SCPI: device-specific

CALCulate:MARKer<1...6>:MAXimum[:PEAK]

This command positions the marker to the current maximum value of the corresponding trace. The corresponding marker is activated first or switched to the marker mode.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:MARK2:MAX
```

Positions marker 2 to the maximum value of the trace.

Characteristics

*RST value: –
SCPI: device-specific

CALCulate:MARKer<1...6>:MAXimum:NEXT

This command positions the marker to the next smaller maximum value of the corresponding trace.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:MARK2:MAX:NEXT
```

Positions marker 2 to the next lower maximum value.

Characteristics

*RST value: –
 SCPI: device-specific

CALCulate:MARKer<1...6>:MINimum[:PEAK]

This command positions the marker to the current minimum value of the corresponding trace. The corresponding marker is activated first or switched to marker mode, if necessary.

This command is an event and therefore has no *RST value and no query.

Example

```
CALC:MARK2:MIN
```

Positions marker 2 to the minimum value of the trace.

Characteristics

*RST value: –
 SCPI: device-specific

CALCulate:MARKer<1...6>:X

This command positions the marker indicated by the suffix to the specified position on the horizontal axis. Depending on the measurement this can be frequency, time or cable distance. The corresponding marker is activated first, if necessary.

Parameter

0 to MAX (frequency, time or distance)

Example

```
CALC:MARK2:X 10.7MHz
```

Positions marker 2 to frequency 10.7 MHz.

Characteristics

*RST value: –
 SCPI: device-specific

CALCulate:MARKer<1...6>:X:SLIMits[:STATe]

This command activates and deactivates marker search limits.

If the power measurement in zero span is active, this command limits the evaluation range on the trace.

The numeric suffix <1...6> is irrelevant for this command.

Parameter

ON | OFF

Example

```
CALC:MARK:X:SLIM ON
```

Switches on search limitation.

Characteristics

*RST value: OFF
 SCPI: device-specific

CALCulate:MARKer<1...6>:X:SLIMits:LEFT

This command sets the left limit of the search range for markers and delta markers. Depending on the span setting of the x-axis the indicated value defines a frequency (span > 0) or time (span = 0).

The numeric suffix <1...6> is irrelevant for this command.

If the power measurement in zero span is active, this command limits the evaluation range to the trace.

The command is available only after the marker search limits have been activated with "CALCulate<1|2>:MARKer<1...6>:X:SLIMits[:STATe]".

Parameter

0 to MAX (frequency | sweep time)

Example

```
CALC:MARK:X:SLIM ON
```

Switches the search limit function on.

```
CALC:MARK:X:SLIM:LEFT 10MHz
```

Sets the left limit of the search range to 10 MHz.

Characteristics

*RST value: – (is set to the left diagram border when switching on search limits)
 SCPI: device-specific

CALCulate:MARKer<1...6>:X:SLIMits:RIGHT

This command sets the right limit of the search range for markers and delta markers. Depending on the span setting of the x-axis the indicated value defines a frequency (span > 0) or time (span = 0).

The numeric suffix <1...6> is irrelevant for this command.

If the power measurement in zero span is active, this command limits the evaluation range to the trace.

The command is available only after the marker search limits have been activated with "CALCulate<1|2>:MARKer<1...6>:X:SLIMits:LEFT".

Parameter

0 to MAX (frequency | sweep time)

Example

```
CALC:MARK:X:SLIM ON
```

Switches the search limit function on.

```
CALC:MARK:X:SLIM:RIGH 20MHz
```

Sets the right limit of the search range to 20 MHz.

Characteristics

*RST value: – (is set to the right diagram border when switching on search limits)
SCPI: device-specific

CALCulate:MARKer<1...6>:Y?

This command queries the measured value of the selected marker. The corresponding marker is activated before or switched to marker mode, if necessary.

To obtain a correct query result, a complete sweep with synchronization to the sweep end must be performed between the activation of the marker and the query of the Y value. This is only possible in single sweep mode.

Return values

Numeric value of the marker position, the unit depends on the measurement format.

Example

```
INIT:CONT OFF
```

Switches to single sweep mode.

```
CALC:MARK2 ON
```

Switches marker 2.

```
INIT;*WAI
```

Starts a sweep and waits for the end.

```
CALC:MARK2:Y?
```

Outputs the measured value of marker 2.

Characteristics

*RST value: –
SCPI: device-specific

7.2.7 Configuring and Using Measurement Functions

This chapter provides information on how to configure two-port measurements with the tracking generator. The structure follows the order of the actual operation sequence used when performing a measurement:

- [Selecting the Cable Characteristics](#) on page 51
- [Selecting the Measurement Mode](#) on page 51
- [Calibrating the Measurement](#) on page 52

To perform the actual measurement, use the commands described in section "[Performing and Triggering Measurements](#)".

7.2.7.1 Selecting the Cable Characteristics

The following commands define the cable characteristics for the cable you are testing in CAT mode.

List of commands

- [CALCulate:DTF:CABLE:PRESet](#) (p. 51)

CALCulate:DTF:CABLE:PRESet

This command selects the cable model.

Parameter

<string> = file name of the cable model

Example

```
CALC:DTF:CAB:PRES 'HLFR.CBLMOD'  
Selects the cable model from the file HLFR.CBLMOD
```

Characteristics

*RST value: -
SCPI: device-specific

7.2.7.2 Selecting the Measurement Mode

The following commands select the measurement mode in CAT mode.

List of commands

- [MEASurement<1|2>:MODE](#) (p. 52)

MEASurement:MODE

This command sets the measurement mode for cable measurements.

Parameter

REFlection	Reflection (S11) measurement
DTFault	Distance-to-fault measurement
LOSS	Cable loss measurement
TRANsmision	Transmission (S21) measurement (option R&S ZVH-K39)

Example

```
MEAS:MODE LOSS
Activates cable loss measurement.
```

Characteristics

*RST value: REFlection
SCPI: device-specific

7.2.7.3 Calibrating the Measurement

The following commands control calibration of cable measurements.

List of commands

- [CALibration:MODE?](#) (p. 52)
- [CALibration:STATus?](#) (p. 53)

CALibration:MODE?

This command queries if the current measurement mode is calibrated.

This command is a query and therefore has no *RST value.

Return values

0 not calibrated
1 calibrated

Example

```
CAL:MODE?
```

Characteristics

*RST value: -
SCPI: device-specific

CALibration:STATus?

This command queries whether the R&S ZVH is fully calibrated for the current measurement mode or not.

This command is a query and therefore has no *RST value.

Return values

NORMal	the R&S ZVH is fully calibrated
APPRoximate	the R&S ZVH is approximately calibrated, meaning that greater measurement uncertainty must be anticipated

Example

```
CAL:STAT?
```

Queries the calibration status of the R&S ZVH.

Characteristics

*RST value: -

SCPI: device-specific

7.3 Remote Commands in Power Meter Mode

The chapter provides information on remote commands that configure and perform power measurements with the power sensor. These commands are available in power meter mode only.



Availability of remote commands for Power Sensor measurements

Note that the listed remote commands take effect only if the power sensors R&S ZVH-Z1, R&S ZVH-Z18, R&S ZVH-Z14 or R&S ZVH-Z44 are installed.

7.3.1 Setting the Frequency

The following chapter describes commands necessary to define frequency settings.

List of commands

- [\[SENSe:\]PMETer:FREQuency](#) (p. 54)

[SENSe:]PMETer:FREQuency

This command sets the frequency of the power sensor.

Parameter

<numeric value> = frequency in Hz

Example

```
PMET:FREQ 500 MHZ
```

Sets the power sensor's frequency to 500 MHz

Characteristics

*RST value: -

SCPI: device-specific

7.3.2 Configuring Power Level Readout

The following chapter describes commands that configure the power level readout.

List of commands

- [\[SENSe:\]PMETer:FREQuency](#) (p. 54)
- [CALCulate:PMETer:RELative:MAGNitude](#) (p. 55)
- [CALCulate:PMETer:RELative:MAGNitude:AUTO](#) (p. 55)
- [CALCulate:PMETer:RELative:MAGNitude:OFFSet](#) (p. 56)
- [UNIT<1|2>:PMETer:POWER](#) (p. 56)

CALCulate:PMETer:RELative[:MAGNitude]

This command sets the reference level for relative measurements.

Parameter

<numeric value> = level of the reference value

Example

```
CALC:PMET:REL 30
```

The the reference value to 30 dBm.

Characteristics

*RST value: -
SCPI: device-specific

CALCulate:PMETer:RELative[:MAGNitude]:AUTO

This command sets the current measurement result as the reference level for relative measurements.

This command is an event and therefore has no *RST value and no query.

Parameter

ONCE

Example

```
CALC:PMET:REL ONCE
```

Characteristics

*RST value: -
SCPI: device-specific

CALCulate:PMETer:RELative[:MAGNitude]:OFFSet

This command sets the offset of the reference level for relative measurements.

Parameter

<numeric value> = reference offset

Example

```
CALC:PMET:REL -10
```

Characteristics

*RST value: -

SCPI: device-specific

UNIT<1|2>:PMETer:POWER

This command selects the unit of the power sensor.

The suffix at UNIT has the following effects:

Power Measurement with R&S ZVH-Z1, R&S ZVH-Z18 and R&S NRP-Z power sensors:

Unit 1 Power unit

Unit 2 not available.

Power Measurement with R&S ZVH-Z14 and R&S ZVH-Z44:

Unit 1 Forward Power

Unit 2 Reflected Power

Parameter

DBM | WATT | W | DB | VSWR

Note on the parameter DB: when applied to UNIT1, the power is relative to the reference level, when applied to UNIT2, the return loss is displayed.

Note on the parameter VSWR: the parameter is only available if applied to UNIT2.

Example

```
UNIT1:PMET:POW DBM
```

When measuring with the R&S ZVH-Z1 or R&S ZVH-Z18: sets unit to dBm.

When measuring with the R&S ZVH-Z14 or R&S ZVH-Z44: sets unit of forward power to dBm.

Characteristics

*RST value: -

SCPI: device-specific

7.3.3 Setting the Bandwidths

The following commands configure the filter bandwidths of the R&S ZVH.

- [CALCulate:PMETer:PRESet:BANDwidth:VIDeo](#) (p. 57)

CALCulate:PMETer:PRESet:BANDwidth:VIDeo

This command sets the filter bandwidth for power sensor measurements.

Parameter

<numeric value> = video bandwidth in Hz

Example

```
CALC:PMET:PRESet:BAND:VID 4 kHz  
Sets a 4 kHz video bandwidth
```

Characteristics

*RST value: -
SCPI: device-specific

7.3.4 Defining the Measurement Time

The following chapter describes commands to define the measurement time of the power sensor.

- [\[SENSe:\]PMETer:MTIME](#) (p. 57)

[SENSe:]PMETer:MTIME

This command sets the duration of measurements with the power sensor.

Parameter

SHORT | NORMal | LONG

Example

```
PMET:MTIME SHOR  
Sets a short measurement time for power measurements.
```

Characteristics

*RST value: -
SCPI: device-specific

7.3.5 Performing Measurements with the Power Sensor

The following chapter describes all commands that are available for performing power measurements with the power sensor.

- [CALibration:PMETer:ZERO:AUTO](#) (p. 58)
- [\[SENSe:\]PMETer:DETEctor\[:FUNCTion\]](#) (p. 58)
- [FETCh<1...2>:PMETer?](#) (p. 59)
- [CALCulate:PMETer:PRESet\[:STATe\]](#) (p. 59)
- [CALCulate:PMETer:PRESet:SElect](#) (p. 60)

7.3.5.1 Zeroing of the Power Sensor

CALibration:PMETer:ZERO:AUTO

This commands starts to zero the power sensor.

Parameter

ONCE

Example

```
CAL:PMET:ZERO:AUTO ONCE
Starts to zero the power meter.
```

Characteristics

*RST value: -
SCPI: device-specific

7.3.5.2 Forward Power Display

Note that the forward power is only available in conjunction with the R&S ZVH-Z14 or R&S ZVH-Z44.

[SENSe:]PMETer:DETEctor[:FUNCTion]

This command selects the forward power display of the power sensor.

Parameter

AVERage average power

PENvelope peak envelope power

Example

```
PMET:DET AVER
Selects the Average weighting mode.
```

Characteristics

*RST value: -
SCPI: device-specific

7.3.5.3 Reading Out Measurement Results

FETch<1...2>:PMETer?

This command queries the results of measurements with the power sensor.

Return values

Measurements with R&S FSH-Z1, R&S FSH -Z18 or R&S NRP-xx power sensors:

FETch1 returns the power unit

FETch2 not available

Measurements with R&S FSH -Z14 or R&S FSH -Z44

FETch1 forward power

FETch2 reflected power

Example

FET2 : PMET?

Returns nothing for R&S FSH -Z1 / Z18 and the R&S NRP power sensors and the reflected power for R&S FSH -Z14 / Z44.

Characteristics

*RST value: -

SCPI: device-specific

7.3.5.4 Selecting a Standard

These commands apply radio communication standards to measurements with the power sensor.

Note that the selection of a standard is available only for the power sensors R&S FSH-Z1, -Z14, -Z18 and -Z44.

CALCulate:PMETer:PRESet[:STATe]

This command activates and deactivates the usage of a standard for power sensor measurements.

Parameters

ON | OFF

Example

CALC : PMET : PRES ON

Activates usage of a standard

Characteristics

*RST value: -

SCPI: device-specific

CALCulate:PMETer:PRESet:SElect

This command selects the standard for measurements with the power sensor.

Parameter

GSM | EDGE | WCDMA | CDMAOne | CDMA2000 | DVBT | DAB | TETRA | USER

Example

```
CALC:PMET:PRE:SEL GSM
```

Selects the GSM standard for power sensor measurements

Characteristics

*RST value: -

SCPI: device-specific

7.4 Saving and Restoring Instrument Settings and Measurement Results

The following commands perform various tasks in the context of file management.

These commands are independent from the operating mode.

List of commands

- [MMEMory:CATalog?](#) (p. 61)
- [MMEMory:CATalog:DIRectories?](#) (p. 62)
- [MMEMory:CDIRectory](#) (p. 62)
- [MMEMory:COpy](#) (p. 62)
- [MMEMory:DATA](#) (p. 63)
- [MMEMory:DELeTe](#) (p. 64)
- [MMEMory:FILE](#) (p. 64)
- [MMEMory:FILE:DATE](#) (p. 64)
- [MMEMory:FILE:TIME](#) (p. 65)
- [MMEMory:INIT](#) (p. 65)
- [MMEMory:LOAD:STATE](#) (p. 65)
- [MMEMory:MDIRectory](#) (p. 66)
- [MMEMory:MOVE](#) (p. 66)
- [MMEMory:RDIRectory](#) (p. 67)
- [MMEMory:STORe:STATE](#) (p. 67)

MMEMory:CATalog?

This command reads the indicated directory. According to DOS convention, wild card characters can be entered in order to query e.g. a list of all files of a certain type.

This command is a query and therefore has no *RST value.

Parameter

<path> = DOS Path name

The path name should be in conformance with DOS conventions and may also include the drive name.

Return values

List of file names in the form of strings separated by commas, i.e.
SPOOL1.WMF,SPOOL2.WMF,SPOOL3.WMF

Example

```
MMEM:CAT? 'D:\USER\*.DFL'
```

Returns all files in D:\user with extension ".DFL"

```
MMEM:CAT? 'D:\USER\SPOOL?.WMF'
```

Returns all files in D:\USER whose names start with SPOOL, have 6 letters and the extension ".WMF".

Characteristics

*RST value: -
SCPI: conform

MMEMory:CATalog:DIRectories?

This command lists the size of memory used by files and the size of memory space available together with a list of subdirectories.

This command is a query and therefore has no *RST value.

Example

```
MMEM:CAT:DIR?
```

Returns memory allocation and subdirectory information.

Characteristics

*RST value: -
SCPI: device-specific

MMEMory:CDIRectory

This command changes the current directory.

Parameter

<directory_name> = DOS path name

In addition to the path name, the indication of the directory may contain the drive name. The path name complies with the DOS conventions.

Example

```
MMEM:CDIR 'D:\user'
```

Selects the directory D:\USER.

Characteristics

*RST value: -
SCPI: conform

MMEMory:COPY

This command copies the files indicated in <file_source> to the destination directory indicated with <file_destination> or to the destination file indicated by <file_destination> if <file_source> is just a file.

This command is an event and therefore has no *RST value and no query.

Parameter

<file_source>,<file_destination> = <file_name> = DOS file name

The indication of the file name may include the path and the drive name. The file names and path information must be in accordance with the DOS conventions.

Example

```
MMEM:COPY 'D:\USER\SETUP.CFG','E:'
```

Copies the SETUP.CFG file to drive E:

Characteristics

*RST value: -

SCPI: conform

MMEMory:DATA

This command writes the block data contained in <block> into the file characterized by <file_name>. The delimiter must be set to EOI to obtain error-free data transfer. The associated query command reads the indicated file from the mass memory and transfers it to the remote control computer. It should be noted that the buffer memory of the control computer should be large enough to store the file. The setting of the delimiter is irrelevant in this case.

The command is useful for reading stored settings files or trace data from the instrument or for transferring them to the instrument.

Parameter

<file_name>[,<block>]

<file_name> selects the file to be transferred

<block> binary data block with the following structure:

- character '#'
- digit for the length of the length information
- indicated number of digits as length information (number of bytes) for the binary data themselves
- binary data with the indicated number of bytes

Example

```
MMEM:DATA 'TEST01.HCP,#216This is the file'
```

means: #2: the next 2 characters are the length indication; 16: number of subsequent binary data bytes; This is the file: 16 bytes stored as binary data in the file TEST01.HCP.

```
MMEM:DATA? 'TEST01.HCP'
```

Transfers the file TEST01.HCP from the instrument to the control computer.

Characteristics

*RST value: -

SCPI: conform

MMEMory:DELeTe

This command deletes the indicated files.

Parameter

<file_name> = DOS file name

The indication of the file name contains the path and, optionally, the drive name. Indication of the path complies with DOS conventions.

Example

```
MMEM:DEL 'TEST01.HCP'
```

The file TEST01.HCP is deleted.

Characteristics

*RST value: -
SCPI: conform

MMEMory:FILE

This command creates a file with the specified name.

Parameter

<string> = file name

Example

```
MMEM:FILE 'TEST.TXT'
```

Creates the file TEST.TXT

Characteristics

*RST value: -
SCPI: conform

MMEMory:FILE:DATE

This command sets or reads the date of the indicated file. The sequence of entry is year, month, day.

Parameter

1980...2099, 1...12, 1...31

Example

```
MMEM:FILE:DATE 2010,04,01
```

Sets the date to April, 1st, 2010.

Characteristics

*RST value: -
SCPI: conform

MMEMory:FILE:TIME

This command sets the time of the indicated file. The sequence of entry is hour, minute, second.

Parameter

0...23, 0...59, 0...59

Example

```
MMEM:FILE:TIME 12,00,00  
Sets the time to 12:00:00
```

Characteristics

*RST value: -
SCPI: conform

MMEMory:INIT

This command formats the indicated drive.

Note

Formatting deletes all data stored on the memory drive.

This command is an event and therefore has no *RST value and no query.

Example:

```
MMEM:INIT  
Formats and deletes all data from the drive.
```

Characteristics:

*RST value: -
SCPI: conform

MMEMory:LOAD:STATe

This command loads the device settings from *.set files. The contents of the file are loaded and set as the new device state.

Parameter

1,<file_name>

with <file_name> = DOS file name without extension

The file name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.

Example

```
MMEM:LOAD:STAT 1, 'D:\USER\TEST01.SET'  
Loads the settings from the file TEST01.
```

Characteristics

*RST value: -
 SCPI: conform

MMEMory:MDIRectory

This command creates a new directory. The file name includes indication of the path and may also include the drive name. The path name complies with DOS conventions.

This command is an event and therefore has no *RST value and no query.

Parameter

<directory_name> = DOS path name

Example

```
MMEM:MDIR 'D:\USER'
```

Creates the USER directory on drive D:

Characteristics

*RST value: -
 SCPI: device-specific

MMEMory:MOVE

This command renames existing files, if <file_destination> contains no path. Otherwise the file is moved to the indicated path and stored under the file name specified there.

This command is an event and therefore has no *RST value and no query.

Parameter

<file_source>,<file_destination> = <file_name> = DOS file name

The file name includes indication of the path and may also include the drive. The path name complies with DOS conventions.

Example

```
MMEM:MOVE 'C:\TEST01.CFG', 'SETUP.CFG'
```

Renames TEST01.CFG in SETUP.CFG in directory C:\.

```
MMEM:MOVE 'C:\TEST01.CFG', 'C:\USER'
```

Moves TEST01.CFG from C:\ to C:\USER.

```
MMEM:MOVE 'C:\TEST01.CFG', 'C:\USER\SETUP.CFG'
```

Moves TEST01.CFG from C:\ to C:\R_S\Instr\user and renames the file in SETUP.CFG.

Characteristics

*RST value: -
 SCPI: conform

MMEMory:RDIRectory

This command deletes the indicated directory. The directory name includes the path and may also include the drive name. The path name complies with DOS conventions.

This command is an event and therefore has no *RST value and no query.

Parameter

<directory_name> = DOS path name

Example

```
MMEM:RDIR 'C:\TEST'
```

Deletes the directory 'TEST' on drive C:

Characteristics

*RST value: -

SCPI: device-specific

MMEMory:STORe:STATe

This command stores the current device settings in a *set file.

This command is an event and therefore has no *RST value and no query.

Parameter

1,<file_name>

with <file_name> = DOS file name without extension

The file name includes the path and may also include the drive name. The path name complies with DOS conventions.

Example

```
MMEM:STOR:STAT 1, 'DATASET001.SET'
```

Saves the current device settings in the file DATASET001.SET.

Characteristics

*RST value: -

SCPI: conform

7.5 Making and Storing Screenshots

The following commands manage screenshots.

These commands are independent from the operating mode.

List of commands

- [HCOPY\[:IMMEDIATE\]](#) (p. 68)
- [MMEMory:NAME](#) (p. 68)

HCOPY[:IMMEDIATE]

This command makes a screenshot of the current trace and stores it on the R&S ZVH internal hard disk.

This command is an event and therefore has no *RST value and no query.

Example

```
MMEM:NAME '\Public\Screenshots\Test.png'
```

Defines the file name of the screenshot.

```
HCOP
```

Makes and stores a screenshot of the current screen.

Characteristics

*RST value: -
SCPI: device-specific

MMEMory:NAME

This command defines the path and file name that the R&S FSH uses for storing screenshots (see "[HCOPY\[:IMMEDIATE\]](#)"). The path and file name comply with DOS conventions.

This command is an event and therefore has no *RST value and no query.

Parameter

<file_name> = DOS file name (incl. path name)

Example

```
MMEM:NAME 'Public\Screenshots\Test.png'
```

Stores the screenshot under D:\Test

Characteristics

*RST value: -
SCPI: device-specific

7.6 Configuring the Instrument

The following commands configure general instrument settings.
These commands are independent from the operating mode.

7.6.1 Mode Selection

This chapter describes all commands that select the operating mode of the R&S ZVH.

List of commands

- [INSTrument\[:SElect\]](#) (p. 69)
- [INSTrument:NSElect](#) (p. 69)

INSTrument[:SElect]

This command switches between the measurement modes by means of text parameters.

Parameter

SANalyzer	Spectrum Analyzer
ACT	Cable & Antenna Test
PM	Power Meter

Example

```
INST SAN
```

Switches the instrument to spectrum analyzer mode.

Characteristics

*RST value: SANalyzer
SCPI: conform

INSTrument:NSElect

This command switches between the measurement modes by means of numbers.

Parameter

1	Spectrum Analyzer
2	Network Analyzer
4	Distance-to-Fault
7	WCDMA

Example

```
INST:NSEL 1
```

Switches the instrument to spectrum analyzer mode.

Characteristics

*RST value: 1

SCPI: conform

7.6.2 Controlling the GPS Receiver

This chapter describes all commands that control the GPS receiver.

List of commands

- [SYSTem:POSition:ALTitude?](#) (p. 70)
- [SYSTem:POSition:GPS\[:STATe\]](#) (p. 70)
- [SYSTem:POSition:GPS:CONNected?](#) (p. 71)
- [SYSTem:POSition:GPS:CORRection:FREQUency?](#) (p. 71)
- [SYSTem:POSition:GPS:QUALity](#) (p. 71)
- [SYSTem:POSition:GPS:SATellites?](#) (p. 72)
- [SYSTem:POSition:LATitude?](#) (p. 72)
- [SYSTem:POSition:LONGitude?](#) (p. 73)
- [SYSTem:POSition:VALid?](#) (p. 73)

SYSTem:POSition:ALTitude?

This command queries the altitude of the current position of the R&S ZVH.

Return values

Altitude in meters above sea level.

Example

```
SYST:POS:ALT?
```

Return value would be, for example, 554.1

Characteristics:

*RST value: -

SCPI: device-specific

SYSTem:POSition:GPS[:STATe]

This command activates and deactivates the GPS receiver (R&S HA-Z240).

Note that the GPS receiver only works if a connection between the R&S ZVH and a GPS signal transmitter is established.

Parameter

ON | OFF

Example

```
SYST:POS:GPS ON
```

Activates the GPS receiver.

Characteristics:

*RST value: OFF
SCPI: device-specific

SYSTem:POSition:GPS:CONNected?

This command queries if the R&S ZVH is currently connected to the GPS receiver (R&S HA-Z240).

Return values

0 no connection to a GPS device
1 connection to a GPS device is established

Example

```
SYST:POS:GPS:CONN?
```

Characteristics:

*RST value: -
SCPI: device-specific

SYSTem:POSition:GPS:CORRection:FREQuency?

This command queries the frequency correction factor. This factor is calculated from a reference signal provided by the GPS receiver R&S HA-Z240. The reference signal is used to determine the deviation of the internal clock of the instrument, which can be turned into a correction factor for the measured frequency.

Return values

<floating point value>

If the GPS receiver is deactivated, this query returns 0.

Example

```
SYST:POS:GPS:CORR:FREQ?
```

Characteristics:

*RST value: -
SCPI: device-specific

SYSTem:POSition:GPS:QUALity

This command queries the quality of the GPS signal.

Return values

INSufficient | LOW | MEDium | HIGH | EXCellent

Example

```
SYST:POS:GPS:QUAL?
```

Characteristics:

*RST value: -
SCPI: device-specific

SYSTem:POSition:GPS:SATellites?

This command queries the number of tracked satellites.

Return values

<number of satellites>

Example

```
SYST:POS:GPS:SAT?
```

Characteristics:

*RST value: -
SCPI: device-specific

SYSTem:POSition:LATitude?

This command queries the latitude of the current position of the R&S ZVH.

Return values

<sign><degrees>,<minutes>,<seconds>

<sign> no sign = northern hemisphere, negative sign (-) = southern hemisphere

<degrees> degrees of latitude (integer value)

<minutes> minutes of latitude (integer value)

<seconds> seconds of latitude (floating point value)

Example

```
SYST:POS:LAT?
```

Return value would be, for example, 48,7,40.0 for 48°, 7', 40.0" in the northern hemisphere.

Characteristics:

*RST value: -
SCPI: device-specific

SYSTem:POSition:LONGitude?

This command queries the longitude of the current position of the R&S ZVH.

Return values

<sign><degrees>,<minutes>,<seconds>

<sign> no sign = east, negative sign (-) = west

<degrees> degrees of longitude (integer value)

<minutes> minutes of longitude (integer value)

<seconds> seconds of longitude (floating point value)

Example

SYST:POS:LONG?

Return value would be, for example, 11,36,46.2 for 11°, 36', 46.2" East

Characteristics:

*RST value: -

SCPI: device-specific

SYSTem:POSition:VALid?

This command queries the validity of the position information.

Return values

0 The position information is not valid

1 The position information is valid.

Example

SYST:POS:VAL?

Characteristics:

*RST value: -

SCPI: device-specific

7.6.3 Display Configuration

This chapter describes commands to set up the display of the R&S ZVH via remote control.

List of Commands

- [DISPlay:BRIGhtness](#) (p. 74)
- [DISPlay:CMAP](#) (p. 74)
- [DISPlay:CMAP:DEFault](#) (p. 74)
- [DISPlay:DATE:FORMat](#) (p. 75)

DISPlay:BRIGhtness

This command sets the brightness of the display backlight.

Parameter

1 to 1

Example

```
DISP:BRIG 0.80
```

Sets the brightness of the display to 80%

Characteristics

*RST value: 0.5 (50%)

SCPI: device-specific

DISPlay:CMAP

This command sets the color scheme of the display to either color or black and white.

Parameter

COLor | BW

Example

```
DISP:CMAP BW
```

Sets the screen colors to black and white

Characteristics

*RST value: COLor

SCPI: conform

DISPlay:CMAP:DEFault

This command resets the screen colors of all display items to their default settings, i.e. to the color scheme.

This command is an event and therefore has no query and no *RST value.

Example

```
DISP:CMPA:DEF
```

Restores the default screen colors

Characteristics

*RST value: -
SCPI: conform

DISPlay:DATE:FORMat

This command sets the display date format.

Parameter

DDMMyyyy | MMDDyyyy

Example

```
DISP:DATE:FORM DDMMyyyy
```

Characteristics

*RST value: DDMMyyyy
SCPI: device-specific

7.6.4 Audio Settings

This chapter describes all commands to control the audio functions of the R&S FSH.

List of commands

- [SYSTem:AUDio:VOLume](#) (p. 75)
- [SYSTem:BEEPer:VOLume](#) (p. 76)
- [SYSTem:BEEPer:KEY:VOLume](#) (p. 76)

SYSTem:AUDio:VOLume

This command sets the volume of the internal speaker. The range is between 0 and 1, with 1 being the maximum possible volume.

Parameter

0 to 1

Example

```
SYST:AUD:VOL 0.40
```

Sets the volume to 40%

Characteristics

*RST value: 0.3 (30%)
SCPI: device-specific

SYSTem:BEEPer:KEY:VOLume

This command sets the volume of the keyboard clicking. The range is between 0 and 1, with 1 being the maximum possible volume.

Parameter

0 to 1

Example

```
SYST:BEEP:KEY:VOL 0.10
```

Sets of keyboard clicking volume to 10%

Characteristics

*RST value: 0.3 (30%)
SCPI: conform

7.6.5 Setting up a Network Connection

This chapter describes all commands that are used if the R&S ZVH is part of a network.

List of commands

- [SYSTem:COMMunicate:LAN:ETHernet?](#) (p. 76)
- [SYSTem:COMMunicate:LAN:SUBMask](#) (p. 77)
- [SYSTem:COMMunicate:SOCKet:ADDRess](#) (p. 77)
- [SYSTem:COMMunicate:SOCKet:DHCP\[:STATe\]](#) (p. 77)
- [SYSTem:COMMunicate:SOCKet:PORT](#) (p. 78)

SYSTem:COMMunicate:LAN:ETHernet?

This command queries the MAC address of the R&S ZVH.

This command is a query and therefore has no *RST value.

Example

```
SYST:COMM:LAN:ETH?
```

Returns the MAC address

Characteristics

*RST value: -
SCPI: device-specific

SYSTem:COMMunicate:LAN:SUBMask

This command sets the subnet mask address of the R&S ZVH.

Parameter

<string> = subnet mask address

Example

```
SYST:COMM:LAN:SUBM '255.255.255.0'
```

Sets the subnet mask address to 255.255.255.0

Characteristics

*RST value: 255.255.255.0
SCPI: device-specific

SYSTem:COMMunicate:SOCKet:ADDRess

This command sets the IP address of the R&S ZVH.

Parameter

<string> = IP address

Example

```
SYST:COMM:SOCK:ADDR '172.76.68.30'
```

Sets the IP address of the R&S ZVH to 172.76.68.30

Characteristics

*RST value: 172.76.68.24
SCPI: device-specific

SYSTem:COMMunicate:SOCKet:DHCP[:STATe]

This command activates and deactivates the Dynamic Host Configuration Protocol (DHCP).

Parameter

ON | OFF

Example

```
SYST:COMM:SOCK:DHCP ON
```

Activates DHCP.

Characteristics

*RST value: ON
SCPI: device-specific

SYSTem:COMMunicate:SOCKet:PORT

This command sets the port number for the connection.

Parameter

<port_number>

Example

```
SYST:COMM:SOCK:PORT 1000  
Sets the port number to 1000
```

Characteristics

*RST value: 5555
SCPI: device-specific

7.6.6 System Settings

This chapter describes all commands that define or query general system settings.

List of commands

- [INPut:IMPedance:PAD](#) (p. 79)
- [\[SENSe:\]ROSCilator:SOURce](#) (p. 79)
- [SYSTem:BNC<1...2>:MODE](#) (p. 79)
- [SYSTem:DATE](#) (p. 80)
- [SYSTem:ERRor\[:NEXT\]?](#) (p. 80)
- [SYSTem:ERRor:ALL?](#) (p. 80)
- [SYSTem:ERRor:COUNT?](#) (p. 81)
- [SYSTem:ERRor:CODE\[:NEXT\]?](#) (p. 81)
- [SYSTem:ERRor:CODE:ALL?](#) (p. 81)
- [SYSTem:HELP:HEADers?](#) (p. 82)
- [SYSTem:HELP:SYNTax?](#) (p. 82)
- [SYSTem:LANGuage:CATalog?](#) (p. 83)
- [SYSTem:POWER:SOURce?](#) (p. 83)
- [SYSTem:POWER:STATus?](#) (p. 84)
- [SYSTem:PRESet:FACTory](#) (p. 84)
- [SYSTem:TIME](#) (p. 84)
- [SYSTem:VERSion?](#) (p. 85)

INPut:IMPedance:PAD

This command selects the matching pad connected to the R&S ZVH.

Parameter

RAM | RAZ | HZTE

Example

```
INPut:IMP 75;PAD RAZ
```

Selects 75 U input impedance and the R&S RAZ as the currently used matching pad.

Characteristics

*RST value: -
SCPI: device-specific

[SENSe:]ROSCillator:SOURce

This command selects the source of the frequency reference oscillator.

If you use an external reference signal, make sure to connect the signal to the Ext Ref BNC connector of the R&S ZVH.

Parameter

INTernal | EXTernal

Example

```
ROSC:SOUR EXT
```

Activates external source as reference signal.

Characteristics

*RST value: -
SCPI: device-specific

SYSTem:BNC<1...2>:MODE

This command selects the function the BNC socket indicated by the numeric suffix is used for.

Parameter

REFerence | TRIGger | BIAS | IF3 | IFDac

Example

```
SYST:BNC2:MODE BIAS
```

Sets the seconds BNC socket to BIAS.

Characteristics

*RST value: BNC 1: TRIGger, BNC 2: IF3
SCPI: device-specific

SYSTem:DATE

This command sets the date for the internal calendar.

The sequence of entry is year, month, day.

Parameter

1980 to 2099, 1 to 12, 1 to 31

Example

```
SYST:DATE 2000,6,1
```

Characteristics

*RST value: -

SCPI: conform

SYSTem:ERRor[:NEXT]?

This command queries the earliest error queue entry and deletes it. The entry consists of an error number and a short description of the error.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

This command is a query and therefore has no *RST value.

Example

```
STAT:ERR?
```

Characteristics

*RST value: -

SCPI: conform

SYSTem:ERRor:ALL?

This command retrieves all entries in the error queue. The entry consists of an error number and a short description of the error.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0 is returned.

This command is a query and therefore no *RST value.

Example

```
SYST:ERR:ALL?
```

Characteristics

*RST value: -

SCPI: device-specific

SYSTem:ERRor:CODE[:NEXT]?

This command queries the earliest error queue entry and deletes it. The entry consists of the error number only..

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "No error", is returned.

This command is a query and therefore has no *RST value.

Example

```
STAT:ERR:CODE?
```

Characteristics

*RST value: -

SCPI: conform

SYSTem:ERRor:CODE:ALL?

This command retrieves all entries in the error queue. The entry consists of the error number only..

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0 is returned.

This command is a query and therefore no *RST value.

Example

```
SYST:ERR:CODE:ALL?
```

Characteristics

*RST value: -

SCPI: device-specific

SYSTem:ERRor:COUNt?

This command queries the number of errors currently in the error queue.

This command is a query and therefore no *RST value.

Example

```
SYST:ERR:COUN?
```

Characteristics

*RST value: -

SCPI: device-specific

SYSTem:FORMat:IDENT

This command sets the response format to the `*IDN?` query. This function is intended for re-use of existing control programs together with the R&S ZVH.

Parameter

LEGacy Format compatible to the R&S ZVH3/6/18
 *IDN would return e.g. "Rohde&Schwarz,FSH8,101805/028,1.30"

NEW New format for the R&S ZVH4/8
 *IDN would return e.g.
 "Rohde&Schwarz,FSH8,1309.6000K28/101805,1.30"

Example

```
SYST:FORM:IDEN
```

Characteristics

*RST value: -

SCPI: device-specific

SYSTem:HELP:HEADers?

This command returns a list of all common commands and instrument-control commands and queries implemented in the instrument.

This command is a query and therefore no *RST value.

Example

```
SYST:HELP:HEAD?
```

Returns the syntax of all available commands.

Characteristics

*RST value:

SCPI: conform

SYSTem:HELP:SYNTax?

This command returns the full syntax and all parameters of the specified command.

This command is a query and therefore no *RST value.

Parameter

<string> = syntax of command

Example

```
SYST:HELP:SYNT? 'SYST:ERR?'
```

Returns the full syntax. In this case: 'SYSTem:ERRor[:NEXT]'.

Characteristics

*RST value: -
SCPI: device-specific

SYSTem:LANGuage

This command sets the language of the R&S ZVH user interface. You can query a list of available languages with "SYSTem:LANGuage:CATalog?".

Parameter

<language> = string of the language

Example

```
SYST:LANG 'english'
```

Sets the system language to English

Characteristics

*RST value: -
SCPI: conform

SYSTem:LANGuage:CATalog?

This command lists all available system languages.

This command is a query and therefore no *RST value.

Example

```
SYST:LANG:CAT?
```

Characteristics

*RST value: -
SCPI: device-specific

SYSTem:POWer:SOURce?

This command queries whether R&S ZVH is battery-powered or line-powered.

This command is a query and therefore has no *RST value.

Return values

ADAP R&S ZVH is powered by the mains adapter.

BATT R&S ZVH is powered by the battery.

Example

```
SYST:POW:SOUR?
```

Characteristics

*RST value: -
SCPI: conform

SYSTem:POWer:STATus?

This command queries the remaining power of the battery.

This command is a query and therefore has no *RST value.

Return values

0...100 %

Example

```
SYST:POW:STAT?
```

Characteristics

*RST value: -

SCPI: conform

SYSTem:PRESet:FACTory

This command initiates an instrument reset back to factory settings.

Example

```
SYST:PRESet:FACT
```

Resets the R&S ZVH to its factory settings.

Characteristics

*RST value: -

SCPI: device-specific

SYSTem:TIME

This command sets the internal clock. The sequence of entry is hour, minute, second.

Parameter

0 to 23, 0 to 59, 0 to 59

Example

```
SYST:TIME 12,30,30
```

Characteristics

*RST value: -

SCPI: conform

SYSTem:VERSion?

This command queries the number of the SCPI version, which is relevant for the instrument.

This command is a query and therefore has no *RST value.

Example

```
SYST:VERS?
```

Characteristics

*RST value: -

SCPI: conform

7.7 Status Reporting System

The status reporting system (**Error! Reference source not found.**) stores all information on the present operating state of the instrument, and on errors which have occurred. This information is stored in the status registers and in the error queue. The status registers and the error queue can be queried via Ethernet.

The information is of a hierarchical structure. The register status byte (STB) defined in IEEE 488.2 and its associated mask register service request enable (SRE) form the uppermost level. The STB receives its information from the standard event status register (ESR) which is also defined in IEEE 488.2 with the associated mask register standard event status enable (ESE) and registers STATus:OPERation and STATus:QUESTionable which are defined by SCPI and contain detailed information on the instrument.

The output buffer contains the messages the instrument returns to the controller. It is not part of the status reporting system but determines the value of the MAV bit in the STB.

7.7.1 Structure of an SCPI Status Register

Each standard SCPI register consists of 5 parts which each have a width of 16 bits and have different functions (**Error! Reference source not found.**). The individual bits are independent of each other, i.e. each hardware status is assigned a bit number that applies to all five parts. For example, bit 0 of the STATus:OPERation register is assigned to the calibration status of the R&S FSH. Bit 15 (the most significant bit) is set to zero for all parts. Thus the contents of the register parts can be processed by the controller as positive integer.

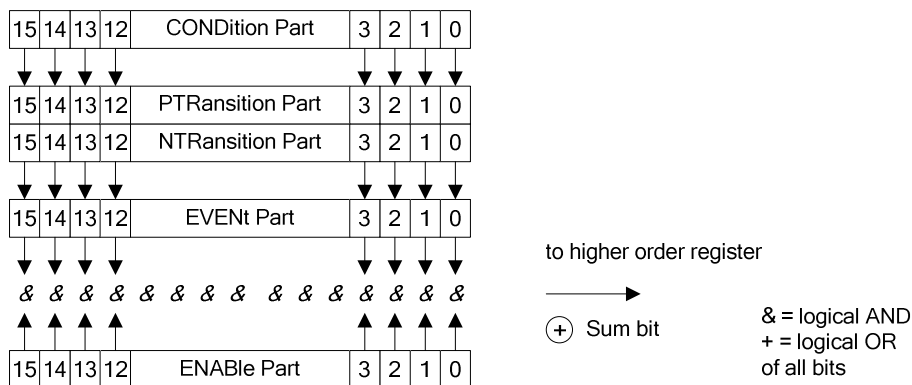


Figure 7-1: The status-register model

7.7.1.1 CONDition part

The CONDition part is directly written into by the hardware or the sum bit of the next lower register. Its contents reflects the current instrument status. This register part can only be read, but not written into or cleared. Its contents is not affected by reading.

7.7.1.2 PTRansition part

The Positive-TRansition part acts as an edge detector. When a bit of the CONDition part is changed from 0 to 1, the associated PTR bit decides whether the EVENT bit is set to 1.

PTR bit =1: the EVENT bit is set.

PTR bit =0: the EVENT bit is not set.

This part can be written into and read at will. Its contents is not affected by reading.

7.7.1.3 NTRansition part

The Negative-TRansition part also acts as an edge detector. When a bit of the CONDition part is changed from 1 to 0, the associated NTR bit decides whether the EVENT bit is set to 1.

NTR-Bit = 1: the EVENT bit is set.

NTR-Bit = 0: the EVENT bit is not set.

This part can be written into and read at will. Its contents is not affected by reading.

With these two edge register parts the user can define which state transition of the condition part (none, 0 to 1, 1 to 0 or both) is stored in the EVENT part.

7.7.1.4 EVENT part

The EVENT part indicates whether an event has occurred since the last reading, it is the "memory" of the condition part. It only indicates events passed on by the edge filters. It is permanently updated by the instrument. This part can only be read by the user. Reading the register clears it. This part is often equated with the entire register.

7.7.1.5 ENABLE part

The ENABLE part determines whether the associated EVENT bit contributes to the sum bit (see below). Each bit of the EVENT part is ANDed with the associated ENABLE bit (symbol '&'). The results of all logical operations of this part are passed on to the sum bit via an OR function (symbol '+').

ENABLE-Bit = 0: the associated EVENT bit does not contribute to the sum bit

ENABLE-Bit = 1: if the associated EVENT bit is "1", the sum bit is set to "1" as well.

This part can be written into and read by the user at will. Its contents is not affected by reading.

7.7.1.6 Sum bit

As indicated above, the sum bit is obtained from the EVENT and ENABLE part for each register. The result is then entered into a bit of the CONDition part of the higher-order register.

The instrument automatically generates the sum bit for each register. Thus an event, e.g. a PLL that has not locked, can lead to a service request throughout all levels of the hierarchy.



The service request enable register SRE defined in IEEE 488.2 can be taken as ENABLE part of the STB if the STB is structured according to SCPI. By analogy, the ESE can be taken as the ENABLE part of the ESR.

7.7.2 Overview of the Status Register

The following figure shows the status registers used by the R&S FSH base unit. The status registers used by the R&S FSH options are described in separate sections at the end of this chapter.

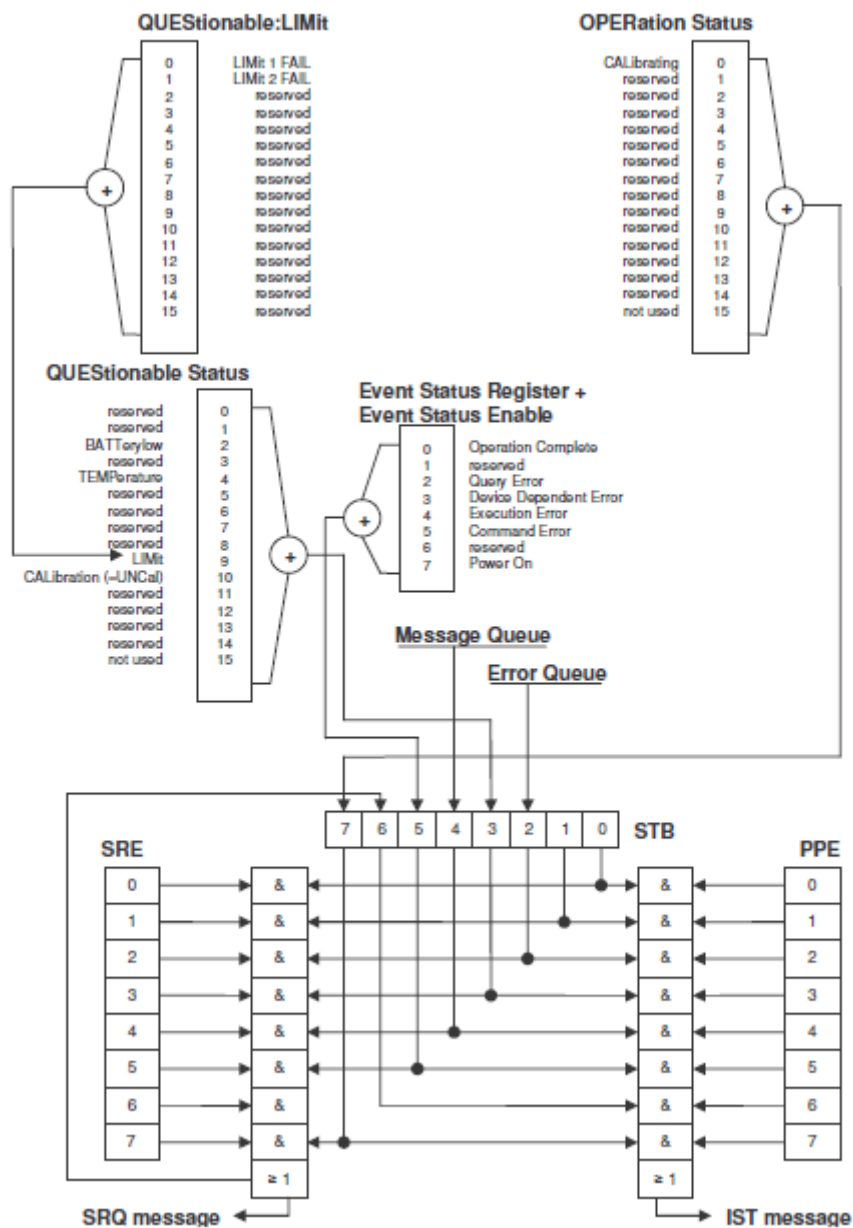


Figure 7-2: Overview of the status registers

7.7.3 Status Byte (STB) & Service Request Enable Register (SRE)

The STB is already defined in IEEE 488.2. It provides a rough overview of the instrument status by collecting the pieces of information of the lower registers. It can thus be compared with the CONDITION part of an SCPI register and assumes the highest level within the SCPI hierarchy. A special feature is that bit 6 acts as the sum bit of the remaining bits of the status byte.

The STATUS BYTE is read using the command "*STB?" or a serial poll.

The STB is linked to the SRE. The latter corresponds to the ENABLE part of the SCPI registers in its function. Each bit of the STB is assigned a bit in the SRE. Bit 6 of the SRE is ignored. If a bit is set in the SRE and the associated bit in the STB changes from 0 to 1, a service request (SRQ) is generated, which triggers an interrupt in the controller if this is appropriately configured and can be further processed there. The SRE can be set using the command "*SRE" and read using the command "*SRE?"

Table 7-1: Meaning of the bits used in the Status Byte

Bit No.	Meaning
0...1	Not used
2	<p>Error Queue not empty</p> <p>The bit is set when an entry is made in the error queue. If this bit is enabled by the SRE, each entry of the error queue generates a service request. Thus an error can be recognized and specified in greater detail by polling the error queue. The poll provides an informative error message. This procedure is to be recommended since it considerably reduces the problems involved with remote control.</p>
3	<p>QUESTIONable status sum bit</p> <p>The bit is set if an EVENT bit is set in the QUESTIONable: status register and the associated ENABLE bit is set to 1. A set bit indicates a questionable instrument status, which can be specified in greater detail by polling the QUESTIONable status register.</p>
4	<p>MAV bit (message available)</p> <p>The bit is set if a message is available in the output buffer which can be read. This bit can be used to enable data to be automatically read from the instrument to the controller.</p>
5	<p>ESB bit</p> <p>Sum bit of the event status register. It is set if one of the bits in the event status register is set and enabled in the event status enable register. Setting of this bit indicates a serious error which can be specified in greater detail by polling the event status register.</p>
6	<p>MSS bit (master status summary bit)</p> <p>The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this registers is set together with its mask bit in the service request enable register SRE.</p>
7	<p>OPERation status register sum bit</p> <p>The bit is set if an EVENT bit is set in the OPERation status register and the associated ENABLE bit is set to 1. A set bit indicates that the instrument is just performing an action. The type of action can be determined by polling the OPERation status register.</p>

7.7.4 Event Status Register (ESR) and Event Status Enable Register (ESE)

The ESR is defined in IEEE 488.2. It can be compared with the EVENT part of a SCPI register. The event status register can be read out using command *ESR?.

The ESE is the associated ENABLE part. It can be set using the command *ESE and read using the command *ESE?.

Table 7-2: Meaning of the bits in the event status register

Bit No.	Meaning
0	Operation Complete This bit is set on receipt of the command *OPC exactly when all previous commands have been executed.
1	Not used
2	Query Error This bit is set if either the controller wants to read data from the instrument without having sent a query, or if it does not fetch requested data and sends new instructions to the instrument instead. The cause is often a query which is faulty and hence cannot be executed.
3	Device-dependent Error This bit is set if a device-dependent error occurs. An error message with a number between -300 and -399 or a positive error number, which denotes the error in greater detail, is entered into the error queue.
4	Execution Error This bit is set if a received command is syntactically correct but cannot be performed for other reasons. An error message with a number between -200 and -300, which denotes the error in greater detail, is entered into the error queue.
5	Command Error This bit is set if a command is received, which is undefined or syntactically incorrect. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue.
6	Not used
7	Power On (supply voltage on) This bit is set on switching on the instrument.

7.7.4.1 STATus:OPERation Register

In the CONDition part, this register contains information on which actions the instrument is being executing or, in the EVEnt part, information on which actions the instrument has executed since the last reading. It can be read using the commands STATus:OPERation:CONDition? or STATus:OPERation[:EVEnt]?

Table 7-3: Meaning of the bits in the STATus:OPERation register

Bit No.	Meaning
0	CALibrating This bit is set as long as the instrument is performing a calibration.
1 to 14	Not used
15	This bit is always 0

7.7.4.2 STATus:QUEStionable Register

This register contains information about indefinite states which may occur if the unit is operated without meeting the specifications. It can be read using the commands STATus:QUEStionable: CONDition? and STATus:QUEStionable[:EVEnt]?

Table 7-4: Meaning of bits in STATus:QUEStionable register

Bit No.	Meaning
0 to 1	These bits are not used
2	BATTERY LOW If the instrument is running without any external power supply and the charging level of the internal battery is approximately lower than 5% this bit is set to indicate that the system will be shut down automatically in approx. 5 minutes.
3	Not used
4	TEMPerature This bit is set if a questionable temperature occurs.
5 to 8	Not used
9	LIMit (device-specific) This bit is set if a limit value is violated
10	CALibration The bit is set if a measurement is performed unaligned (label UNCAL)
11 to 14	Not used
15	This bit is always 0.

7.7.4.3 STATus:QUEStionable:LIMit Register

This register contains information about the observance of limit lines. It can be read using the commands STATus:QUEStionable:LIMit:CONDition? and STATus:QUEStionable:LIMit[:EVENT]?

Table 7-5: Meaning of bits in STATus:QUEStionable:LIMit register

Bit No.	Meaning
0	LIMit 1 FAIL This bit is set if limit line 1 is violated.
1	LIMit 2 FAIL This bit is set if limit line 2 is violated.
2 to 14	Not used
15	This bit is always 0.

7.7.5 Application of the Status Reporting Systems

In order to be able to effectively use the status reporting system, the information contained there must be transmitted to the controller and further processed there. There are several methods which are represented in the following.

7.7.5.1 Service Request

Under certain circumstances, the instrument can send a service request (SRQ) to the controller. Usually this service request initiates an interrupt at the controller, to which the control program can react appropriately. As evident from Fig. 1-4, an SRQ is always initiated if one or several of bits 2, 3, 4, 5 or 7 of the status byte are set and enabled in the SRE. Each of these bits combines the information of a further register, the error queue or the output buffer. The ENABLE parts of the status registers can be set so that arbitrary bits in an arbitrary status register initiate an SRQ. In order to make use of the possibilities of the service request effectively, all bits should be set to "1" in enable registers SRE and ESE.

Example

Use of the command *OPC to generate an SRQ at the end of a sweep

```
CALL InstrWrite(analyzer, "*ESE 1")
'Set bit 0 in the ESE (Operation Complete)

CALL InstrWrite(analyzer, "*SRE 32")
'Set bit 5 in the SRE (ESB)?
```

After its settings have been completed, the instrument generates an SRQ.

The SRQ is the only possibility for the instrument to become active on its own. Each controller program should set the instrument in a way that a service request is initiated in the case of malfunction. The program should react appropriately to the service request.

7.7.5.2 Serial Poll

In a serial poll, just as with command *STB, the status byte of an instrument is queried. However, the query is realized via interface messages and is thus clearly faster. The serial-poll method has already been defined in IEEE 488.1 and used to be the only standard possibility for different instruments to poll the status byte. The method also works with instruments which do not adhere to SCPI or IEEE 488.2.

The VISUAL BASIC command for executing a serial poll is IBRSP(). Serial poll is mainly used to obtain a fast overview of the state of several instruments connected to the controller.

7.7.5.3 Query by Means of Commands

Each part of any status register can be read by means of queries. The individual commands are listed in the description of the STATus Subsystem. The returned value is always a number that represents the bit pattern of the queried register. This number is evaluated by the controller program.

Queries are usually used after an SRQ in order to obtain more detailed information on the cause of the SRQ.

7.7.5.4 Error Queue Query

Each error state in the instrument leads to an entry in the error queue. The entries of the error queue are detailed plain-text error messages that can be displayed via manual operation using the setup menu or queried via remote control using the command SYSTem:ERRor?. Each call of SYSTem:ERRor? provides one entry from the error queue. If no error messages are stored there any more, the instrument responds with 0, "No error".

The error queue should be queried after every SRQ in the controller program as the entries describe the cause of an error more precisely than the status registers. Especially in the test phase of a controller program the error queue should be queried regularly since faulty commands from the controller to the instrument are recorded there as well.

7.7.6 Reset Values of the Status Reporting System

Table 7-6 contains the different commands and events causing the status reporting system to be reset. None of the commands, except *RST and SYSTem:PRESet, influences the functional instrument settings. In particular, DCL does not change the instrument settings.

Table 7-6: Resetting the status reporting system

Event	Switching on supply voltage		DCL,SDC			
	Power-On-Status-Clear					
			(Device Clear, Selected Device Clear)	*RST or SYSTem:PRESet	STATus:PRESet	*CLS
Effect	0	1				
Clear STB,ESR	—	yes	—	—	—	yes
Clear SRE,ESE	—	yes	—	—	—	—
Clear PPE	—	yes	—	—	—	—
Clear EVENT parts of the registers	—	yes	—	—	—	yes
Clear ENABLE parts of all OPERation and QUEStionable registers; Fill ENABLE parts of all other registers with "1".	—	yes	—	—	yes	—
Fill PTRansition parts with "1"; Clear NTRansition parts	—	yes	—	—	yes	—
Clear error queue	yes	yes	—	—	—	yes
Clear output buffer	yes	yes	yes	1)	1)	1)
Clear command processing and input buffer	yes	yes	yes	—	—	—

1) Every command being the first in a program message, i.e., immediately following a <PROGRAM MESSAGE TERMINATOR> clears the output buffer.

7.7.7 Remote Commands of the Status Reporting System

The following commands control the status-reporting system. *RST does not influence the status registers.

The OPERation status register contains information about the calibration status of the instrument.

The QUEStionable status register contains information about the status of the reference and local oscillator, possible overloads of the instrument and the status of limit checks and limit margins.

The commands are independent from the operating mode.

List of commands

- [STATus:PRESet](#) (p. 96)
- [STATus:QUEue\[:NEXT\]](#) (p. 96)
- [STATus:OPERation\[:EVENT\]?](#) (p. 97)
- [STATus:OPERation:CONDition?](#) (p. 97)
- [STATus:OPERation:ENABle](#) (p. 97)
- [STATus:OPERation:NTRansition](#) (p. 98)
- [STATus:OPERation:PTRansition](#) (p. 98)
- [STATus:QUEStionable\[:EVENT\]?](#) (p. 98)
- [STATus:QUEStionable:CONDition?](#) (p. 99)
- [STATus:QUEStionable:ENABle](#) (p. 99)
- [STATus:QUEStionable:NTRansition](#) (p. 99)
- [STATus:QUEStionable:PTRansition](#) (p. 100)

STATus:PRESet

This command resets the edge detectors and ENABle parts of all registers to a defined value. All PTRansition parts are set to FFFFh, i.e. all transitions from 0 to 1 are detected. All NTRansition parts are set to 0, i.e. a transition from 1 to 0 in a CONDition bit is not detected. The ENABle part of the STATus:OPERation and STATus:QUEStionable registers are set to 0, i.e. all events in these registers are not passed on.

Example

```
STAT:PRESet
```

Characteristics

*RST value: -
SCPI: conform

STATus:QUEue[:NEXT]

This command returns the earliest entry to the error queue and deletes it.

Positive error numbers indicate device-specific errors, negative error numbers are error messages defined by SCPI. If the error queue is empty, the error number 0, "no error", is returned. This command is identical with the command SYSTem:ERRor.

Example

```
STAT:QUE?
```

Characteristics

*RST value: –
SCPI: conform

STATus:OPERation[:EVENT]?

This command queries the contents of the EVENT section of the STATus:OPERation register.

The contents of the EVENT section are deleted after readout.

Example

```
STAT:OPER?
```

Characteristics

*RST value: -
SCPI: conform

STATus:OPERation:CONDition?

This command queries the CONDition section of the STATus:OPERation register. Readout does not delete the contents of the CONDition section. The value returned reflects the current hardware status.

Example

```
STAT:OPER:COND?
```

Characteristics

*RST value: -
SCPI: conform

STATus:OPERation:ENABLE

This command sets the bits of the ENABLE section of the STATus:OPERation register. The ENABLE register selectively enables the individual events of the associated EVENT section for the summary bit in the status byte.

Parameter

0 to 65535

Example

```
STAT:OPER:ENAB 65535
```

Characteristics

*RST value: -
SCPI: conform

STATus:OPERation:NTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 1 to 0 for the transitions of the CONDition bit.

Parameter

0 to 65535

Example

```
STAT:OPER:NTR 65535
```

Characteristics

*RST value: -

SCPI: conform

STATus:OPERation:PTRansition

This command sets the edge detectors of all bits of the STATus:OPERation register from 0 to 1 for the transitions of the CONDition bit.

Parameter

0 to 65535

Example

```
STAT:OPER:PTR 65535
```

Characteristics

*RST value: -

SCPI: conform

STATus:QUEStionable[:EVENT]?

This command queries the contents of the EVENT section of the STATus:QUEStionable register.

The contents of the EVENT section are deleted after readout.

Example

```
STAT:QUES?
```

Characteristics

*RST value: -

SCPI: conform

STATus:QUEStionable:CONDition?

This command queries the CONDition section of the STATus:QUEStionable register. Readout does not delete the contents of the CONDition section. The value returned reflects the current hardware status.

Example

```
STAT:QUES:COND?
```

Characteristics

*RST value: -
SCPI: conform

STATus:QUEStionable:ENABle

This command sets the bits of the ENABle section of the STATus:QUEStionable register. The ENABle register selectively enables the individual events of the associated EVENT section for the summary bit in the status byte.

Parameter

0 to 65535

Example

```
STAT:QUES:ENAB 65535
```

Characteristics

*RST value: -
SCPI: conform

STATus:QUEStionable:NTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable register from 1 to 0 for the transitions of the CONDition bit.

Parameter

0 to 65535

Example

```
STAT:QUES:NTR 65535
```

Characteristics

*RST value: -
SCPI: conform

STATus:QUEStionable:PTRansition

This command sets the edge detectors of all bits of the STATus:QUEStionable register from 0 to 1 for the transitions of the CONDition bit.

Parameter

0 to 65535

Example

```
STAT:OPER:PTR 65535
```

Characteristics

*RST value: -

SCPI: conform

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