Manual

Signal Generator

R&S® SMF100A
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ROHDE & SCHWARZ
Test and Measurement Division

Dear Customer,

throughout this manual, the Signal Generator R&S® SMF100A is abbreviated as R&S SMF.

The Signal Generator includes software developed by the OpenSSL Project for use in the OpenSSL Toolkit (http://www.openssl.org/).

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

CD-ROM including complete operating manual and compiled online help
(provided in the file inside pocket)

Data Sheet

Safety Instructions
Certificate of Quality
EU Certificate of Conformity
Support-Center Address
List of R&S Representatives

User documentation for Signal Generator R&S SMF

Operating Manual

Tabbed Divider

Service Manual Instrument

Safety Instructions

Tabbed Divider

Before putting the product into operation for the first time, make sure to read the following

S a f e t y   I n s t r u c t i o n s

All plants and locations of the Rohde & Schwarz group of companies make every effort to keep the safety standard of our products up to date and to offer our customers the highest possible degree of safety. Our products and the auxiliary equipment required for them are designed and tested in accordance with the relevant safety standards. Compliance with these standards is continuously monitored by our quality assurance system. The product described here has been designed and tested in accordance with the EC Certificate of Conformity and has left the manufacturer's plant in a condition fully complying with safety standards. To maintain this condition and to ensure safe operation, 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 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 an 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 the product be used exclusively by skilled and specialized staff or thoroughly trained personnel with the required skills. If personal safety gear is required for using Rohde & Schwarz products, this will be indicated at the appropriate place in the product documentation.

Symbols and safety labels

Observe product documentation	Weight indication for units >18 kg	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal	Attention! Electrostatic sensitive devices

Supply voltage ON/OFF	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double/reinforced insulation

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 putting the product into operation. It is also absolutely essential to observe the additional safety instructions on personal safety 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

DANGER   This tag indicates a definite hazard carrying a high risk of death or serious injury if not avoided.

WARNING   This tag indicates a possible hazard carrying a medium risk of death or (serious) injury if not avoided.

CAUTION   This tag indicates a hazard carrying a low risk of minor or moderate injury if not avoided.

ATTENTION   This tag indicates the possibility of incorrect use that can cause damage to the product.

NOTE   This tag indicates a situation where the user should pay special attention to operating the product but which does not lead to damage.

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 thus contribute to personal injury or material damage.

Basic safety instructions

1. The product may be operated only under the operating conditions and in the positions specified by the manufacturer. Its ventilation must not be obstructed during operation. Unless otherwise specified, the following requirements apply to Rohde & Schwarz products: prescribed 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 2000 m above sea level, max. transport altitude 4500 m above sea level.
Unless specified otherwise in the data sheet, a tolerance of ±10% shall apply to the nominal voltage and of ±5% to the nominal frequency.

2. Applicable local or national safety regulations and rules for the prevention of accidents must be observed in all work performed. The product may be opened only by authorized, specially trained personnel. Prior to performing any work on the product or opening the product, the product must be disconnected from the supply network. Any adjustments, replacements of parts, maintenance or repair must be carried out only by technical personnel 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).

3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens, e.g. nickel) such as aluminum cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties), consult a physician immediately to determine the cause.

4. If products/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, e.g. for disposal purposes, by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.

5. If handling the product yields hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation.

6. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn life requires increased protection, pregnant women should be protected by appropriate measures. Persons with pacemakers may also be endangered by electromagnetic radiation. The employer/operator is required to assess workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the danger.

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

8. Prior to switching on the product, it must be ensured 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.

9. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with earthing contact and protective earth connection.

10. Intentionally breaking the protective earth connection either in the feed line or in the product itself is not permitted. Doing so can result in the danger of an electric shock from the product. If extension cords or connector strips are implemented, they must be checked on a regular basis to ensure that they are safe to use.

11. If the product has no power switch for disconnection from the AC supply, the plug of the connecting cable is regarded as the disconnecting device. In such cases, it must be ensured 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. If products without power switches are integrated in racks or systems, a disconnecting device must be provided at the system level.

12. 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, ensure that the cable cannot be damaged and that no one can be hurt by e.g. tripping over the cable or suffering an electric shock.

13. 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).

14. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, this can result in sparks, fire and/or injuries.

15. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.

16. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.

17. Ensure that the connections with information technology equipment comply with IEC 950/EN 60950.

18. 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.

19. If a product is to be permanently installed, the connection between the PE terminal on site and the product's PE conductor must be made first before any other connection is made. The product may be installed and connected only by a license electrician.

20. 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 suitable protection is provided for users and products.

21. Do not insert any objects into the openings in the housing that are not designed for this purpose. Never pour any liquids onto or into the housing. This can cause short circuits inside the product and/or electric shocks, fire or injuries.

22. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a thunderstorm) can reach the product. Otherwise the operating personnel will be endangered by electric shocks.

23. Rohde & Schwarz products are not protected against penetration of water, unless otherwise specified (see also safety instruction 1.). If this is not taken into account, there exists the danger of electric shock for the user or damage to the product, which can also lead to personal injury.

24. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product was moved from a cold to a warm environment.

25. Do not close any slots or openings on the product, since they are necessary for ventilation and prevent the product from overheating. Do not place the product on soft surfaces such as sofas or rugs or inside a closed housing, unless this is well ventilated.

26. Do not place the product on heat-generating devices such as radiators or fan heaters. The temperature of the environment must not exceed the maximum temperature specified in the data sheet.

27. Batteries and storage batteries must not be exposed to high temperatures or fire. Keep batteries and storage batteries away from children. Do not short-circuit batteries and storage batteries.
If batteries or storage batteries are improperly replaced, this can cause an explosion (warning: lithium cells). Replace the battery or storage battery only with the matching Rohde & Schwarz type (see spare parts list). Batteries and storage batteries must be recycled and kept separate from residual waste. Batteries and storage batteries that contain lead, mercury or cadmium are hazardous waste. Observe the national regulations regarding waste disposal and recycling.

28. Please be aware that in the event of a fire, toxic substances (gases, liquids etc.) that may be hazardous to your health may escape from the product.

29. The product can be very heavy. Be careful when moving it to avoid back or other physical injuries.

30. Do not place the product on surfaces, vehicles, cabinets or tables that for reasons of weight or stability are unsuitable for this purpose. Always follow the manufacturer's installation instructions when installing the product and fastening it to objects or structures (e.g. walls and shelves).

31. Handles on the products are designed exclusively for personnel to hold or carry the product. It is therefore not permissible to use handles for fastening the product to or on means of transport such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport and for observing the safety regulations of the manufacturer of the means of transport. Noncompliance can result in personal injury or material damage.

32. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. The driver is always responsible for the safety of the vehicle. The manufacturer assumes no responsibility for accidents or collisions.

33. If a laser product (e.g. a CD/DVD drive) is integrated in a Rohde & Schwarz product, do not use any other settings or functions than those described in the product documentation. Otherwise this may be hazardous to your health, since the laser beam can cause irreversible damage to your eyes. Never try to take such products apart, and never look into the laser beam.

Por favor lea imprescindiblemente antes de la primera puesta en funcionamiento las siguientes

Informaciones de seguridad

El principio del grupo de empresas Rohde & Schwarz consiste en tener nuestros productos siempre al día con los estandards 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. Nuestra sección de gestión de la seguridad de calidad controla constantemente que sean cumplidas estas normas. El presente producto ha sido fabricado y examinado según el comprobante de conformidad adjunto según las normas de la CE y ha salido de nuestra planta en estado impecable según los estandards técnicos de seguridad. Para poder preservar este estado y garantizar un funcionamiento libre de peligros, el usuario deberá atenerse a todas las informaciones, 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 solamente fue elaborado para ser utilizado en la industria y el laboratorio o para fines de campo y de ninguna manera deberá ser utilizado de modo que alguna persona/cosa pueda ser dañada. El uso del producto fuera de sus fines definidos o despreciando las informaciones de seguridad 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 dentro de las instrucciones de la correspondiente documentación de 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 profundos y conocimientos parciales del idioma inglés. Por eso se deberá tener en cuenta de exclusivamente autorizar para el uso del producto a personas peritas o debidamente minuciosamente instruidas con los conocimientos citados. Si fuera necesaria indumentaria de seguridad para el uso de productos de R&S, encontrará la información debida en la documentación del producto en el capítulo correspondiente.

Símbolos y definiciones de seguridad

Ver documentación de producto	Informaciones para maquinaria con uns peso de > 18kg	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 electroestática

potencia EN MARCHA/PARADA	Indicación Stand-by	Corriente continua DC	Corriente alterna AC	Corriente continua/alterna DC/AC	El aparato está protegido en su totalidad por un aislamiento de doble refuerzo

Tener en cuenta las informaciones de seguridad sirve para tratar de evitar daños y peligros de toda clase. Es necesario de que se lean las siguientes informaciones de seguridad concienzudamente y se tengan en cuenta debidamente antes de la puesta en funcionamiento del producto. También deberán ser tenidas en cuenta las informaciones para la protección de personas que encontrarán en el capítulo correspondiente de la documentación de producto y que también son obligatorias de seguir. En las informaciones de seguridad actuales hemos juntado todos los objetos vendidos por 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	Identifica un peligro directo con riesgo elevado de provocar muerte o lesiones de gravedad si no se toman las medidas oportunas.
ADVERTENCIA	Identifica un posible peligro con riesgo medio de provocar muerte o lesiones (de gravedad) si no se toman las medidas oportunas.
ATENCIÓN	Identifica un peligro con riesgo reducido de provocar lesiones de gravedad media o leve si no se toman las medidas oportunas.
CUIDADO	Indica la posibilidad de utilizar mal el producto y a consecuencia dañarlo.
INFORMACIÓN	Indica una situación en la que deberían seguirse las instrucciones en el uso del producto, pero que no consecuentemente deben de llevar a un daño del mismo.

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 de 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 malinterpretaciones y tener por consecuencia daños en personas u objetos.

Informaciones de seguridad elementales

1. El producto solamente debe ser utilizado según lo indicado por el fabricante referente a la situación y posición de funcionamiento sin que se obstruya la ventilación. Si no se convino de otra manera, es para los productos R&S válido lo que sigue:
como posición de funcionamiento se define principalmente la posición con el suelo de la caja para abajo , modo de protección IP 2X, grado de suciedad 2, categoría de sobrecarga eléctrica 2, utilizar solamente en estancias interiores, utilización hasta 2000 m sobre el nivel del mar, transporte hasta 4.500 m sobre el nivel del mar.
A menos que se especifique otra cosa en la hoja de datos, se aplicará una tolerancia de ±10% sobre el voltaje nominal y de ±5% sobre la frecuencia nominal.

2. En todos los trabajos deberán ser tenidas en cuenta las normas locales de seguridad de trabajo y de prevención de accidentes. El producto solamente debe de ser abierto por personal perito autorizado. Antes de efectuar trabajos en el producto o abrirlo deberá este ser desconectado de la corriente. El ajuste, el cambio de partes, la manutención y la reparación deberán ser solamente efectuadas por electricistas autorizados por R&S. Si se reponen partes con importancia para los aspectos de seguridad (por ejemplo el enchufe, los transformadores o los fusibles), solamente podrán ser sustituidos por partes originales. Despues de cada recambio de partes elementales para la seguridad deberá ser efectuado un control de seguridad (control a primera vista, control de conductor protector, medición de resistencia de aislamiento, medición de medición de la corriente conductora, control de funcionamiento).

3. Como en todo producto de fabricación industrial no puede ser excluido en general de que se produzcan al usarlo elementos que puedan generar alergias, los llamados elementos alergénicos (por ejemplo el níquel). Si se producieran en el trato con productos R&S reacciones alérgicas, como por ejemplo urticaria, estornudos frecuentes, irritación de la conjuntiva o dificultades al respirar, se deberá consultar inmediatamente a un médico para averiguar los motivos de estas reacciones.

4. Si productos / elementos de construcción son tratados fuera del funcionamiento definido de forma mecánica o térmica, pueden generarse elementos peligrosos (polvos de sustancia de metales pesados como por ejemplo plomo, berilio, níquel). La partición elemental del producto, como por ejemplo sucede en el tratamiento de materias residuales, debe de ser efectuada solamente por personal especializado para estos tratamientos. La partición elemental efectuada inadecuadamente puede generar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes al tratamiento de materias residuales.

5. En el caso de que se produjeran agentes de peligro o combustibles en la aplicación del producto que debieran de ser transferidos a un tratamiento de materias residuales, como por ejemplo agentes refrigerantes que deben ser repuestos en periodos definidos, o aceites para motores, deberan ser tenidas en cuenta las prescripciones de seguridad del fabricante de estos agentes de peligro o combustibles y las regulaciones regionales para el tratamiento de materias residuales. Cuiden también de tener en cuenta en caso dado las prescripciones de seguridad especiales en la descripción del producto.

6. Ciertos productos, como por ejemplo las instalaciones de radiación HF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. En vista a la protección de la vida en desarrollo deberían ser protegidas personas embarazadas debidamente. También las personas con un bypass pueden correr peligro a causa de la radiación electromagnética. El empresario/usario está comprometido a valorar y señalar areas de trabajo en las que se corra un riesgo aumentado de exposición a radiaciones para evitar riesgos.

7. La utilización de los productos requiere instrucciones especiales y una alta concentración en el manejo. Debe de ponerse por seguro de que las personas que manejen los productos estén a la altura de los requerimientos necesarios referente a sus aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario lleva la responsabilidad de seleccionar el personal usuario apto para el manejo de los productos.

8. Antes de la puesta en marcha del producto se deberá tener por seguro de que la tensión preseleccionada en el producto equivalga a la del la red de distribución. Si es necesario cambiar la preselección de la tensión también se deberán en caso dabo cambiar los fusibles correspondientes del prodcuto.

9. Productos de la clase de seguridad I con alimentación móvil y enchufe individual de producto solamente deberán ser conectados para el funcionamiento a tomas de corriente de contacto de seguridad y con conductor protector conectado.

10. Queda prohibida toda clase de interrupción intencionada del conductor protector, tanto en la toma de corriente como en el mismo producto. Puede tener como consecuencia el peligro de golpe de corriente por el producto. Si se utilizaran cables o enchufes de extensión se deberá poner al seguro, que es controlado su estado técnico de seguridad.

11. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de distribución como interruptor. En estos casos deberá asegurar de que el enchufe sea de fácil acceso y nabejo (según la medida del cable de distribución, 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 construciones o instalaciones, se deberá instalar el interruptor al nivel de la instalación.

12. No utilice nunca el producto si está dañado el cable eléctrico. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegure a través de las medidas de protección y de instalación adecuadas de que el cable de eléctrico no pueda ser dañado o de que nadie pueda ser dañado por él, por ejemplo al tropezar o por un golpe de corriente.

13. Solamente está permitido el funcionamiento en redes de distribución TN/TT aseguradas con fusibles de como máximo 16 A (utilización de fusibles de mayor amperaje sólo previa consulta con el grupo de empresas Rohde & Schwarz).

14. 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. Si no tiene en consideración estas indicaciones se arriesga a que se originen chispas, fuego y/o heridas.

15. No sobrecargue las tomas de corriente, los cables de extensión o los enchufes de extensión ya que esto pudiera causar fuego o golpes de corriente.

16. En las mediciones en circuitos de corriente con una tensión de entrada de U_{eff} > 30 V se deberá tomar las precauciones debidas para impedir cualquier peligro (por ejemplo medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).

17. En caso de conexión con aparatos de la técnica informática se deberá tener en cuenta que estos cumplan los requisitos de la EC950/EN60950.

18. 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 heridas, fuego o daños en el producto.

19. Si un producto es instalado fijamente en un lugar, se deberá primero conectar el conductor protector fijo con el conductor protector del aparato antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

20. En caso de que los productos que son instalados fijamente en un lugar sean sin protector implementado, autointerruptor o similares objetos de protección, el circuito de suministro de corriente deberá estar protegido de manera que usuarios y productos estén suficientemente protegidos.

21. Por favor, no introduzca ningún objeto que no esté destinado a ello en los orificios de la caja del aparato. No vierta nunca ninguna clase de líquidos sobre o en la caja. Esto puede producir corto circuitos en el producto y/o puede causar golpes de corriente, fuego o heridas.

22. Asegúrese con la protección adecuada de que no pueda originarse en el producto una sobrecarga por ejemplo a causa de una tormenta. Si no se verá el personal que lo utilice expuesto al peligro de un golpe de corriente.

23. Los productos R&S no están protegidos contra el agua si no es que exista otra indicación, ver también punto 1. Si no se tiene en cuenta esto se arriesga el peligro de golpe de corriente para el usario o de daños en el producto lo cual también puede llevar al peligro de personas.

24. No utilice el producto bajo condiciones en las que pueda producirse y se hayan producido líquidos de condensación en o dentro del producto como por ejemplo cuando se desplaza el producto de un lugar frío a un lugar caliente.

25. Por favor no cierre ninguna ranura u orificio del producto, ya que estas son necesarias para la ventilación e impiden que el producto se caliente demasiado. No pongan el producto encima de materiales blandos como por ejemplo sofás o alfombras o dentro de una caja cerrada, si esta no está suficientemente ventilada.

26. No ponga el producto sobre aparatos que produzcan calor, como por ejemplo radiadores o calentadores. La temperatura ambiental no debe superar la temperatura máxima especificada en la hoja de datos.

27. Baterías y acumuladores no deben de ser expuestos a temperaturas altas o al fuego. Guardar baterías y acumuladores fuera del alcance de los niños. No cortocircuitar baterías ni acumuladores. Si las baterías o los acumuladores no son cambiados con la debida atención existirá peligro de explosión (atención celulas de Litio). Cambiar las baterías o los acumuladores solamente por los del tipo R&S correspondiente (ver lista de piezas de recambio). Las baterías y acumuladores deben reutilizarse y no deben acceder a los vertederos. Las baterías y acumuladores que contienen plomo, mercurio o cadmio deben tratarse como residuos especiales. Respete en esta relación las normas nacionales de evacuación y reciclaje.

28. Por favor tengan en cuenta que en caso de un incendio pueden desprenderse del producto agentes venenosos (gases, líquidos etc.) que pueden generar daños a la salud.

29. El producto puede poseer un peso elevado. Muévalo con cuidado para evitar lesiones en la espalda u otras partes corporales.

30. No sitúe el producto encima de superficies, vehículos, estantes o mesas, que por sus características de peso o de estabilidad no sean aptas para él. Siga siempre las instrucciones de instalación del fabricante cuando instale y asegure el producto en objetos o estructuras (por ejemplo paredes y estantes).

31. Las asas instaladas en los productos sirven solamente de ayuda para el manejo que solamente está previsto para personas. Por eso no está permitido utilizar las asas para la sujeción en o sobre medios de transporte como por ejemplo grúas, carretillas elevadoras de horquilla, carros etc. El usuario es responsable de que los productos sean sujetados de forma segura a los medios de transporte y de que las prescripciones de seguridad del fabricante de los medios de transporte sean tenidas en cuenta. En caso de que no se tengan en cuenta pueden causarse daños en personas y objetos.

32. Si llega a utilizar el producto dentro de un vehículo, queda en la responsabilidad absoluta del conductor que conducir el vehículo de manera segura. Asegure el producto dentro del vehículo debidamente para evitar en caso de un accidente las lesiones u otra clase de daños. No utilice nunca el producto dentro de un vehículo en movimiento si esto pudiera distraer al conductor. Siempre queda en la responsabilidad absoluta del conductor la seguridad del vehículo. El fabricante no asumirá ninguna clase de responsabilidad por accidentes o colisiones.

33. Dado el caso de que esté integrado un producto de laser en un producto R&S (por ejemplo CD/DVD-ROM) no utilice otras instalaciones o funciones que las descritas en la documentación de producto. De otra manera pondrá en peligro su salud, ya que el rayo laser puede dañar irreversiblemente sus ojos. Nunca trate de descomponer estos productos. Nunca mire dentro del rayo laser.

QUALITÄTSZERTIFIKAT

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 Managementsystems entwickelt, gefertigt und geprüft.
Das Rohde & Schwarz Managementsystem ist zertifiziert nach:

DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:1996

CERTIFICATE OF QUALITY

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DIN EN ISO 9001:2000
DIN EN 9100:2003
DIN EN ISO 14001:1996

ROHDE&SCHWARZ

1171.0200.11-01.00

ROHDE&SCHWARZ
EC Certificate of Conformity

C€

Certificate No.: 2006-101

This is to certify that:

Equipment type	Stock No.	Designation
SMF100A	1167.0000.02	Signal Generator Basic Unit
SMF-B122	1167.7004.02	Frequency Range 1 GHz to 22 GHz
SMF-B1	1167.9159.02	Reference Oscillator OCXO
SMF-B20	1167.9594.02	AM/FM/Scan Modulator
SMF-B26	1167.5553.02	Step Attenuator 100 kHz bis 22 GHz
SMF-B83	1167.6408.02	Removable GPIB

complies with the provisions of the Directive of the Council of the European Union on the approximation of the laws of the Member States

- relating to electrical equipment for use within defined voltage limits
  (73/23/EEC revised by 93/68/EEC)

- relating to electromagnetic compatibility
  (89/336/EEC revised by 91/263/EEC, 92/31/EEC, 93/68/EEC)

Conformity is proven by compliance with the following standards:

EN 61010-1 : 2001
EN 55011 : 1998 + A1 : 1999 + A2 : 2002, Klasse A
EN 61326 : 1997 + A1 : 1998 + A2 : 2001 + A3 : 2003

Affixing the EC conformity mark as from 2006

ROHDE & SCHWARZ GmbH & Co. KG
Mühldorfstr. 15, D-81671 München

Munich, 2006-12-14

Central Quality Management MF-QZ / Radde

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USA & Canada	Monday to Friday (except US public holidays) 8:00 AM – 8:00 PM Eastern Standard Time (EST)	
	Tel. from USA	888-test-rsa (888-837-8772) (opt 2)
	From outside USA	+1 410 910 7800 (opt 2)
	Fax	+1 410 910 7801
	E-mail	Customer.Support@rsa.rohde-schwarz.com
East Asia	Monday to Friday (except Singaporean public holidays) 8:30 AM – 6:00 PM Singapore Time (SGT)	
	Tel.	+65 6 513 0488
	Fax	+65 6 846 1090
	E-mail	Customersupport.asia@rohde-schwarz.com
Rest of the World	Monday to Friday (except German public holidays) 08:00 – 17:00 Central European Time (CET)	
	Tel. from Europe	+49 (0) 180 512 42 42
	From outside Europe	+49 89 4129 13776
	Fax	+49 (0) 89 41 29 637 78
	E-mail	CustomerSupport@rohde-schwarz.com

ROHDE & SCHWARZ

Address List

Headquarters, Plants and Subsidiaries

Headquarters

ROHDE&SCHWARZ GmbH & Co. KG
Mühldorfstraße 15 · D-81671 München
P.O.Box 80 14 69 · D-81614 München

Phone +49 (89) 41 29-0
Fax +49 (89) 41 29-121 64
info.rs@rohde-schwarz.com

Plants

ROHDE&SCHWARZ Messgerätebau GmbH
Riedbachstraße 58 · D-87700 Memmingen
P.O.Box 16 52 · D-87686 Memmingen

Phone +49 (83 31) 1 08-0
+49 (83 31) 1 08-1124
info.rsmb@rohde-schwarz.com

ROHDE&SCHWARZ GmbH & Co. KG
Werk Teisnach
Kaikenrieder Straße 27 · D-94244 Teisnach
P.O.Box 11 49 · D-94240 Teisnach

Phone +49 (99 23) 8 50-0
Fax +49 (99 23) 8 50-174
info.rsdts@rohde-schwarz.com

ROHDE&SCHWARZ závod
Vimperk, s.r.o.
Location Spidrova 49
CZ-38501 Vimperk

Phone +420 (388) 45 21 09
Fax +420 (388) 45 21 13

ROHDE&SCHWARZ GmbH & Co. KG
Dienstleistungszentrum Köln
Graf-Zeppelin-Straße 18 · D-51147 Köln
P.O.Box 98 02 60 · D-51130 Köln

Phone +49 (22 03) 49-0
Fax +49 (22 03) 49 51-229
info.rsdc@rohde-schwarz.com
service.rsdc@rohde-schwarz.com

Subsidiaries

R&S BICK Mobilfunk GmbH
Fritz-Hahne-Str. 7 · D-31848 Bad Münder
P.O.Box 20 02 · D-31844 Bad Münder

Phone +49 (50 42) 9 98-0
Fax +49 (50 42) 9 98-105
info.bick@rohde-schwarz.com

ROHDE&SCHWARZ FTK GmbH
Wendenschloßstraße 168, Haus 28
D-12557 Berlin

Phone +49 (30) 658 91-122
Fax +49 (30) 655 50-221
info.ftk@rohde-schwarz.com

ROHDE&SCHWARZ SIT GmbH
Am Studio 3
D-12489 Berlin

Phone +49 (30) 658 84-0
Fax +49 (30) 658 84-183
info.sit@rohde-schwarz.com

R&S Systems GmbH
Graf-Zeppelin-Straße 18
D-51147 Köln

Phone +49 (22 03) 49-5 23 25
Fax +49 (22 03) 49-5 23 36
info.rssys@rohde-schwarz.com

GEDIS GmbH
Sophienblatt 100
D-24114 Kiel

Phone +49 (431) 600 51-0
Fax +49 (431) 600 51-11
sales@gedis-online.de

HAMEG Instruments GmbH
Industriestraße 6
D-63533 Mainhausen

Phone +49 (61 82) 800-0
Fax +49 (61 82) 800-100
info@hameg.de

Locations Worldwide

Please refer to our homepage: www.rohde-schwarz.com
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Contents of User Documentation for Signal Generator R&S SMF100A

The user documentation describes the Signal Generator R&S SMF and all options. It includes a printed Quick Start Guide and a CD-ROM with the complete operating and service manual in printable pdf-format.

The R&S SMF is equipped with a context-sensitive online help that offers a help page for each instrument function.

Quick Start Guide

The present quick start guide describes everything that is needed to put the instrument into operation and to get familiar with the generator. The quick start guide gives an introduction to remote control and manual control via external monitor, mouse and keyboard.

The quick start guide is subdivided into the data sheet plus 4 chapters plus index:

The data sheet informs about specifications and characteristics of the instrument.

Chapter 1 Describes the control elements and connectors on the front and rear panel as well as all procedures required for putting the instrument into operation.

Chapter 2 Gives an introduction the operating concept and typical applications of the R&S SMF.

Chapter 3 Describes key operating modes, the structure of the graphical interface and the principles of manual control.

Annex Contains an index for the quick start guide.

Help System

The help system is embedded in the instrument, offering quick, context-sensitive reference to the information needed for operation and programming. The help contains the complete user documentation for the Signal Generator including the contents of the present quick start guide.

The help files (*.chm) are also available on the CD-ROM and can be used as a standalone help.

Documentation CD-ROM
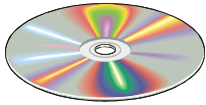
The CD-ROM provides the complete user documentation for the Signal Generator:

- The online help system (*.chm).
- The complete operating manual and service manual in printable form (*.pdf).
- The data sheet (brochure and specifications) in printable form.
- Links to different useful sites in the R&S internet.

Note: Please use the ADOBE® Acrobat® Reader for PDF files and the browser Internet Explorer® ≥ 4.0 for the HTML help.

Optional Documentation
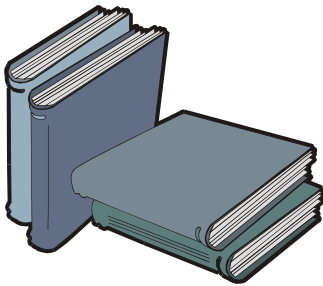
The printed version of the operating and service manual provides the contents of the quick start manual plus the complete reference and the service information for the Signal Generator. This manual can be ordered as an option (stock no. 1167.2302.62 (English - A4 format) or 1167.2302.62 (English - letter format)); see ordering information in the data sheet.

*Note: The CD-ROM contains the *.pdf version of the manuals.*

Manual Control

The operating manual contains comprehensive information about the instrument functions and remote control, in addition to the chapters of the quick start guide. It includes information about maintenance of the instrument and about error detection listing the error messages which may be output by the instrument. It is sub-divided into 10 chapters:

The data sheet	informs about specifications and characteristics of the instrument.
Chapter 1	describes the control elements and connectors on the front and rear panel as well as all procedures required for putting the instrument into operation.
Chapter 2	gives an introduction to the operating concept and typical applications of the R&S SMF.
Chapter 3	describes key operating modes, the structure of the graphical interface and the principles of manual control.

Chapter 4	forms a reference for manual control of the R&S SMF and contains a detailed description of all instrument functions and their application. The chapter also lists the remote control command corresponding to each instrument function.
Chapter 10	contains an index for the operating manual.

Remote Control

Chapter 5	describes the basics for programming the R&S SMF, command processing and the status reporting system.
Chapter 6	lists all the remote-control commands defined for the instrument.
Chapter 7	-
Chapter 8	describes preventive maintenance and the characteristics of the instrument's interfaces.
Chapter 9	gives the status messages and a list of error messages that the R&S SMF may generate.
Chapter 10	contains an index for the operating manual.

Service Manual Instrument

The service manual - instrument informs on how to check compliance with rated specifications, on instrument function, repair, troubleshooting and fault elimination. It contains all information required for the maintenance of R&S SMF by exchanging modules. In addition it describes how to perform a firmware update and how to install options.

Internet Site
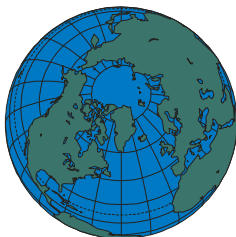
The Internet site at: R&S Signal Generator R&S SMF100A provides the most up to date information on the R&S SMF. The current operating manual at a time is available as printable PDF file in the download area.

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

Contents - Chapter 1 "Putting into Operation"

1 Putting into Operation

Introduction - Putting into Operation

Chapter 1, "Putting into Operation" explains the control elements and connectors of the Signal Generator R&S SMF with the aid of the front and rear views and describes how to put the instrument into operation. It also describes the connection of peripherals such as keyboard and mouse. A detailed description of the device interfaces is given in Chapter 8, "*Maintenance and Remote Control Interfaces*". Specifications of interfaces can be seen in the data sheet.
Chapter 2, "*Getting Started*" gives an overview of generator functions and introduces the operating concept. Detailed operating instructions and an overview of menus follow in Chapter 3, "*Manual Operation*".
The complete manual on the CD-ROM in printable pdf-format provides chapters 4 to 9: Menus and instrument functions are described in detail in Chapter 4, "*Instrument Functions*", basics of remote control of the instrument in Chapter 5, "*Remote Control - Basics*" and commands for remote control in chapter 6 "*Remote Control - Commands*". Chapter 9, "*Error Messages*" contains a list of possible status and error messages.

Legend for Front Panel View

This section gives an overview of control elements and connectors on the front panel of the R&S SMF. Each element/connector is briefly described and a reference is given to the chapters containing detailed information.
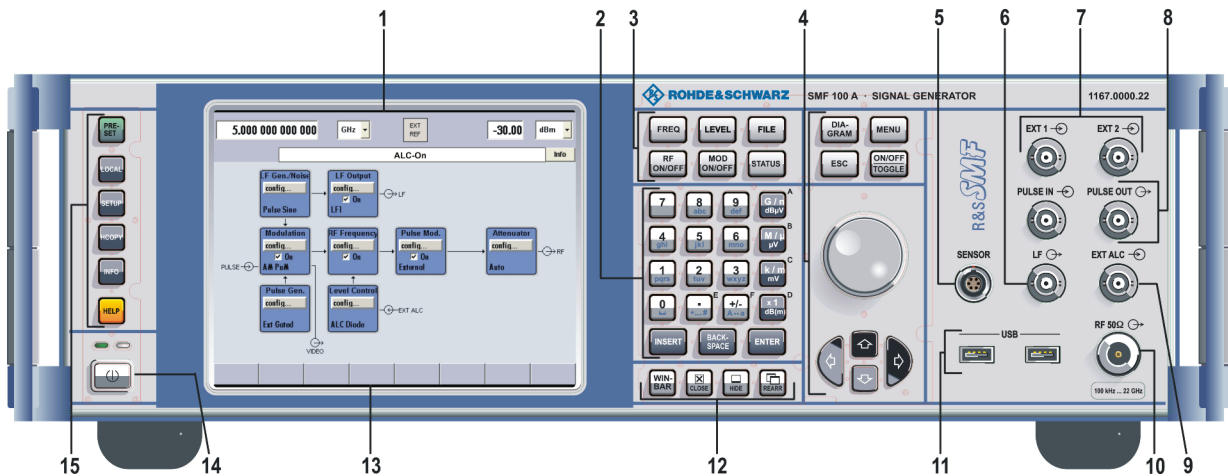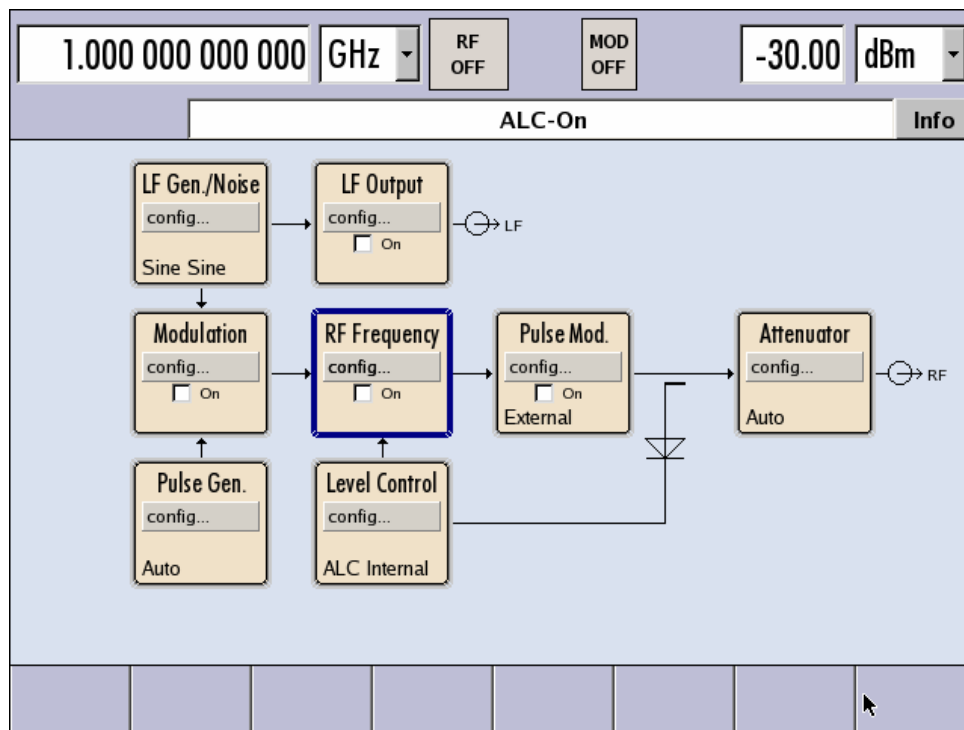

Figure 1-1   Front panel view

1   Display

Display	The display clearly shows all main settings and signal generator states.	See chapter 3, section "*Display*"
	The display is divided into two sections:	
	- Frequency and level display with info line	
	- Block diagram	
	The **frequency and level display section with info line** shows	
	- Frequency and level settings containing offset	
	- Status messages	
	- Brief error messages (detailed information for a message can be called with the INFO key)	
	The **block diagram** shows the current configuration and the signal flow in the generator with the aid of function blocks containing an on/off switch. Clicking the function block opens a list of associated setting menus. Active menus, info windows and graphs are displayed on top of the block diagram. The block diagram can be displayed in the foreground anytime with the DIAGRAM key.	

2   Keypad for data entry

Keypad for data entry

0…9
    Entry of numeric values

.
    Entry of decimal point

–
    Entry of sign

abc
    Entry of letters

    Entry of a space

*… #
    Entry of special characters

A ↔ a
    Switchover between uppercase and lowercase letters.

ENTER
– Calls the next menu level.
– Activates the editing mode for highlighted numeric and alphanumeric parameters.
– Terminates a data entry; the new value is set. In case of numeric parameters, the unit indicated next to the value in the menu applies.
– Switches highlighted status parameters on and off (on/off state).
– Confirms (OK) and closes message windows.

BACKSPACE
– Deletes the character to the left of the cursor.

INSERT
– Toggles between insert and overwrite mode.

See chapter 3, section "*Setting Parameters*"

2   Keypad for data entry
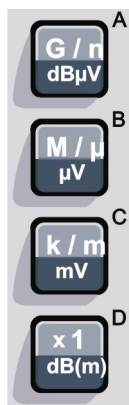
Keys for data entry

The unit keys can either select a unit and thus determine the absolute value, or change the unit, i.e. trigger a recalculation without changing the absolute value. Their function depends on the time at which they are pressed during parameter entry:

Selecting the unit

If a unit key is pressed immediately after a numeric value has been entered, it terminates the entry and determines the multiplication factor for the respective basic unit (e.g. the k/m key determines the unit kHz after frequency entry).

If a level value is entered, the unit keys are directly labelled with the units they select. The level entry must be active in this case, e.g. by pressing the LEVEL key.

Changing the unit

If a numeric entry is terminated with ENTER (e.g. by clicking the rotary knob) and not with a unit key, the unit displayed in the unit field of the parameter in the menu is assigned. If the unit key is pressed later, the unit is changed but not the value. The value is recalculated to suit the new unit (e.g. the display changes from 1000 to 1 when the Hz is changed to kHz). The new unit is then indicated in the value field of the menu.

Assignment

G/n	dBμV	giga/nano, dBμV for RF levels, dBu for LF levels
M/μ	μV	mega/micro, μV for levels
k/m	mV	kilo/milli, mV for levels
x1	dB(m)	basic unit dBm for levels dB for level offset and level step width same function as ENTER key for unit-free values

See chapter 3, section "*Selecting a Unit - Setting Parameters*"

3   Keys for setting parameters

FREQ

                    Activates frequency entry.

LEVEL

                    Activates level entry.

FILE

                    Activates the menu for storing or loading files.

RF ON/OFF

                    Switches the RF signal on and off. **RF OFF** is displayed in the header next to the **Frequency** field.

MOD ON/OFF

                    Switches the active modulations on and off. **MOD OFF** is displayed in the info line of the header next to the **Level** field.

STATUS

                    Indicates the instrument status.

See chapter 3, section "*Setting Parameters*", and chapter 4, section "*RF Signal*" and "*Modulation*"

4   Keys for settings and navigation in the display and for setting parameters

DIAGRAM

Brings the block diagram to the foreground. Active menus are minimized. Active menus are indicated by the buttons in the menu bar.

MENU

Calls the menu tree.

ESC

Calls the next higher selection level. This opens up the following functions:

– Closes the active menu if the cursor is in the top-level menu (parameter selection).
   If settings in this menu require acknowledgement by means of an **Accept** button, a query is displayed asking whether the changes made should be cancelled.
– Switches between different entry fields of a menu.
– Quits the editing mode and restores the previous value. This function is only available in the editing mode, i.e. only before an entry is confirmed or selected with Enter.
– Cancels queries in message windows.
– Shifts the entry cursor from the frequency or level display to the previously active menu, or to the previously highlighted block in the block diagram if no menu is active.

ON/OFF TOGGLE

– Switches highlighted elements or a function block on and off.
– Switches between two or more settings, e.g. items of selection lists. At the end of a list, the cursor is set on the first entry again.

See chapter 3, section "*Setting Parameters*"

4   Keys for settings and navigation in the display and for setting parameters   E-1

Keys for settings and navigation in the display and for setting parameters

Rotary knob

–   Varies the value at a cursor position.
For frequency and level entry, a fixed step width can be set and activated for the variation.

–   Moves the entry cursor in the block diagram or menu.

–   Moves the cursor in tables and selection lists.

–   Clicking the rotary knob (= Enter) terminates entries. In this case the entry mode is terminated and the value set.

See chapter 3, section "*Setting Parameters*"

Keys for setting and navigation in the display and for setting parameters

Arrow keys

Vary the entry value or highlight a selected list item in the editing mode.
Highlight parameters in menus and tables (up/down).

Move the cursor in the entry fields (editing mode). Highlight parameters in menus and tables (left/right).

See chapter 3, section "*Setting Parameters*"

5   Connector for power sensor

Connector for R&S NRP-Zxx power sensors. With the aid of the **User Correction** function, a table with correction values for external test assemblies can be automatically determined, e.g. for compensating the frequency response of cables.

The power sensors are connected by inserting the male connector. To disconnect hold the connector by its sleeve. Pulling on the sensor cable will not release the sensor connector.

6   LF output

LF

Output for internal LF Generator and monitoring signal (option R&S SMF-B20).

7   Inputs for external modulation signals

EXT 1 | EXT 2

Inputs for external modulation signals for AM, FM, Phase Modulation, ASK, FSK, and PSK (option R&S SMF-B20).

8   Input/output for pulse generation

PULSE IN

Input of external pulse signal or input for triggering the pulse generator (option R&S SMF-K23).

PULSE OUT

Output of internal pulse signal generated by the internal pulse generator (option R&S SMF-K23).

9   EXT ALC input

EXT ALC

Input for detection voltage of an external level detector.

10	RF output	
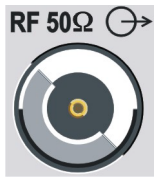
	Output for RF signal.	See data sheet
	Caution Do not overload the RF output. The maximum permissible back-feed is specified in the data sheet.	

11	USB connectors type A	

	USB (universal serial bus) interfaces of type A (host).	See chapter 1, section "*Connecting an External Keyboard and Mouse*" and chapter 8, section "*USB Connection*"
	− Connection of peripherals such as mouse and keyboard − Connection of memory stick for file transmission − Firmware update Optionally, another USB interface type A (host) and a USB interface type B (device, for remote control) are available on the rear panel (option R&S SMF-B84).	

12	Keys for setting parameters	

	WINBAR Toggles between display and blanking of the Winbar. CLOSE Closes the currently active menu. HIDE Hides the open menus. REARR Automatic rearrangement of open menus.	

13 Winbar

Level Sweep	AM	Menu	

The **Winbar** is the bar at the bottom of the display. The **Winbar** indicates open menus by a labelled button. When a button is clicked using the rotary knob, the associated menu is displayed either in the foreground or minimized in the **Winbar**.

The **Winbar** can be called with the WINBAR key.

14 Standby on/off switch

The on/off switch switches the instrument from the standby mode to the operating state provided the power switch on the instrument rear is switched on.

The yellow LED (right) is on in the standby mode; the green LED (left) is on when the instrument is ready for operation.

See chapter 1, section "*Switching On*"

Warning!

The AC line is still connected to the instrument in the standby mode.

15 Keys for general instrument settings

PRESET

Sets the instrument to a defined state.

LOCAL

Switches from REMOTE control to LOCAL (manual) control.

SETUP

Opens the setup menu for configuring presetting.

HCOPY

Opens the print menu for configuring and starting printing.

INFO

Activates the display of status messages, error messages, and warnings.

HELP

Activates the context-sensitive help display.

See chapter 4, section "*General Instrument Settings*"

Legend for Rear Panel View

This section gives an overview of connectors on the rear panel of the R&S SMF. Each connector is briefly described and a reference is given to the chapters containing detailed information. For technical data of the connectors refer to the data sheet.
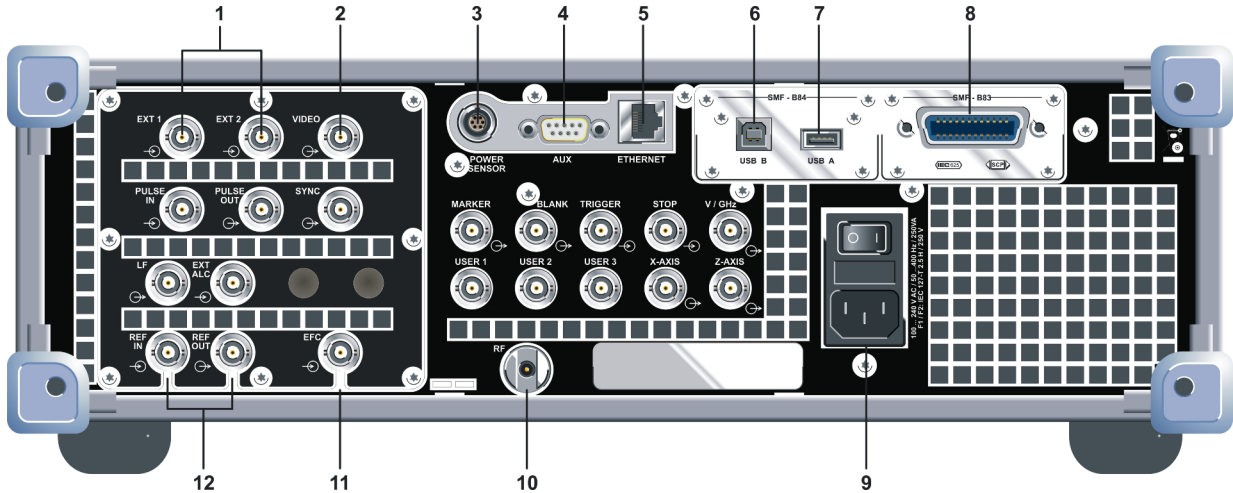
Fig. 1-2   Rear panel view, connectors 1 - 12

1   Inputs for external signal
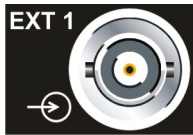
EXT 1 | EXT 2
> Inputs for external modulation signals for AM, FM, Phase Modulation, ASK, FSK, and PSK (option R&S SMF-B20).
>
> The rear panel inputs are available only with option R&S SMF-B81.
> This option is recommended for use of the instrument in a 19" rack. Installing the instrument in a 19" rack requires a rack adapter (refer to data sheet for Order No.).

2   Output for video signal

VIDEO
> Output of the external or internal pulse modulation signal (video signal).

3   Connector for power sensor

SENSOR
Rear panel connector for R&S NRP-Zxx
power sensors.

4   AUX I/O interface

AUX
Interface for direct control of additional
external devices.

5   LAN interface

Ethernet interface
− Integrating signal generators in a network
− Remote control of signal generator
− Manual remote control of signal generator
− Firmware update

6   USB connector type B

USB (universal serial bus) interface of type B
(device USB)
− Remote control of signal generator

This USB interface is available only with option
R&S SMF-B84.

7   USB connector type A

USB (universal serial bus) interfaces of type A
(host).
− Connection of peripherals such as mouse
and keyboard
− Connection of memory stick for file
transmission

This USB interface is available only with option
R&S SMF-B84.

Two further USB interfaces of type A are
available on the front panel.

8   IEC/IEEE-bus connector
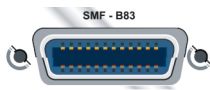
IEC-bus (IEEE 488) interface for remote control of the R&S SMF.

The IEC-bus is available only with option R&S SMF-B83.

See data sheet and chapter 8,section "*IEC/IEEE Bus Interface*"

9   AC supply

Power switch

Power connector

AC supply connector & Power Switch

When the R&S SMF is connected to the AC supply, it automatically sets itself to the correct range for the applied voltage (range: see type label). There is no need to set the voltage manually or change fuses.

See section "*Connecting the R&S SMF to the AC Supply*" and data sheet

10   Output for RF

RF
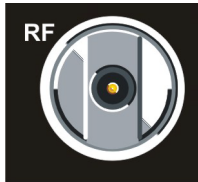
Rear panel output for internal RF generator signal.

This rear panel output is available only with option R&S SMF-B81.

This option is recommended for use of the instrument in a 19" rack. Installing the instrument in a 19" rack requires a rack adapter (refer to data sheet for Order No.).

Caution
  Do not overload the RF output. The maximum permissible back-feed is specified in the data sheet.

See data sheet

11   Input for EFC

EFC
> Input for external EFC signal.

12   REF input/output

REF IN
> Input for external reference signal.

REF OUT
> Output for the reference signal. It can be adjusted whether the internal or the external signal is to be output.
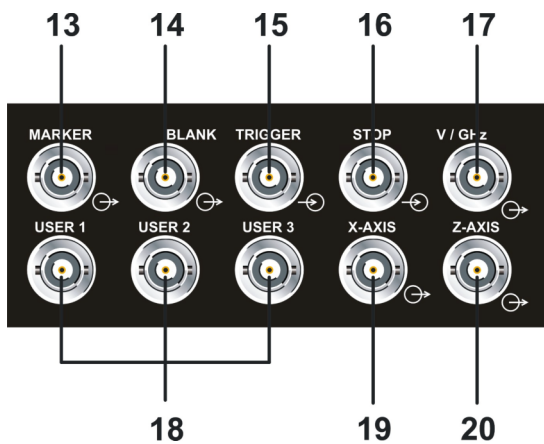
Fig. 1-3   Selection of Rear panel view, connectors 13 - 20

13   Sweep output Marker

MARKER
> Output for user-programmable marker signal used for brightness control of an oscilloscope. This output becomes active when the sweep run has reached the marker.

14   Sweep output Blank

BLANK

Output for triggering and blanking an oscilloscope or for PEN LIFT control of an XY recorder.

15   Sweep input Trigger

TRIGGER

Input for triggering the sweep in the **Extern Single** and **Extern Step** modes.

16   Sweep input Stop

STOP

Input and output for stopping the sweep in all modes. This connector is bidirectional: Used as an input, the sweep can be stopped by an external network analyzer. Used as an output, the generator can stop the sweep of an external network analyzer.

17   Sweep output V/GHz
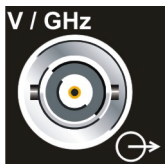
V/GHz

Output for supplying a voltage which is proportional to the frequency.

18   User connector

USER 1 | USER 2 | USER 3

Input/output for configurable signals for triggering and control.

| 19 | *Sweep output X-Axis* | E-1 |

X-AXIS

Output for supplying a voltage ramp
for the X deflection of an oscilloscope
or an XY recorder.

| 20 | *Sweep output Z-Axis* | |

Z-AXIS

Output for supplying a voltage pulse
for the combined blanking and
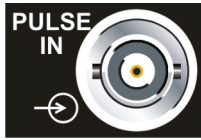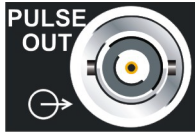marker generation for network
analyzers.
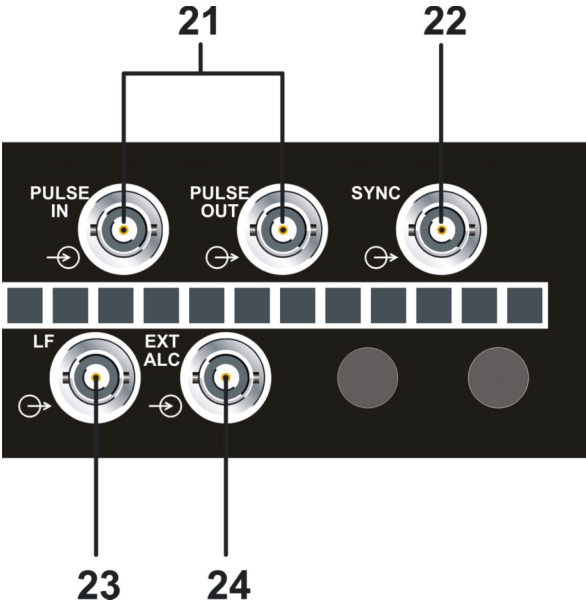
Fig. 1-4   Selection of Rear panel view, connectors 21- 24

21   Input/output for pulse generation

PULSE IN

> Input of external pulse signal or input for triggering the pulse generator (option R&S SMF-K23).

PULSE OUT

> Output of internal pulse signal generated by the internal pulse generator (option R&S SMF-K23).
>
> The PULSE IN/PULSE OUT connectors at the rear panel are available only with option R&S SMF-B81.
>
> This option is recommended for use of the instrument in a 19" rack. Installing the instrument in a 19" rack requires a rack adapter (refer to data sheet for Order No.).

22   Output for SYNC
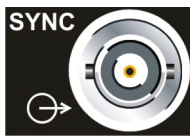
SYNC

> Output for internal SYNC signals for pulse modulation.

23   Output for LF

LF
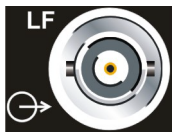
> Output for internal LF generator signals.
>
> This rear panel output is available only with option R&S SMF-B81.
>
> This option is recommended for use of the instrument in a 19" rack. Installing the instrument in a 19" rack requires a rack adapter (refer to data sheet for Order No.).

24   Input for Automatic Level Control

EXT ALC

    Input for detection voltage of an external level detector.

    This rear panel output is available only with option R&S SMF-B81.

    This option is recommended for use of the instrument in a 19" rack. Installing the instrument in a 19" rack requires a rack adapter (refer to data sheet for Order No.).

Putting into Operation

The following section describes the procedure for putting the instrument into operation. It contains general safety instructions for instrument operation.

The installation of options and the firmware update are described in Chapter 4 of the Service Manual (supplied with the instrument on the CD-ROM).

Unpacking the Instrument
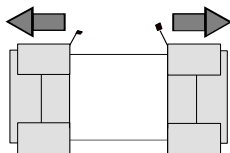
Remove protective covers

➢ Remove the instrument from its packaging and check the equipment for completeness using the delivery note and the accessory lists for the separate items.

➢ Remove the two protective covers from the front and rear panel of the signal generator and carefully check the instrument for damage.

➢ If there is damage, immediately contact the carrier who delivered the instrument. In this case, make sure not to discard the box and packing material.

➢ The original packaging is also useful for transporting or shipping the signal generator later on. Keep at least the two protective covers to prevent control elements and connectors from being damaged.

Setting up the Instrument or Installing it in a 19" Rack

The instrument is designed for indoors use. It can either be set up independently or mounted in a 19" rack.
A rack adapter (refer to data sheet for Order No.) is required for installation in a 19" rack. The mounting instructions are supplied with the adapter. With options R&S SMF-B81 (Rear Panel Connectors, factory-fitted) the front panel inputs and outputs are relocated to the rear panel. An adapter for telescopic sliders may not be used because it obstructs the vents.

Safety Instructions

General Precautions

⚠️ **Caution!**
Prior to putting the instrument into operation, check the following:

- *The covers of the housing are in place and screwed on.*
- *Vents are not obstructed. Make sure that the air can escape freely through the vents at the rear and at the sides. The minimum distance to the wall should therefore be at least 10 cm.*
- *The signal levels at the inputs do not exceed permissible limits.*
- *The outputs of the instrument are not overloaded or incorrectly connected.*
  This particularly applies to the maximum permissible back-feed at the RF outputs, which is specified in the data sheet.
- *The instrument should only be operated in horizontal position on an even surface.*
- *The ambient temperature must not exceed the range specified in the data sheet.*

  Any non-compliance with these precautions may cause damage to the instrument.

Protection against Electrostatics

To avoid damaging the electronic components of the EUT due to electrostatics produced by contact, the use of appropriate protective measures is recommended.

Setting up the Instrument

⚠️ **Warning!**
The feet must be fully folded in or folded out. Only then can a stable position of the instrument and reliable operation be ensured.
The uniform pressure on the folded-out feet must not exceed 500 N (weight of instrument and of equipment stacked on top).
Stacked instruments must be secured against slipping (e.g. by locking the feet to the top of the front-panel frame).

<500N
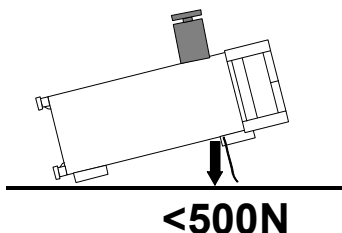
When the instrument is shifted with the feet out, the feet might fold in. To avoid injuries, do not shift the instrument with the feet out.

EMC Safety Precautions

To avoid electromagnetic interference, only suitable, double shielded signal, and control cables must be used.

Connecting the R&S SMF to the AC Supply

The R&S SMF is automatically matched to the applied AC voltage (see rear panel). There is no need to set the voltage manually or change fuses. The AC supply connector is at the rear of the unit (see below).

Switching On

Power switch
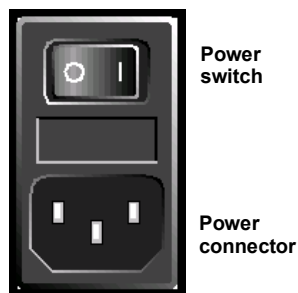
Power connector

➢ Connect the signal generator to the AC supply by means of the supplied power cable.

Since the instrument is a protection class I Equipment, it should only be connected to a socket with a protective earth contact.

➢ Press the main power switch at the rear of the instrument to position I.

➢ After power-up, the instrument is either ready for operation (STANDBY) or in operating mode, depending on the position of the ON/STANDBY switch on the instrument front (see below).

Note:
The power switch may remain on for any period of time. Switching off is required only if the instrument should be completely isolated from the AC supply.
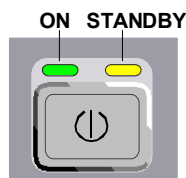
ON STANDBY

➢ Press the ON/STANDBY switch on the front panel; the green LED must be on.

➢ The instrument is ready for operation. All modules in the instrument are supplied with power.

Start Display and Booting the R&S SMF

After instrument switch-on, the Linux operating system boots and then the instrument firmware. During booting of the instrument firmware, a selftest is performed. After booting is completed, the block diagram of the signal generator is displayed and the instrument is ready to be operated. The settings that were active before the last switch-off are established unless another start setting has explicitly been selected in the **File** menu.

Note:
If the software stops unexpectedly, the instrument can be shut down by pressing the STANDBY key for approx. 5 s.

Switching Off
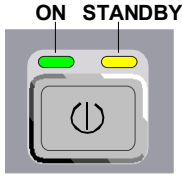
ON   STANDBY

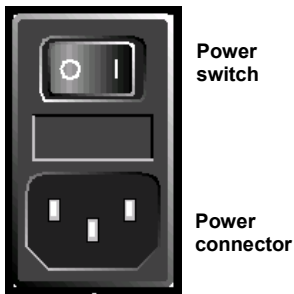➢ Press the ON/STANDBY switch on the front panel.

The R&S SMF stores the current setting on the compact flash disk before it shuts down the Linux operating system. Then the AC supply is switched to the STANDBY mode.

➢ Only the AC supply is powered and the oven-controlled crystal oscillator is kept at operating temperature.

➢ The yellow LED must be on.

Warning:
The instrument is still connected to the AC supply when the instrument is in the standby mode.

Power switch

Power connector

➢ Press the main power switch at the rear of the instrument to position 0. None of the front-panel LEDs should be on.

Note:
It is recommended to switch the instrument to STANDBY mode before completely disconnecting it from the AC supply. If the power switch is set to 0 before the instrument is switched to the standby mode, all current settings are lost.

Power Fuses
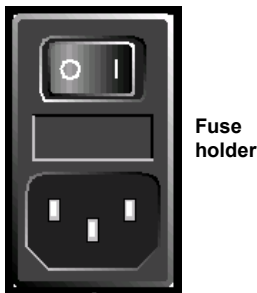
Fuse holder

The R&S SMF is fully fused by two fuses IEC127-T4H/250 V. The fuses are accommodated in the pull out fuse holder next to the power connector. Before replacing the fuses, disconnect the power cord from the R&S SMF; the fuse box is locked mechanically as long as a power connector is plugged in. Use two screwdrivers simultaneously to lift the fuse holder below the power connector and pull it out. Use only fuses of the mentioned type.

Function Check

The signal generator automatically monitors the main functions when the instrument is switched on and continuously during operation.

If a fault is detected, ERROR is displayed in the info line together with a brief error description.
For in-depth identification of the error, press the INFO key. In response, a description of the error(s) is displayed (see "*Error Messages*").

Besides automatic monitoring of instrument functions, other capabilities in the R&S SMF ensure correct functioning of the signal generator.

- **Internal Adjustments**
  Adjustments can be performed in the **Setup-System-Internal Adjustments** menu. Thus maximum level accuracy can be obtained, for instance.

- **Test points**
  Internal test points can be queried by the user and the results can be displayed. See section "*Test Point... - Setup-Test*".

Default Settings

The instrument is set to a defined state with the PRESET key.

RF frequency	1 GHz
RF level	OFF
Reference frequency	internal, adjustment off
Frequency Offset	0
Level Offset	0
Modulations	switched off
Uninterrupted level setting	switched off; level attenuator mode: AUTO
Internal level control	Level ALC: ON
User correction	Level Ucor: OFF
LF output	switched off
Sweep	switched off
IEC/IEEE-bus address	not changed

With PRESET, all parameters and switch states are preset, including those of deactivated operating modes.

Presettings beyond those in the above list can be seen from the *RST values of the associated IEC/IEEE-bus commands.

Linux Operating System

> **Caution:**
>
> *Drivers and programs used in the instrument under Linux have been adapted to the signal generator. To avoid impairment of instrument functions, only the settings described below are permissible. Existing software must only be modified with update software released by Rohde & Schwarz. Likewise, only programs authorized by Rohde & Schwarz for use on the instrument must be executed.*

The signal generator is equipped with the Linux operating system. The configuration of the operating system is optimally adapted to signal generator functions in the factory. Changes in the system setup are only required if peripherals like keyboard are installed or in the event that the network configuration does not comply with the default settings (see sections "*Connecting the R&S SMF to a Network (LAN)*").

After power-up of the signal generator, the operating system boots and the instrument firmware is started automatically. The operating system cannot be accessed. All necessary system settings can be made in the **Environment** section of the **Setup** menu.

The R&S SMF provides a internal compact flash card, it does not contain a disk drive. The compact flash card holds the firmware and the stored data. However, data transfer is only possible via a memory stick connected to a USB interface. The memory stick and the flash card are accessed via the **File Manager**. "

Screen saver:
A screen saver is activated by default in the R&S SMF. The display lamp is shut off when no entries via front panel, external mouse or external keyboard are made for a period of time. The screen saver prolongs the life time of the display lamp.
The screen saver can be switched off and on and the time period can be set in the **Environment** section of the **Setup** menu.

Connecting an External Keyboard and Mouse

A commercial, external keyboard and mouse with USB interface can be connected to the R&S SMF. A keyboard simplifies entry of list items, comments, file names, etc. A mouse simplifies control of the block diagram and of associated menus.

The keyboard and the mouse are connected to a USB interface, type A, on the front or rear panel of the instrument.

1   USB   2

The keyboard and mouse are recognized automatically when it is connected. The US keyboard assignment is the default setting. The keyboard language and the layout can be changed in the **Environment** section of the **Setup** menu.

Connecting the R&S SMF to a Network (LAN)

The R&S SMF is equipped with a network interface and can be connected to an Ethernet LAN (local area network).
Provided the appropriate rights have been assigned by the network administrator, the instrument can be remote-controlled and remote-accessed in the network.

Remote-access means that the user can operate the R&S SMF from any remote PC in the network using the **VNC** protocol. For instance, the user can control one or more R&S SMFs from a desk that is part of a test assembly located in another section of the building.
A VNC client program for Windows operating systems is provided on the R&S SMF CD-ROM (included in delivery). VNC client programs for other operating systems are available free-of-charge on the internet.

Remote-control of the instrument via the LAN interface is described in section "*Remote Control via LAN Interface*". A firmware update via the LAN interface is described in chapter 2 of the service manual (on CD-ROM).

The configuration of the R&S SMF for networking is performed in the **Environment** section of the **Setup** menu.
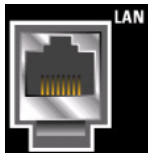
Connection to the Network

> *Caution:*
> *We recommend that connection of the instrument to the network be coordinated with the network administrator. Connection errors may affect the entire network.*
>
> *Connect and disconnect the network cable only when the instrument is switched off (standby). Only then can the network connection be reliably detected and impairments to instrument operation avoided.*

The instrument is connected to the LAN with the aid of a commercial RJ-45 cable suitable for a 10/100 Mbps connection attached to the LAN interface at the rear of the instrument.

The connector is described in chapter 8.

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Configuring the R&S SMF for Network Operation

The network interface functions with 10/100 Mbps Ethernet IEEE 802.3u. The TCP/IP network protocol and the associated network services are preconfigured.

For data exchange in a LAN, each connected PC or instrument must be accessible via an IP address or via an unambiguous computer name.

Networks using DHCP

The R&S SMF is preconfigured for networks using DHCP (dynamic host configuration protocol). In these networks, an available IP address is automatically assigned to the R&S SMF. The R&S SMF provides an unambiguous computer name in the network via the DHCP request. The DHCP server in the network must consider this name and pass it to the DNS server in order to ensure that the R&S SMF can be addressed in the network.
Each R&S SMF is assigned an individual computer name in the factory. This name can be queried and changed in **Environment** section of the **Setup** menu.

Networks using fixed IP addresses

In networks using fixed IP addresses, the addresses are mostly assigned by the network administrator. A fixed IP address must be entered in the **Environment** section of the **Setup** menu (see "*Identifying the R&S SMF in the Network*" below).

Point-to-Point Connection

To build a simple network – just a LAN connection between the R&S SMF and a controller without integration into a larger network – an IP address has to be assigned to the R&S SMF and the controller. For such purposes, the IP addresses 192.168.xxx.yyy are available .The value range for xxx and yyy is 1...254, the value for the subnet mask is always 255.255.255.0. The gateway IP address must also be provided, however, it is without relevance.
Example:
R&S SMF IP address: 192.168.0.2;
PC IP address: 192.168.0.1
gateway IP address: 192.168.0.3
For this type of connection, a commercial cross-over RJ-45 cable is used.

Identifying the R&S SMF in the Network

1. Open the **Setup** menu by pressing the Setup key.
2. Click **Network Settings** menu in the **Environment** section.
3. Select the IP address mode and enter the network data in the respective fields of the menu. The data is provided by the network administrator. The Computer name is indicated in the **Hostname** field. The name can be changed.

Remote Access via an External Controller

The R&S SMF can be remote-accessed from an external PC via a network link. This allows convenient operation of the signal generator from the desktop although the instrument is integrated in a rack somewhere else.

Remote access in contrast to **remote control** does not use remote-control commands but the regular user interface displayed using separate software which is installed on the external PC. The instrument can thus be manually operated from the PC as on the unit itself.
Preconditions for remote access are a connection between signal generator and PC via a LAN network and the installation of the VNC client software on the PC and on the R&S SMF.
The VNC client software for setting up the connection is included in the Linux/Unix operating system per default.
For Windows operating system, the free-of-charge software **Ultr@VNC** is provided on the R&S SMF CD-ROM. VNC client programs for other operating systems are available free-of-charge on the internet.
After the connection is established, the signal generator screen with the block diagram is displayed on the external PC and the R&S SMF can be manually remote-accessed from the external PC. The individual functions are operated using the mouse and keyboard. Specific instrument functions can be executed using specific key combinations on the keyboard or a front panel key emulation that can be operated with the mouse (see chapter 3, section "*Legend of Front-Panel Controls*").
Installation of the software Ultr@VNC and establishing the connection between external PC and signal generator for Windows operating system is described in the following. Remote access via an external controller with Linux/Unix operating system is performed accordingly.

Configuration for Remote Access via Ultr@VNC

The instrument is operated with the aid of the program **Ultr@VNC**. It is available as a free-of-charge download on the internet for operating system Windows XP (http://ultravnc.sourceforge.net/download.htm) and on the R&S SMF CD-ROM.

Remote access of the signal generator is possible under the following conditions:
− The external PC with Linux/Unix or Windows operating system (Windows 95 or higher) is equipped with a LAN interface which is configured for the network.
− The signal generator and PC are linked via a LAN.
− A user-specific password for the **VNC** connection is defined on the R&S SMF. The default password is "instrument", it can be changed in the **Environment** section of the **Setup** menu.
− The **Ultr@VNC Viewer** software is installed on the external PC (or any other VNC client) R&S SMF IP address and the user-specific password for the **VNC** connection are entered in the **VNC Viewer** panel.

<table>
<tr>
<td>⚠️</td>
<td>

Caution:
After enabling the VNC connection, any user on the network who knows the password and IP address of the signal generator can access this R&S SMF. Even after closing the connection, the VNC functionality is still enabled and the R&S SMF can be accessed any time.
To enhance security, also communication on the network via Ultr@VNC program should be disabled in the firewall.

</td>
</tr>
</table>

## Install VNC Viewer and Establish VNC Connection on the Windows PC

The **Ultr@VNC** program is available on the Internet as a free-of-charge download or on the R&S SMF CD-ROM.
Following the instructions on the Internet, the program can be copied onto the external Windows PC.
Only the program component **VNC Viewer** is required.

Note:
*The VNC Viewer program is included in the download for the installation of the Ultr@VNC program on the signal generator if **Full installation** was selected in the **Select Componen**t panel. In this case, the program ultr@vncviewer.exe can be copied to the Windows PC.*

---

1. Install **VNC Viewer** program component on the PC.

2. Start **VNC Viewer** program component on the PC.
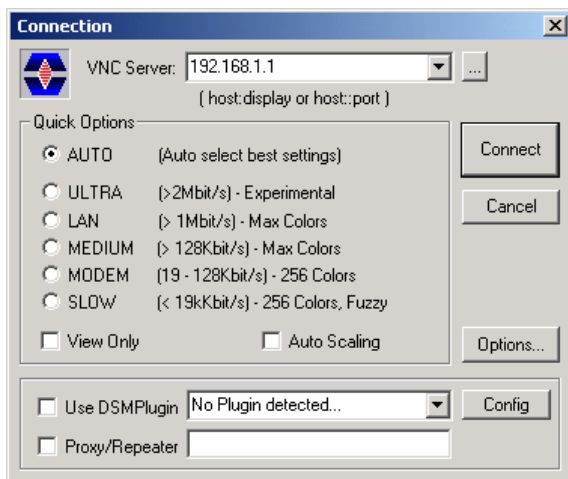
3. Enter IP address (or host name) of R&S SMA in input line **VNC Server.**

4. Initialize the connection by pressing the **Connect** button.
   A message requesting the password appears.

5. Enter the **VNC** password defined in the **Environment** section of the **Setup** menu of R&S SMF (default = "instrument"). The connection is established when the **Log On** button is pressed. .

   After the connection is established, the current signal generator screen with the block diagram is displayed and the R&S SMF can be manually remote-controlled from the external PC. The individual functions are operated using the mouse and keyboard. Specific instrument functions can be executed using specific key combinations on the keyboard (see table in Chapter 3, section "*Legend of Front-Panel Controls"*). Direct control on the R&S SMF is possible while manual remote-control is established, it can be performed alternately with the remote access.

Close Remote Access Connection via Ultr@VNC

The connection can be closed on the external PC by closing the VNC Viewer program.
Closing the connection does not disable it. It can be established again any time.

Contents - Chapter 2 "Getting Started"

2 Getting Started

Introduction - Getting Started

The main field of application of the R&S SMF is the generation of microwave signals with very high spectral purity. The signals can be generated with a set frequency and level (CW mode) or as a sweep with corresponding parameters (Sweep mode).

The RF signal can also be generated in modulated form. Option R&S SMF-B20 provides two internal LF generators, a noise generator and two external modulation inputs **EXT 1** and **EXT 2** at the front of the instrument which are available as the source for analog and/or digital modulations. Option R&S SMF-K23 provides an internal pulse generator.

The architecture of the R&S SMF and the signal flow are shown in a block diagram on the R&S SMF user interface. In the diagram, signal processing is performed from left to right (left: modulation generator, right: RF output/LF output). The block diagram in the figure below shows a fully equipped R&S SMF.
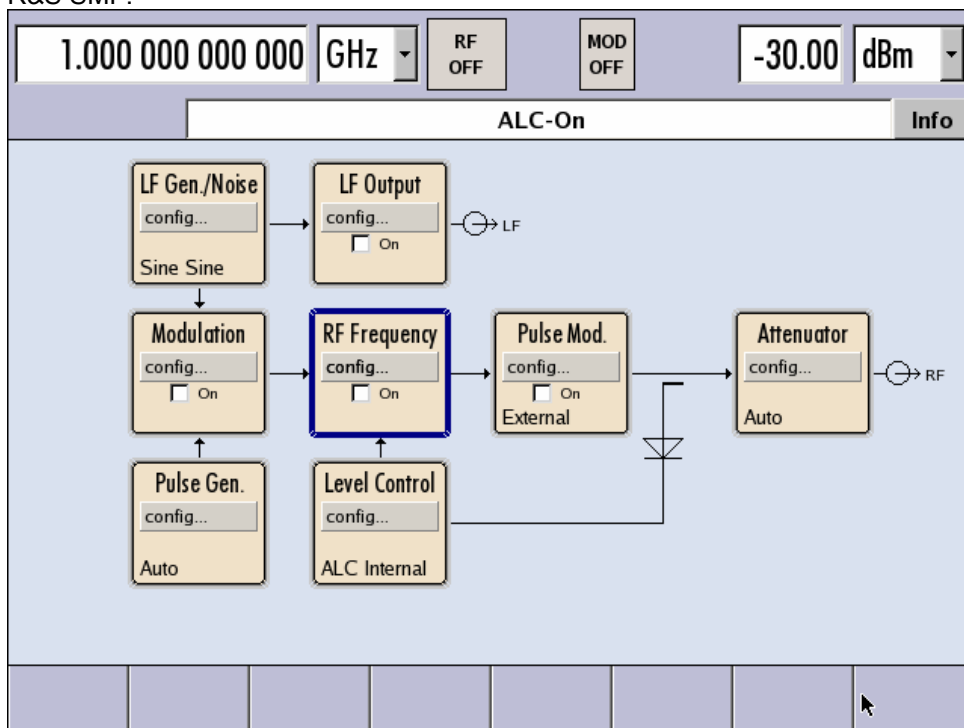

Fig. 2-1   Block diagram of a fully equipped R&S SMF

For more detailed information on options, refer to the R&S SMF data sheet (available on the R&S SMF Homepage on the Internet; http://www.rohde-schwarz.com/products).

Description of Individual Diagram Blocks

Available Blocks

Block	Function of block	Status display in the block	Effect of TOGGLE ON/OFF key
RF Frequency	RF signal is activated and configured. Frequency sweep is activated and configured. Reference oscillator is configured.	State of RF output	Switches the RF output on or off.
Level Control	RF signal is activated. Level sweep is activated and configured. ALC is activated and configured. User Correction is activated and configured.	State of RF output State of ALC	
Modulation	Analog and digital modulations are activated and configured.	Active modulations	Switches the modulation on or off.
LF Gen. Noise	LF and noise generator signals are configured. LF frequency sweep is activated and configured.	Waveform shapes of the LF generators	
LF Output	LF signal output is activated and configured. LF Level Sweep is activated and configured.	State of LF output and monitoring. Source of LF signal.	
Pulse Generator	Generation and configuration of pulse modulation signals	Trigger mode	
Pulse Modulation	Pulse Modulation is activated and configured.	State of Pulse Modulation Modulation source	
Attenuator	RF signal attenuation	Attenuator mode	

RF Frequency block

In this block, the RF frequency settings are performed.

RF frequency settings include:
−   RF frequency and phase settings
−   Frequency sweep settings
−   Reference oscillator settings

The RF ON/OFF key switches the RF signal on and off.

Note:
    Numeric values for the frequency are entered best and quickest with the aid of the FREQ key.

Level Control block

In this block, the RF level settings are performed.

RF level settings include:
−   RF level settings
−   RF level sweep settings
−   Automatic level control
−   User Correction

Note:
    Numeric values for the level are entered best and quickest with the aid of the LEVEL key.

Modulation block

In this block, the modulation settings are performed. The [MOD ON/OFF] key switches the active modulation(s) on/off.

The external inputs EXT 1 and EXT 2 at the front of the instrument are provided for external amplitude, frequency, phase, and digital modulation (ASK, FSK, PSK).

Pulse modulation is available via the internal standard pulse generator. The external pulse modulation is available via the PULSE IN connector at the front of the instrument. The connector can be used as trigger input for internal pulse modulation. The external (and internal) pulse signal is output at the VIDEO connector at the back of the instrument.

Internal Pulse Modulation with extended features, e.g. generation of double pulse, requires option R&S SMF-K23, Pulse Generator. The pulse signal is output at the PULSE OUT connector at the front of the instrument.

Note:
  For modulation modes that can be simultaneously used, refer to the R&S SMF data sheet or section Chapter 4, section "Simultaneous Operating of Several Modulations or Other Operating Modes".

The status display in the block shows the active modulation(s).

LF Gen./Noise block

In this block, two internal LF generators and a noise generator which can be used as internal modulation sources for analog modulations (amplitude modulation, frequency modulation, phase modulation) are configured. The LF/noise generators can also be used as the signal source for the LF output at the rear of the instrument.

The LF frequency sweep is also configured in this block.

LF Output block

In this block, the LF output and the LF level sweep are configured.

The internal LF generators, the noise generator, or the external inputs **EXT 1** and **EXT 2** can be selected as source for the LF output.

Pulse Gen. block

In this block, the settings for the internal pulse generator can be performed.
The pulse generator provides single and double pulse modulation with selectable pulse widths and periods. The signal is output at the PULSE OUT connector.

Pulse Mod. block

In this block, the narrow pulse modulation is activated and configured. Narrow pulse modulation requires option R&S SMF-K3.

Attenuator block
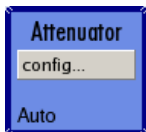
In this block, the attenuator settings for the RF signal are performed.

Info and Help System

The R&S SMF comprises a comprehensive **info** and **help system**. Context-sensitive help can be called any time with the HELP key. The help system indicates the currently selected parameter and offers additional services such as cross references, index, and contents. The content of the help system corresponds to the operating manual of the R&S SMF.

Warning and conflict messages caused by incorrect operation as well as further information are displayed in the **Info line**. A complete list of existing conflicts is displayed when the INFO key is pressed. Additional information on entries can be requested from the help system. The history function permits display of all messages.

Detailed operating instructions and an overview of menus follow in Chapter 3, "*Manual Operation*".
Menus and instrument functions are described in detail in Chapter 4, "*Instrument Functions*".

Example of Setup

A central element of the R&S SMF display is the block diagram that illustrates the signal flow. Each block represents a section of signal generation. The main settings of a block are indicated in the block. The interconnection of employed inputs and outputs is also shown. The user is thus always informed about the connection of inputs and outputs in the signal flow and where they can be configured.

A window is opened for each menu where parameters can be set. All open menus are of equal priority (not modal) and can be accessed any time via the Winbar.

The R&S SMF can be entirely operated from the front panel. Peripherals such as mouse or keyboard can be connected but are not essential.
With the aid of the rotary knob, the user can navigate in the block diagram and the dialogs. The cursor is moved line by line through the block diagram or dialog. Turning the button clockwise advances the cursor.
The selected block can be activated or deactivated with the ON/OFF TOGGLE key. Active blocks are highlighted by a colored background.
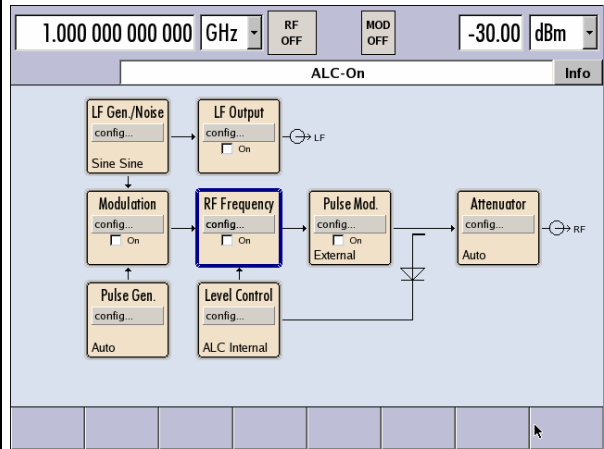
Generation of an Amplitude-Modulated Signal

In the example, a simple AM-modulated signal is configured. Proceed as described below:

1. Activate default (preset) state.
2. Select and activate AM modulation.
3. Set frequency and level and activate RF signal.

Step 1: Activate default (preset) state

Set a defined instrument state by pressing the
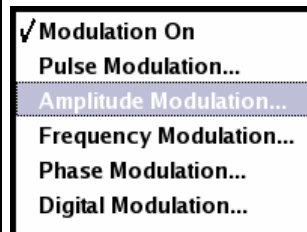PRESET key.

Step 2: Select and activate AM modulation

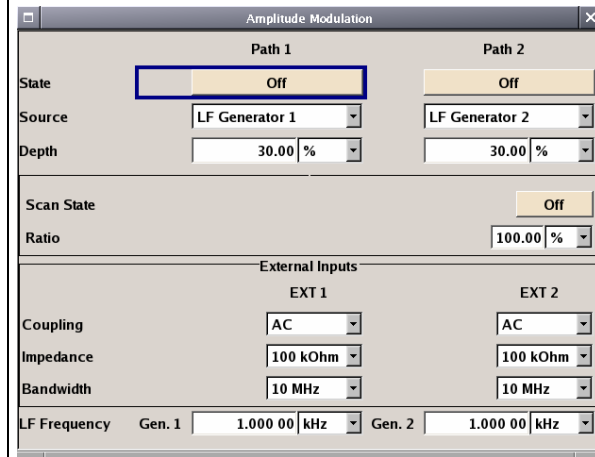|	
Select the **Modulation** block by turning the rotary knob.	
Press the rotary knob to open the menu where the modulation can be selected.	

Press the rotary knob to open the **Amplitude Modulation** menu.

Select the **Depth** parameter by turning the rotary knob, and then enter the desired AM depth with the aid of the numeric keypad and the unit keys.
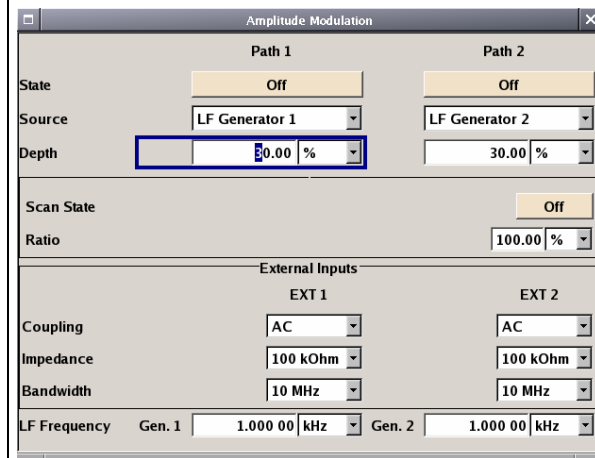
Finally, switch on AM modulation by selecting **State On** and subsequently pressing the rotary knob.
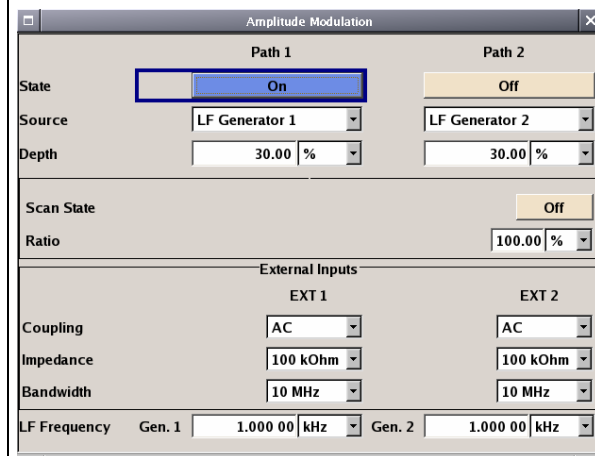
To indicate the active state, the **Modulation** block is displayed in blue. The **RF Frequency** is not yet active, which means that no RF signal is output.

Step 3:   **Set frequency and level and activate RF signal**

Press the FREQ key to activate the editing mode for frequency entry. The frequency entry field in the header section of the display is highlighted.

Enter the frequency of the desired RF carrier using the numeric keypad and terminate the entry by pressing a unit key.
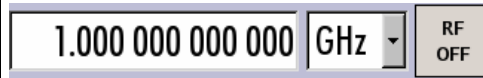
Enter the level of the desired RF carrier in the same way after pressing the LEVEL key.
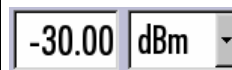
Select the **RF Frequency** block by turning the rotary knob and activate it by pressing the RF ON/OFF key.
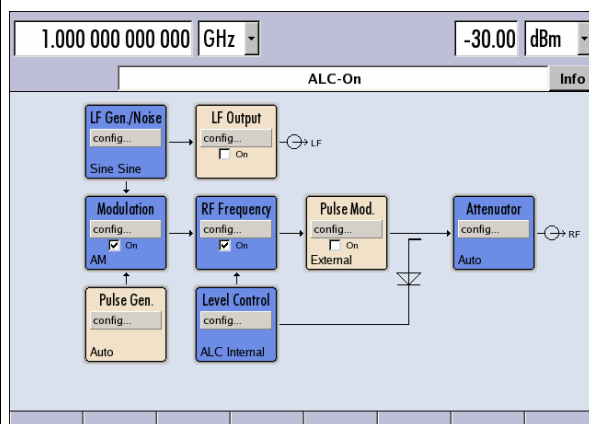
The AM modulation signal is now present at the RF output.

Generation of a Frequency Modulated Signal with Noise

In the example, a FM modulated signal with noise is configured. Proceed as described below:

1. Activate default (preset) state.
2. Select FM modulation with internal noise signal and a deviation of 500 kHz.
3. Set frequency and level and activate RF signal.

Step 1: Activate default (preset) state

Set a defined instrument state by pressing the PRESET key.
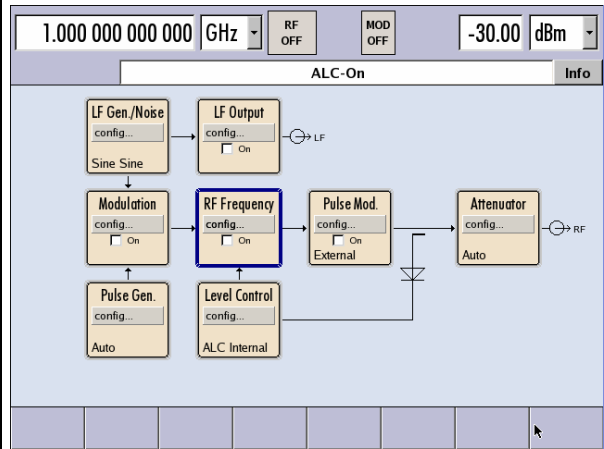
Step 2: Select FM modulation with internal noise signal and a deviation of 500 kHz

Select the **Modulation** block by turning the rotary knob.

Press the rotary knob to open the menu where the modulation can be selected.

√ Modulation On
Pulse Modulation...
Amplitude Modulation...
Frequency Modulation...
Phase Modulation...
Digital Modulation...
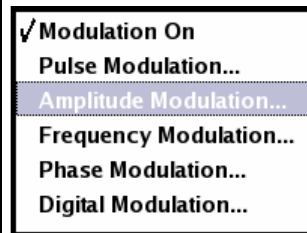
Highlight **Frequency Modulation...** by turning the rotary knob.

Press the rotary knob to open the **Frequency / Phase Modulation** menu.
The internal source is the LF generator 1 by default. This setting is not changed.
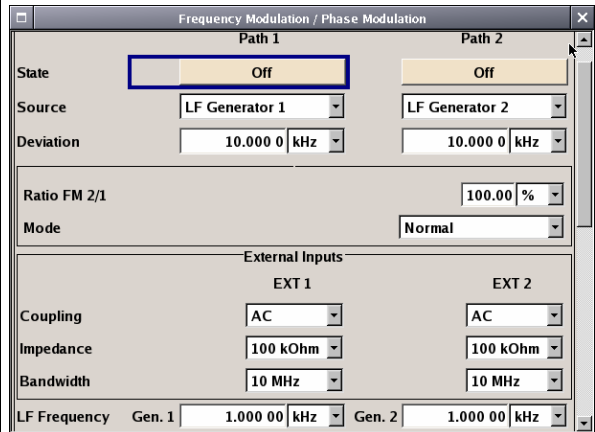
Select the **Source** parameter by turning the rotary knob. Press the button to open the selection list. Select **Noise Generator** by turning the rotary knob and press it to activate the selected item. The settings for the noise generator are performed in the **LF Gen./Noise** block. Gauss distribution with a bandwidth of 100 kHz are the default settings for the noise signal.
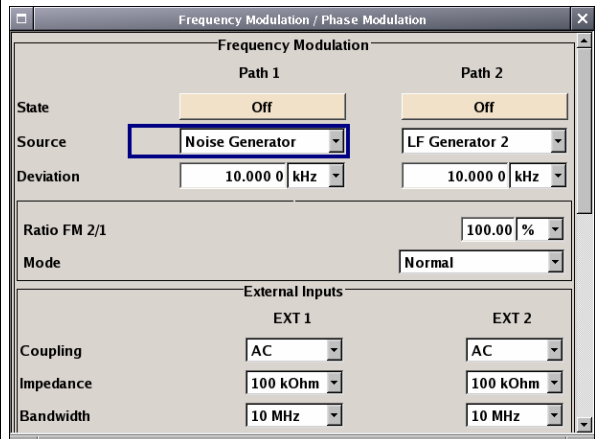
Select the **Deviation** parameter by turning the rotary knob. Enter 500 with the numeric key pad and press the rotary knob.
Now the deviation is set to 500 kHz.
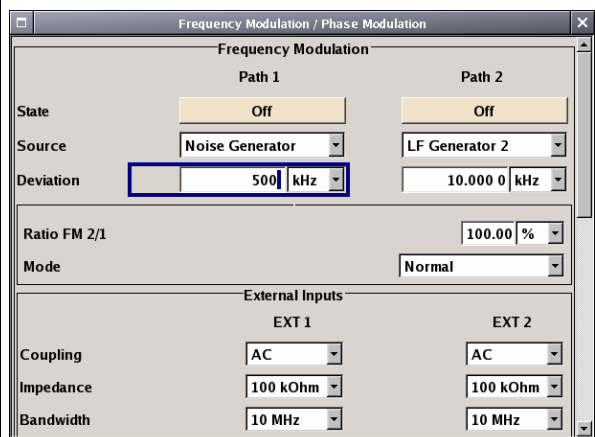
Finally, switch on FM modulation by selecting **State On**.
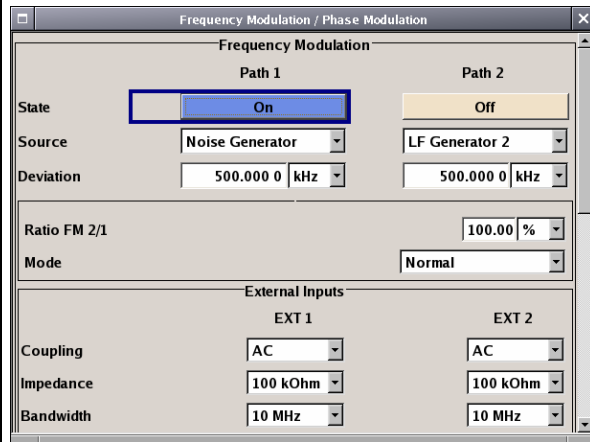
Close menu by pressing the CLOSE key.

To indicate the active state, the **Modulation** block is displayed in blue. The **RF Frequency** is not yet active, which means that no RF signal is output.

Step 3:   **Set frequency and level and activate RF signal**

Press the FREQ key to activate the editing mode for frequency entry. The frequency entry field in the header section of the display is highlighted.

Enter the frequency of the desired RF carrier using the numeric keypad and terminate the entry by pressing a unit key.
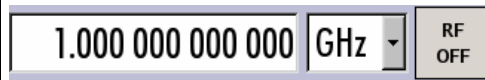
Enter a level of 0 dB for the RF carrier in the same way after pressing the LEVEL key.

The noise now superimposed the modulation signal. The **RF Frequency** is not yet active, which means that no RF signal is output.

Select the **RF Frequency** block by turning the rotary knob and activate it by pressing the RF ON/OFF key.
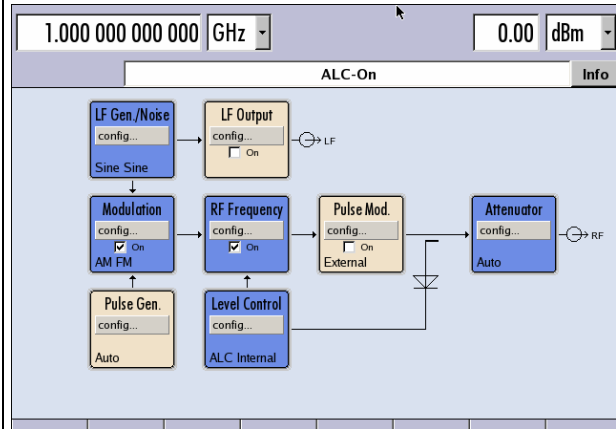
The FM modulated RF signal with noise is now present at the RF output. The LF output is not yet activated, i.e., the modulation signal is not output there.
The graph below shows the FM modulated signal with noise (lower green trace) and the unmodulated signal (upper blue trace).
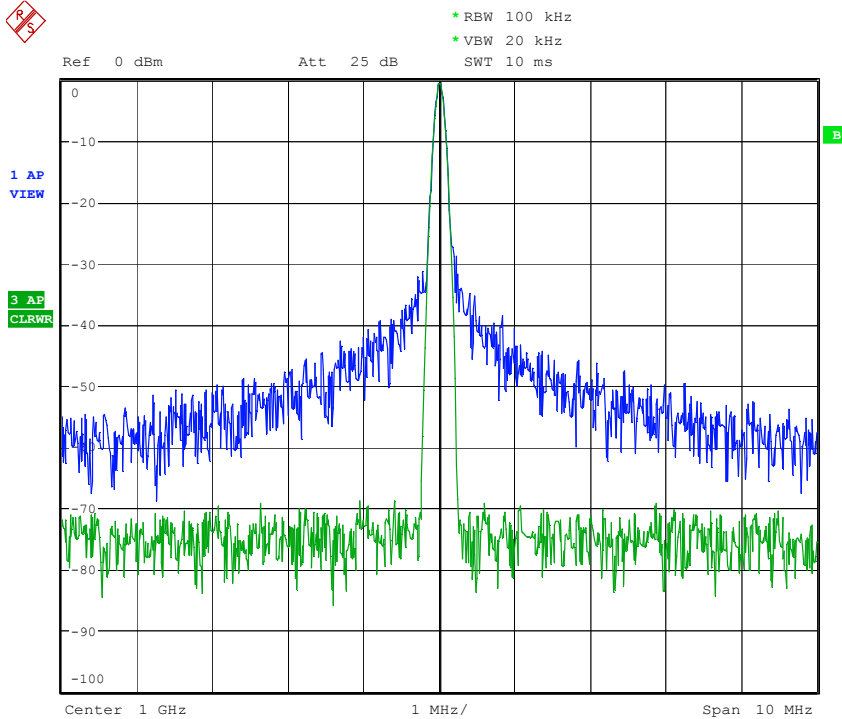
Date: 13.DEC.2005 15:15:42

Contents - Chapter 3 "Manual Operation"

3 Manual Operation

Introduction - Manual Operation

The Signal Generator R&S SMF can be operated intuitively either via the interactive block diagram or via a menu tree. All menus are in the form of windows that can be operated in the same way. Rotary knob, keys and softkeys, or alternatively a mouse, allow direct and therefore convenient access to entries and settings. The clear-cut display shows the current signal generator state. Numerous help functions support the user in signal configuration.

The following chapter describes manual operation of the signal generator. This includes a description of screenshots, operation of menus and the block diagram and the setting of parameters.

Chapter 4 includes a detailed description of signal generator functions. Chapter 2 explains the operating concept in general and includes a brief introduction to operation by a step-by-step description of the configuration. Remote control of the instrument is described in chapters 5 and 6.

Operating Concept

The operating concept of the R&S SMF enables the user to make settings as intuitively as possible and at the same time gives a permanent overview of characteristics of the generated signal and of the current instrument state. Numerous on-line help functions support user settings.

The block diagram is the core of the operating concept

A large graphics display showing the current configuration and the signal flow in the form of a block diagram is the core of the operating concept of the Signal Generator R&S SMF. The block diagram gives an overview of signal configuration, and the graphical elements can be accessed for operation. The desired element is selected by means of the rotary knob and the associated setting function is called by clicking this button. Required menus are displayed on the block diagram which is displayed again in the foreground whenever the DIAGRAM key is pressed.

Permanent display of frequency and level of the RF output signal

The main characteristics of the RF signal, frequency and level, are permanently displayed in the header section of the screen and can be directly set in the display fields after the FREQ or LEVEL key is pressed. Status messages for the output signal are displayed in addition to frequency and level.

| 1.000 000 000 000 | GHz | ▾ | | 0.00 | dBm | ▾ |

Operation via the graphics interface

Menus are assigned to the specific function blocks in the block diagram. The function blocks represent elements of signal generation, e.g. the **Modulation** block which contains all menus required for modulation signal configuration. In this block, all modulations can be selected. Function blocks displayed with a blue frame can be directly switched on and off by means of the TOGGLE ON/OFF key. In the example, amplitude modulation can be activated in this way. The menus of the highlighted function blocks can be called by clicking the rotary knob or by pressing the ENTER key.
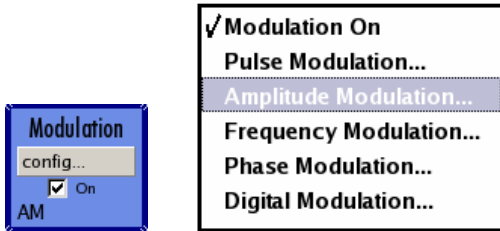
The signal flow between the function blocks and the employed inputs and outputs are also shown.
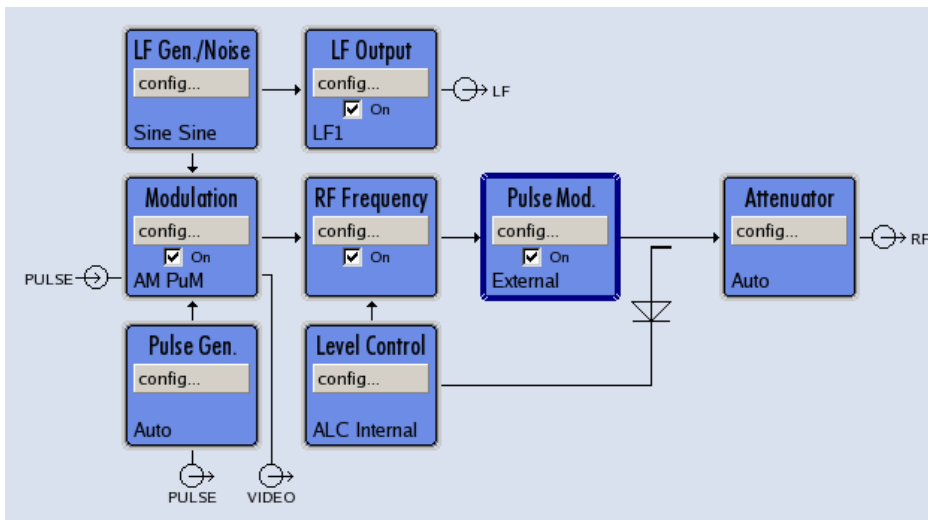
The menu tree can be opened and closed with the MENU key. The menu tree is organized in the same way as the directories under Windows. The function blocks correspond to the first directory level, the menus to subdirectories.
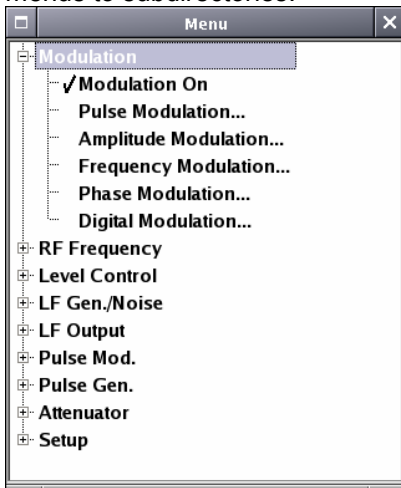
Operation corresponds to the Linux concept

To offer the user a familiar environment, operation is very similar to operation of Linux user interfaces. All menus and tables are made up of known elements, e.g. selection lists,
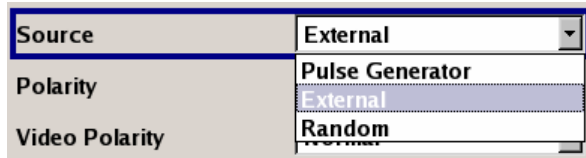
check boxes,

or entry fields.

A blue frame indicates that the selected item is active. In the highlighted element, entries can be made.

Most of the settings can be easily made with the rotary knob

Operation is possible via front-panel keys, an external keyboard, and the mouse. Most of the settings can be made with the rotary knob:

- Turning the rotary knob shifts the entry focus to the desired element.
- Clicking the rotary knob activates the selected entry field.
  Depending on the parameter, the submenu is now called, the numeric value varied, the list entry selected, or the check box activated or deactivated.
- If a value is entered, the entry is stored by another click on the rotary knob and the editing mode is exited.

Clear settings with the aid of independent submenus

A separate menu is opened for each menu and submenu. The menus can be operated independently of each other, i.e. none of the menus requires that settings in other menus be completed before it can be closed. This ensures flexible operation at all times.

The Winbar gives an overview of menus and simplifies their access

The menus are displayed on top of the block diagram but they can be "hidden" using the ⎕DIAGRAM⎕ key. They can be displayed again in full size (⎕WINBAR⎕ key). This makes room on the screen for other displays that may be required but the setting menus can thus be accessed any time.

The keys are assigned simple functions

Most keys on the front panel of the R&S SMF directly perform a simple function. Since a great number of settings can thus be made by a keystroke, operation is easy. For instance, the ⎕CLOSE⎕ key closes the active menu; with the ⎕RF ON/OFF⎕ key the RF output signal can be switched on or off.
An exception are keys that call a menu such as the ⎕MENU⎕ key which opens the complete menu tree of the R&S SMF, the ⎕SETUP⎕ key which opens the menus for general instrument settings or the ⎕FILE⎕ key which opens the menu for file management.

Help functions support the user

Numerous help functions support the user in signal configuration.
The valid setting range can be displayed for each numeric parameter. This requires a short wait after activation of the entry field. The range is then displayed automatically after a few seconds. If the entered value is outside the permissible range, the next permissible value is automatically set and a message is output (see below).

Offset	0.000	Hz	▼
Multiplier	Min = -50.000 000 000 000 GHz Max = 50.000 000 000 000 GHz replace mode		
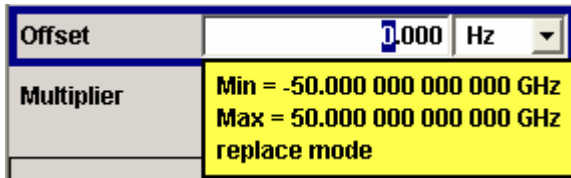
Context-sensitive help for each parameter can be called with the HELP or F1 key:

Contents Index Back Previous Next

Default Instrument Settings - Preset Key

The PRESET key calls up a defined instrument setup. All parameters and switching states are preset (also those of inactive operating modes). The default instrument settings provide a reproducible initial basis for all other settings.

Remote-control command:
*RST
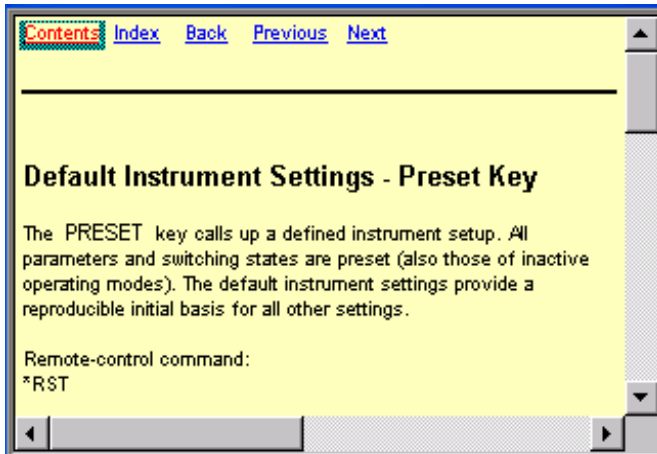
Each help page is part of a comprehensive online help function which can be called by means of the **Content**, **Index**, **Back**, **Previous** and **Next** links.

Messages indicate the current instrument state

A great variety of different messages such as status messages, error messages, warnings, or information are displayed in the header field of the screen. With the aid of the INFO key, help pages can be called for most of the messages. They provide background information on the message and indicate operating steps that may be required. All messages are explained in the online help which can be called with the HELP key.

1.000 000 000 000 GHz ▾		0.00 dBm ▾
	ALC-On	Info

Display

The display shows the current signal generator state and offers graphical elements for direct operation. It is divided into two sections:

• The frequency and level display with info line indicates the main output signal parameters and reports the current state with status, error, and warning messages.

• The block diagram shows the instrument configuration, the signal characteristic as well as the inputs and outputs used and permits interactive operation via graphics elements. Active menus and graphs are displayed on top of the block diagram.
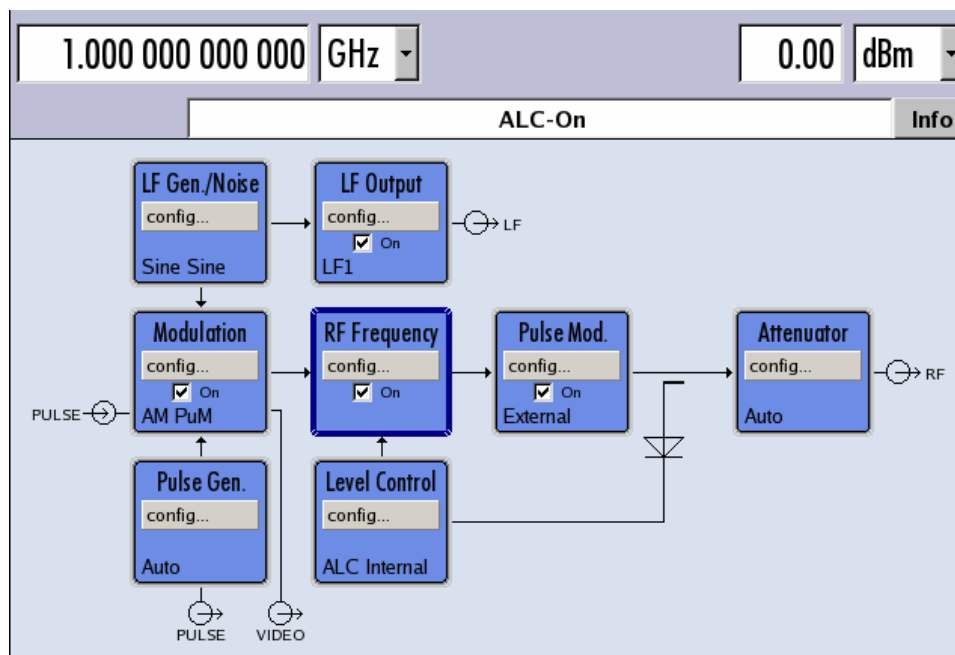
Frequency and Level Setting - Display

Frequency/level settings and a few status messages (see below) are displayed in the header field of the screen. The display may vary depending on the instrument's operating mode:
−   In the sweep mode, the current frequency or level of the output signal is displayed. The status message **SweepMode** is displayed in the info line.
−   If user correction is active, the status message **UCorr** is displayed in the info line.

It should be noted that the signal at the RF output may differ from the indicated value by a set offset (frequency or level) or multiplier factor (see sections "*RF Frequency*" and "*RF Level*" in chapter 4).

Status Information and Messages - Display

The status information and messages are displayed in the header section of the screen. The messages differ with respect to their importance (errors, warnings, info) and the time of their appearance (brief and permanent messages). They require different treatment by the user. Further information on all messages can be called in the info window (see section "*Info Window - Display*").
Chapter "Error Messages" includes an overview of all status information and messages as well as instructions for error elimination.

Status Information

The status information gives the user an overview of the main operating states and settings of the R&S SMF. The states are indicated for information only and do not necessitate any action by the user. Status information is displayed between the frequency and level fields, at the left of the info line or in the info line itself.

| 1.000 000 000 000 | GHz | ▾ | | 0.00 | dBm | ▾ |

| ALC-On | Info |

Messages

Messages indicate errors in the instrument. They are displayed in the info line in different colors depending on their importance and display duration. Errors (e.g. no calibration data) are displayed in red, information (e.g. file not found) and warnings in black. Warnings indicate less significant errors (e.g. the instrument operates outside specified data).

Brief messages

Brief messages report automatic settings in the instrument (e.g. switching off of incompatible types of modulation) or on illegal entries that are not accepted by the instrument (e.g. range violations). They are displayed in the info line on a yellow background. They are displayed on top of status information or permanent messages.
Brief messages do not normally demand user actions and disappear automatically after a brief period of time. They are stored in the history, however.

Permanent messages

Permanent messages are displayed if an error occurs that impairs further instrument operation, e.g. a hardware fault. The error signaled by a permanent message must be eliminated before correct instrument operation can be ensured.
The message is displayed until the error is eliminated. It covers the status display in the info line. After error elimination, the message automatically disappears and is also recorded in the history.

Info Window - Display

A few operating states and the current message are displayed in the info line (see also Chapter "*Error Messages*").

The info window with a list of current permanent messages and a detailed description of each message can be opened with the INFO key.
The upper section of the info window contains a list of all current permanent messages in the order of their occurrence, i.e. the most recent message is displayed first. In the lower section of the window, additional information on the highlighted message is displayed.
A history of all messages that have occurred since instrument switch-on can be called with the **History** button. The most recent message is displayed first.
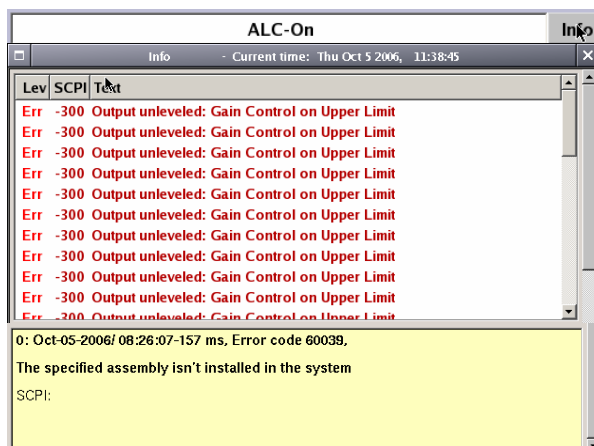
Info line

List of current messages with short message text

Detailed description for highlighted message

Softkeys
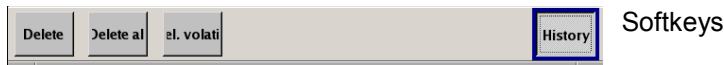
The messages are color-coded according to their level. Device-specific messages are red, info and remote control error are black. The level is also indicated in the **Lev** column (Err, Sys or Info). Column **SCPI** indicates the SCPI error code.

With the aid of the softkey buttons, error messages can be cleared and a history of all messages called.

Delete   Clears the highlighted message. This button is available only if the history of the messages is displayed.

                      Remote-control command:
                      (see below)
Delete All   Clears all messages.
                      This button is available only if the history of the messages is displayed.

                      Remote-control command:
                      SYST:ERR:ALL
Delete Vol.   Clears all brief messages. This button is available only if the history of the messages is displayed.
History   Calls the list of all messages that have occurred since instrument switch-on. The most recent messages are displayed at the top of the list. When the button is pressed again, the list of current messages is displayed.
                      Remote-control command:
                      :SYST:ERR? or :STAT:QUE?
                      (Each time a SYSTem:ERRor? or :STATus:QUEue? query is sent, the oldest entry in the error queue is returned and at the same time cleared in the list).

Block Diagram - Display

The block diagram shows provided options, signal configuration and the currently selected signal flow of the generator with inputs and outputs used. Signal generation can be completely operated from the block diagram. The highlighted function block can be directly switched on and off with the TOGGLE ON/OFF key. Clicking the rotary knob (= Enter) opens the associated setting menu.
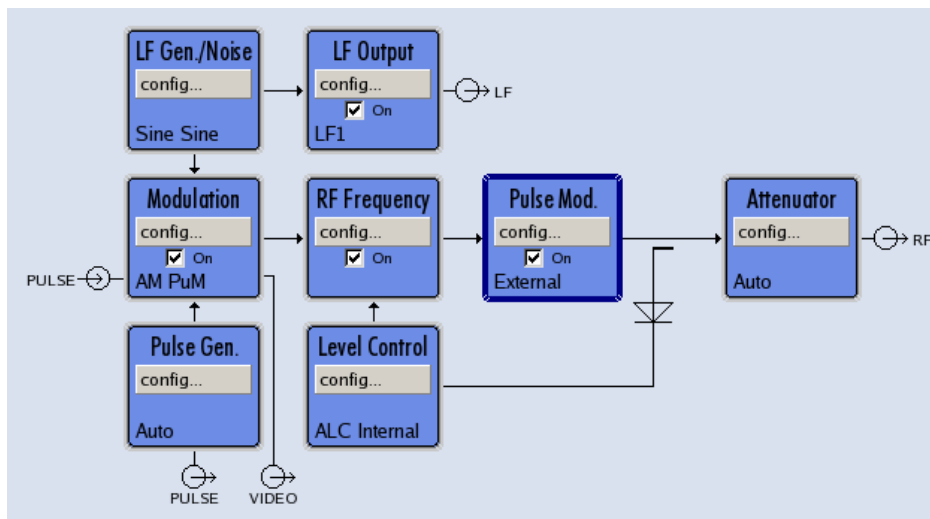
Function Blocks in the Block Diagram

Each block represents a function of signal generation. The function is indicated in the headline of the block, e.g. **Modulation**. In this block, the modulation signals are set, for instance.

 In the check box ☑ On , the respective function can be quickly activated/ deactivated with the TOGGLE ON/OFF key. After activation, the block is displayed in blue.
Status information is displayed below the check box. It is different for the different blocks. In the **Modulation** block, for instance, the selected modulation is indicated.

Clicking the rotary knob (front panel) or the **config...** button (mouse) opens the associated setting menu.
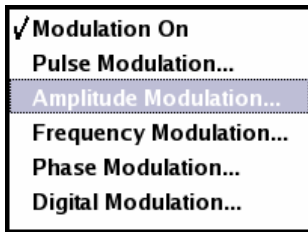
Signal Flow and Input/Output Symbols in the Block Diagram

The input/output symbols in the block diagram show the currently used inputs and outputs of the signal generator. Unused inputs and outputs are not shown. The lines indicate the signal flow.

Symbols and labels refer to the corresponding inputs and outputs on the front and rear panel of the signal generator. The direction - input or output - is indicated by an arrow.
Example:
The symbols indicate the input for the external pulse signal on the instrument rear panel.
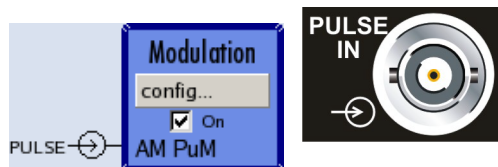
Menu Structure - Display

The parameters are set in the menus. Menus are called either via the function blocks in the diagram or by means of the MENU key. The menus are displayed on top of the block diagram. If the menu buttons assign menu-specific functions to the softkeys, the Winbar is hidden.
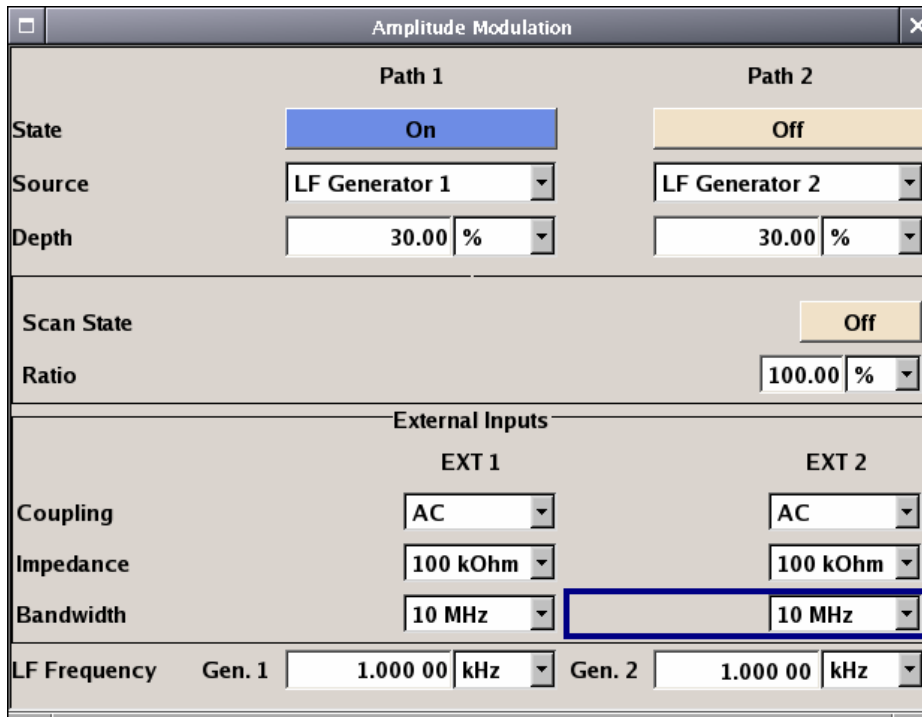
This section describes the menu structure. Menu operation is described in section "*Menu Operation*", page 3.19, the setting of parameters in section "*Setting Parameters*".

The menus are in Linux format. They differ in details depending on their function but they consist of the same main elements.

Menu header

The header line contains the name of the menu (e.g. Frequency / Phase) and the buttons for minimizing [_] and closing [X] the menu. The buttons can be operated with the mouse. For operation from the front panel, the HIDE and CLOSE keys can be used.

The remaining menu area is variable and comprises various fields for setting parameters.
Each of the setting fields is assigned a parameter name. The kind of setting varies depending on the parameter to be set.
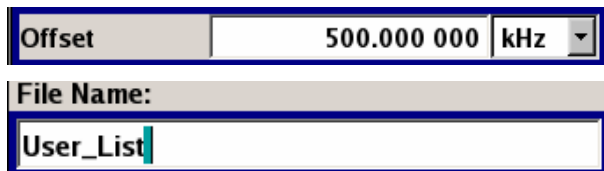
Entry field

A numeric value (e.g. offset) or an alpha-numeric value (e.g. file name) can be entered in this field.

	Selection field
	The ▾ button indicates that a selection can be made from a list. The fold-down selection list is displayed below the selection field. Depending on the number of entries, the full list or only part of it is shown.
	One entry at a time can be selected from the list.
	If an item is not available for selection, it is printed in grey and cannot be accessed.
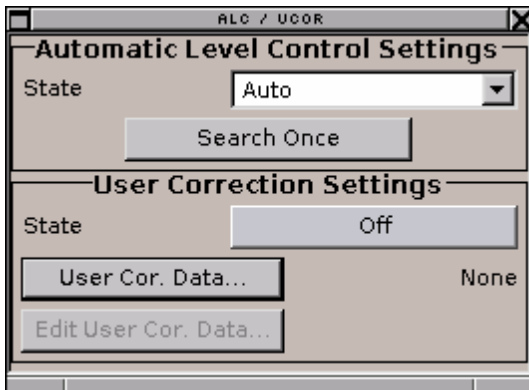
	Units
	The unit of a parameter is displayed next to the value. When the parameter is edited, the unit is selected either from the list or by means of the front-panel keys. When the entry is completed, the unit can be changed. In this case the value remains unchanged but is automatically adapted to the new unit.

	Check-box field
	If the check box is ticked, the associated parameter setting is active (e.g. switched on).

	Access denied
	Some settings can only be made in a specific configuration. If setting is not permitted with the specific configuration selected, the respective item is disabled and displayed in grey and the entry or selection field or button cannot be accessed.

	Menu area
	Several fields of associated but separately set parameters can be organized in a menu area.
	The menu area is framed and labelled with the function common to all parameters (e.g. Noise Generator).

	Buttons
	The buttons either trigger a single action (e.g. Execute Single Sweep), or call the next menu level (to be identified by 3 dots, e.g. User Cor. Data...).

Setting Parameters

The R&S SMF offers several and sometimes alternative possibilities for setting parameters. Operation is possible from the front panel, with the aid of a mouse and/or from a PC keyboard. Operation of the R&S SMF with the aid of these control media is shown in the tables below.

Frequency and level are directly set in the header area of the display using the $\boxed{\text{FREQ}}$ and $\boxed{\text{LEVEL}}$ keys. Some of the keys trigger a direct action, e.g. the $\boxed{\text{RF ON/OFF}}$ key switches the RF output on and off. An overview of key functions can be found at the end of this chapter (see section "*Legend of Front-Panel Controls*", page *3.27*), a detailed description of key functions is given in chapter 4, "*Instrument Functions*".

Most of the parameters are set in the menus. Menus can be opened from the function blocks of the diagram either with the aid of the rotary knob (= Enter) on the front-panel or by a mouse click on the **Config...** button.
An exception are the **Setup** and **File** menus. In the **Setup** menu, general settings are made which are not directly concerned with signal generation, e.g. setting of the IEC/IEEE-bus address. In the **File** menu, files and lists are managed. These menus can only be called with the $\boxed{\text{SETUP}}$ and $\boxed{\text{FILE}}$ keys.

Specific settings can also be made directly in the block diagram, e.g. activating a function block by means of the $\boxed{\text{TOGGLE ON/OFF}}$ key. Changes affecting the signal flow are immediately visible in the graphics display.

Calling a Menu - Setting Parameters

After instrument switch-on, the cursor is always on the first function block of the diagram (default setting). It can be moved by means of the rotary knob or the arrow keys. Clicking the rotary knob opens the menu associated with the function block. The $\boxed{\text{MENU}}$ key opens the complete menu tree.
With the aid of the appropriate keys and softkeys, the cursor can also be moved to the header area or the Winbar.

- The $\boxed{\text{FREQ}}$ and $\boxed{\text{LEVEL}}$ keys activate the frequency or level entry fields in the header area.
- The $\boxed{\text{DIAGRAM}}$ key moves the cursor to the block diagram.
- The $\boxed{\text{WINBAR}}$ key moves the Winbar to the foreground. The button that was active last in the Winbar is highlighted. The associated menu is activated by clicking the rotary knob (= Enter).
- The $\boxed{\text{MENU}}$ key opens the complete menu tree, the $\boxed{\text{FILE}}$ and $\boxed{\text{SETUP}}$ keys the respective menus. Menus can be closed with the $\boxed{\text{CLOSE}}$ key.
- The cursor can also be moved with the $\boxed{\text{ESC}}$ key. However, the function of this key depends on the current cursor position:
    - **Parameter field (editing mode)**:
      The editing mode is terminated and the previous value is restored (exception: value variations with the rotary knob cannot be cancelled).
    - **Menu area:**
      The cursor is set to another menu area.
    - **Menu:**
      The menu is closed and the cursor changes to the next higher control level.
    - **Frequency/level field:**
      The cursor is set on the previously active menu or, if no menu was active, on the first function block in the diagram.
    - **Function block in the diagram**:
      The cursor is set on the first menu in the Winbar. If no menus are open, the current cursor position remains unchanged.

Function	Front panel	PC keyboard	Mouse
Edits the frequency or level in the entry fields of the header area	Press FREQ or LEVEL key. Enter value.	Press CTRL + F (frequency) or CTRL + L (level). Enter value.	Click the entry field and enter value.
Activates the block diagram	Press DIAGRAM key.	Press CTRL + D.	Click the function block.
Activates the Winbar	Press softkey. Press WINBAR key .	Press CTRL + F1... F8 Press CTRL + W.	Click button in Winbar.
Calls the Setup or File menu or the menu tree	Press SETUP, FILE or MENU key.	Press CTRL + E (Setup), CTRL + S (File) or CTRL + M (menu tree).	-

Selecting a Control Element - Setting Parameters

Control elements are always selected in the same way no matter whether a function block in the diagram, a menu in the menu tree, a parameter in the menu, or an entry in a list or table is concerned.

- An element is activated by means of the cursor. An active element is highlighted by a blue frame.

Variation Step	1.000 000 000	MHz

Function	Front panel	PC keyboard	Mouse
Selects an element	Select element by means of the rotary knob or the arrow keys.	Select element by means of the arrow keys.	Click element.

Switching Parameters On/Off - Setting Parameters

A parameter can be activated and deactivated using a button or a check box.

- The ENTER function of the different control media switches the highlighted element on or off (toggle function). Color and label of a button change, the check box is ticked or the tick is removed.

State	On	State	Off
Variation Active	☑	Variation Active	☐

Function	Front panel	PC keyboard	Mouse
Switches on/off	Press rotary knob, ENTER or TOGGLE ON OFF key.	Press Enter key.	Click check box or button.

Selecting and Exiting a Menu Area - Setting Parameters

Some menus are organized in areas. The cursor can be moved either only within an area or between the higher-level menu areas. This applies to the **File Select** menus when files are saved or loaded. When the menu is called, one of the menu areas is highlighted by a blue frame.
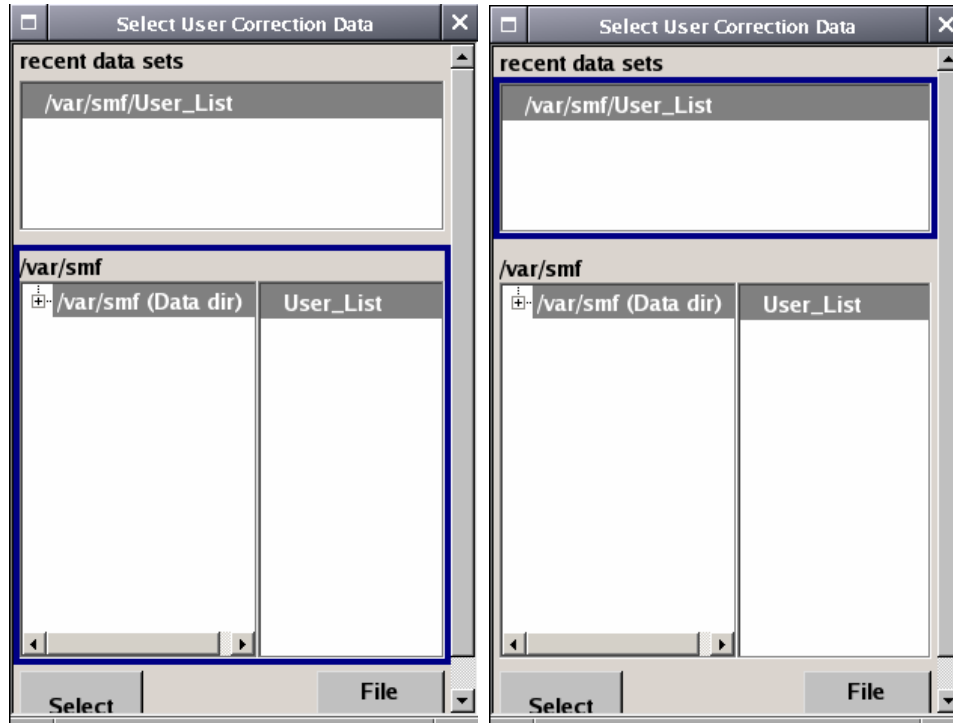
- Another menu area can be selected (highlighted) by means of the rotary knob or the arrow keys.
- Clicking the rotary knob (= Enter) moves the cursor to the highlighted menu area. When the cursor is placed on a lower-level area in the menu, the area is highlighted by a grey frame. The currently selected item is printed on a blue background (in the example the selected directory).
  The rotary knob and the arrow keys up/down move the cursor only within the grey-framed area.
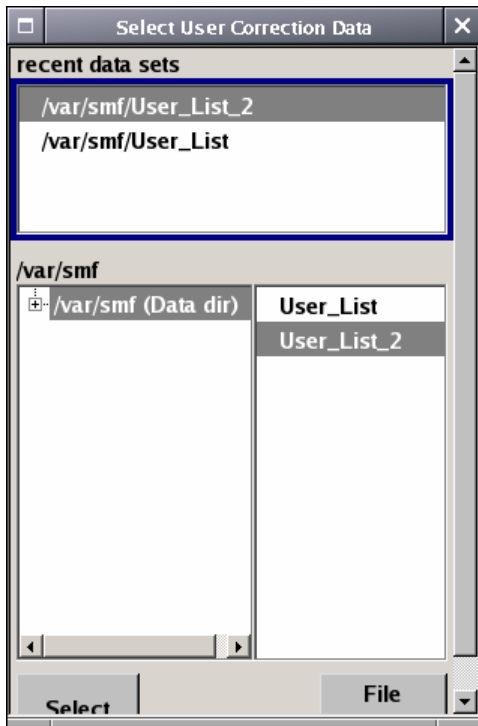
- Clicking the rotary knob (= Enter) terminates the setting, i.e. selection of a file. The cursor is either set on the next higher menu level or the menu is closed as in our example.
- The left/right cursor keys first shift the entry focus within the menu range from left to right (or vice versa); in the example, from the directory tree to the file list. Press again and the entry focus is shifted up one menu level.
- Clicking the rotary knob (= Enter) performs a setting.
  In the example of the **File Select** menu, this is the display of the subdirectories if a directory is marked and, if a file is marked, the selection of this file. After a file has been selected, the menu closes automatically.
- The ESC key moves the cursor to the next higher menu level.

Function	Front panel	PC keyboard	Mouse
Selects a menu area	Select menu area using the rotary knob or the arrow keys. Press the rotary knob or the ENTER key. Rotary knob and arrow keys up/down move the cursor only within the selected menu area.	Select menu area using the arrow keys. Press the Enter key. The arrow keys up/down move the cursor only within the selected menu area.	- (The menu area is selected by selecting an entry.)
Exits a menu area	Press the ESC key. Rotary knob or arrow keys move the cursor between different menu areas.	Press the Enter key. The arrow keys move the cursor between different menu areas.	- (The menu area is exited by setting the cursor on an item outside the area).

Entering a Value - Setting Parameters

Numeric and alphanumeric values can be edited in the entry fields. In the editing mode, cursors of different color are used. A blue cursor indicates the overwrite mode, a green cursor the insert mode. The [INSERT] key toggles between the two modes. The insert mode is the default setting.

Numeric values can either be newly entered or the existing value can be varied. Incorrect entries are cleared with the [BACK SPACE] key.

- **Entering a new value:**
  A click on a numeric key activates the editing mode. The previous value is cleared and the new value can be entered.

  | Dwell Time | 15.0 | ms | ▾ |

  | Dwell Time | 10 | ms | ▾ |

- **Variation:**
  Clicking the rotary knob (= Enter) activates the editing mode. Set the cursor to the left of the number to be changed using the left/right arrow keys. The value at the cursor position is varied. An increase or decrease of the value depends on the cursor used (up/down) or on the direction of rotation of the rotary knob.

  | Dwell Time | 15.0 | ms | ▾ |

  | Dwell Time | 15 | ms | ▾ |

Alphanumeric values can be newly entered (e.g. file name).

- **New entry:**
  The entry is started by clicking an alphanumeric key.

File Name:

File Name:
User_List_2

Function	Front panel	PC keyboard	Mouse
Enters a new value	Press an alphanumeric key.	Press a letter key or a numeric key.	-
Edits a value	Click the rotary knob. Select the desired numeric digit with the rotary knob and mark it by clicking the button. Change the number using the keypad.	Press the Enter key. Select the desired numeric digit using the left/right arrow keys. Enter new value using the keyboard.	Click the desired position to set the cursor. Change the value using the keyboard.
Varies a value	Click the rotary knob. Select the desired numeric digit with the rotary knob and mark it by clicking the button. Vary the number using the rotary knob.	Press the Enter key. Select the desired numeric digit using the left/right arrow keys. Vary the number using the up/down arrow keys.	-

Selecting a Unit - Setting Parameters

The entry of a numeric value can be terminated by pressing a unit key on the front panel, selecting a unit in the selection field next to the value or by clicking the rotary knob (= Enter). The unit is assigned in different ways:

Terminating the value entry by selecting a unit in the units field
When the entry is terminated by selecting a unit in the units field next to the value, the selected unit is assigned, e.g. s (for list selection see next section).
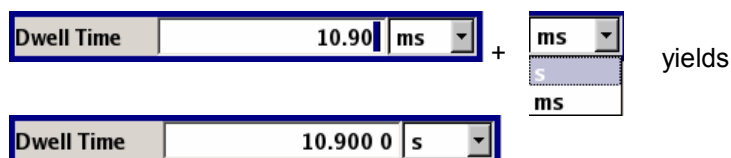
Terminating the value entry with Enter
If an entry is terminated by clicking the rotary knob (= Enter) or with the ENTER key, the unit displayed in the entry field next to the value is assigned (in the example ms).
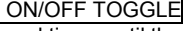
Function	Front panel	PC keyboard	Mouse
Assigns a unit	To terminate the entry, press one of the unit keys or select unit in the field at the right of the value (for list selection see next section).	To terminate the entry press one of the key combinations ALT + F9/ + F10/+ F11/+ F12 or select unit in the field at the right of the value (for list selection see next section).	Select unit in the field at the right of the value **before** entering the value (for list selection see next section).
Changes a unit	After the value entry has been terminated press a unit key or select unit in the field at the right of the value (for list selection see next section).	After the value entry has been terminated press one of the key combinations ALT + F9/+ F10/+ F11/+ F12 or select unit in the field at the right of the value (for list selection see next section).	Select unit in the field at the right of the value **after** the value entry (for list selection see next section).

Selecting a Value from a List - Setting Parameters

The ▾ button next to the value field indicates that a selection list is available.
- Clicking the rotary knob (= Enter) opens the list. Selection is made by choosing an entry (item is highlighted) and confirmation with ENTER. If the list is longer than the displayed window, a scroll bar is available

Mode	Single ▾
	Auto
Start Freq	Single
	Step
Stop Freq	Extern Single
	Extern Step

Function	Front panel	PC keyboard	Mouse
Opens the selection list	Press rotary knob or ENTER key.	Press Enter key.	Click ▾ button.
Selects an entry	Select entry using the rotary knob or the up/down arrow keys and confirm with the rotary knob or the ENTER key or press ON/OFF TOGGLE key several times until the desired entry is displayed in the selection field.	Select entry using the up/down arrow keys and confirm with the Enter key.	Double-click the desired entry.
Scrolls	Shift the displayed list section using the rotary knob or the up/down arrow keys.	Shift the displayed list section using the up/down arrow keys.	Press ▾ or ▲ button in the scroll bar until the desired entry is displayed.

Terminating Entries - Setting Parameters

Variations by means of the rotary knob are immediately set, e.g. RF frequency variation.
All other parameter settings have to be confirmed by pressing the rotary knob or one of the unit keys (see also section "*Selecting a Unit*", page *3.16*).

Some settings require additional confirmation with the Accept button. This is the case when it is useful to first enter a few values and to confirm them together, e.g. when network settings are made. Settings not yet confirmed by Accept are displayed in the menu on a yellow background. This indicates that the currently displayed values do not represent the desired signal.

All settings of instrument functions that can be switched on and off are calculated and effective only after this function has been switched on.
This applies to most settings on the R&S SMF. An exception is, for instance, the frequency variation of the reference oscillator, which is immediately set after confirmation.

Function	Front panel	PC keyboard	Mouse
Accepts value immediately	Vary the value using the rotary knob or the up/down arrow keys.	Vary the value with the up/down arrow keys.	-
Confirms entries	Press rotary knob or ENTER key or press unit key.	Press Enter key or one of the key combinations ALT + F9/+ F10/+ F11/+ F12.	Exit entry field.
Confirms entries in the menus with the Accept button.	Press **Accept** button.	Select **Accept** button with the arrow keys and press Enter.	Click **Accept** button.
Sets the entries in the instrument	If the instrument function is active, the new value is immediately calculated and set. If the instrument function is not active, the new confirmed value is calculated and set only when the function is switched on.	(see front panel)	(see front panel)

Restoring the Previous Value - Setting Parameters

Parameter variations with the rotary knob are immediately set and therefore not reversible.
Normally, values cannot be restored also in the case of mouse control because no explicit confirmation is required in this case and entries are automatically confirmed when the entry or selection field is exited.

In the case of front-panel control or operation from the keyboard, previous values can be restored as long as the new value is not confirmed, i.e. the entry is not completed. This can be done with the ESC key.

Function	Front panel	PC keyboard	Mouse
Restores previous values	Press the ESC key before the entries are confirmed.	Press the Esc key before the entries are confirmed.	-

Menu Operation

Menus are operated with the aid of the Winbar buttons and with the $\boxed{\text{CLOSE}}$, $\boxed{\text{DIAGRAM}}$, and $\boxed{\text{REARR}}$ keys on the front panel.
The Winbar can be called to the front with the $\boxed{\text{WINBAR}}$ key.

- The $\boxed{\text{DIAGRAM}}$ key moves the cursor to the block diagram. All active menus are hidden. They are still open and can be displayed again with the $\boxed{\text{WINBAR}}$ key.

- The $\boxed{\text{CLOSE}}$ key closes an active menu.

- The $\boxed{\text{REARR}}$ key rearranges all open menus that where shifted outside the display range with the mouse.

- The $\boxed{\text{WINBAR}}$ key calls the Winbar to the front. The open menus are displayed after pressing the associated Winbar button.

Note:
  The $\boxed{\text{ESC}}$ key also closes the active menu if the cursor is at the highest menu level.

Function	Front panel	PC keyboard	Mouse
Displays the block diagram in the foreground	Press the $\boxed{\text{DIAGRAM}}$ key.	Press CTRL + D.	Click function block.
Displays a menu in the foreground	Press the associated button.	Press CTRL + F1 to F8.	Click the respective button in the Winbar.
Closes an active menu	Press the $\boxed{\text{CLOSE}}$ key.	Press CTRL + G.	Click the ☒ button in the menu bar.
Hides all menus	Click the $\boxed{\text{DIAGRAM}}$ key.	Press CTRL + D.	-
Automatically arranges displayed menus	Click the $\boxed{\text{REARR}}$ key.	Press CTRL + A.	- The menus can be shifted with the mouse as required. The frequency and level fields and the info line cannot be covered, however.

Editors

The R&S SMF provides user-friendly editors for defining lists. Lists containing frequency and level value pairs are used for the user-defined level correction.
The lists are saved to files and may thus have any length. The file name of the lists and the directory to which the files are saved are user-selectable. The file prefix is different for each list type and is permanently assigned by the system (see section "*File Management*", page 3.23).

List Editor

The **User Correction** menu provides the list editor for defining the frequency/level value pairs.

User Cor. Data...

- The selected list is displayed. If no list has been selected, a blank list of only one row is displayed.

	Edit User Correction Data User_List_2	
	Frequency / Hz	Power / dB
1	1 000 000 000.00	12.00
2	1 000 000 000.00	18.00
3		

Goto | Insert/Fill Row(s) | Save As. | Save
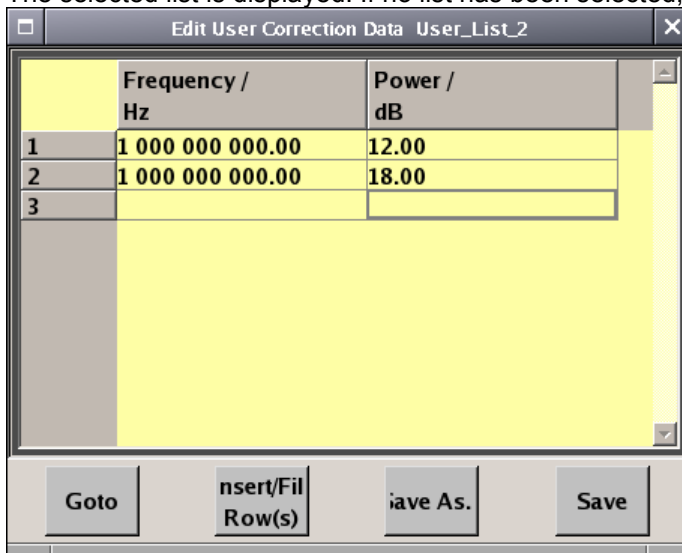
- The value pairs are entered in the **Frequency/Hz** and **Power/dBm** table columns. A blank row is inserted at the end of the list.

- New rows can be inserted anywhere in the table by means of the **Insert Row(s)...** button.

- After the list has been edited, i.e. changed, it can be saved under its current name by means of the **Save** button, or under a new name by means of the **Save as...** button. Only complete value pairs are taken into consideration; rows containing an entry in only one column are ignored.

- An existing list can be edited in the insert or overwrite mode.

- A new list can be created under a new name either by generating a blank file in the **File Select** menu (see section "*File Management*", page 3.23) or by changing an existing list which will then be saved under a new name.

Function	Front panel	PC keyboard	Mouse
Call up editor The cursor marks the first row of the Frequency/Hz column.	Use the rotary knob or the cursor keys to mark the **Edit xxx Data...** button in the individual menu, click the rotary knob or press the ENTER key.	Mark the **Edit xxx Data...** button in the individual menu and press the Enter key.	Click the **Edit xxx Data...** button in the individual menu.
Enter value	Use the numeric keys to enter the value and terminate the entry by pressing the Unit key.	Use the numeric keys to enter the value and terminate the entry by pressing the Enter key.	-
Change column	Press the left/right cursor keys.	Press the left/right cursor keys.	Click cell.
Change row	Use the rotary knob or the up/down cursor keys to mark the row.	Use the up/down cursor keys to mark the row.	Click cell.
Select row The cursor moves to the selected row.	Use the rotary knob or the cursor keys to mark the **GoTo** button, click the rotary knob or press the ENTER key. Enter the row index in the entry field by means of the numeric keys, click the rotary knob or press the ENTER key.	Mark the **GoTo** button and press the Enter key. Use the numeric keys to enter the row index and terminate the entry by pressing the Enter key.	Click cell.
Insert row A row is inserted above the currently marked row. If no row has been selected, a row is inserted at the beginning of the list.	Select the row above which the new row is to be inserted. Use the rotary knob or the cursor keys to mark the **Insert Row(s)** button, click the rotary knob or press the ENTER key.	Select the row above which the new row is to be inserted. Mark the **Insert Row(s)** button and press the Enter key.	Click the row above which the new row is to be inserted. Click the **Insert Row(s)** button.
Save list under a new name	Use the rotary knob or the cursor keys to mark the **Save as..** button, click the rotary knob or press the ENTER key. Enter the file name in the **File Select** menu and select the directory.	Mark the **Save as..** button and press the Enter key. Enter the file name in the **File Select** menu and select the directory.	Double-click the **Save as...** button. Enter the file name in the **File Select** menu and select the directory.
Save list under the same name	Use the rotary knob or the cursor keys to mark the **Save** button, click the rotary knob or press the ENTER key.	Mark the **Save** button and press the Enter key.	Double-click the **Save** button.
Create new list	Mark the **User Correction Data** button, click the rotary knob or press the ENTER key. Mark **Create New List**, click the rotary knob or press the ENTER key. Enter the file name in the **File Select** menu and select the directory.	Mark the **User Correction Data** button and press the ENTER key. Mark **Create New List** and press the Enter key. Enter the file name in the **File Select** menu and select the directory.	Double-click the **User Correction Data** button. Double-click **Create New List**. Enter the file name in the **File Select** menu and select the directory.

Help system

The R&S SMF is equipped with a context-sensitive help function. A help page is available for each parameter and can be called any time during instrument operation. The context-sensitive page which is opened with the HELP key is part of a comprehensive help system. It is possible to move from this context-sensitive page to any page of the help system.

Note:

Compiled online help systems are also available for all functions of the R&S SMF on the CD-ROM supplied with the instrument. This help program can be called on any controller with Internet Explorer version V 4.0 and higher.
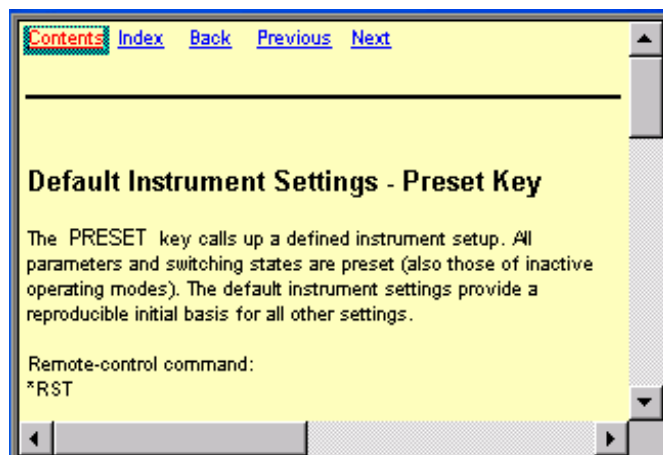
The help function is provided with a navigation bar, i.e. other help pages can be called from the context-sensitive page via the table of contents, the index, arrows for scrolling, and page-internal links.

Operation of context-sensitive help

Function	Front panel	PC keyboard	Mouse
Open the help system The help page for the respective parameter is displayed.	Press HELP key.	Press F1 key.	-
Close the help system	Press HELP key again.	Press F1 key again.	-
Activate the link The help system branches to the linked page.	Select link with rotary knob or arrow keys and activate by clicking the rotary knob or ENTER key.	Select link using the arrow keys and activate with the Enter key.	Click link.
Page Up/down	Select **Previous**, **Next** or **Back** in the help window using the arrow keys and activate by clicking the rotary knob or the ENTER key.	Select **Previous**, **Next** or **Back** in the help window using the arrow keys and activate with the Enter key.	Click **Previous**, **Next** or **Back.**
Scroll	Move indicated help window area using the rotary knob and the arrow keys	Move indicated help window area using the arrow keys.	Click the scroll bar and move to the desired position.
Select an item in the table of contents	Select **Content** in the help window using the arrow keys	Select **Content** in the help window using the arrow keys	Click **Content**

The help page of the item is displayed.	and activate by clicking the rotary knob or the ENTER key. Select the desired item using the rotary knob or the arrow keys up/down and activate by clicking the rotary knob or the ENTER key.	left/right and activate with the Enter key. Select the desired item using the arrow keys and activate with Enter.	Click item.
Select an index term The help page of the term is displayed.	Select **Index** in the help window using the arrow keys and activate by clicking the rotary knob or the ENTER key. Select the desired item using the rotary knob or the arrow keys up/down and activate by clicking the rotary knob or the ENTER key.	Select **Index** in the help window using the arrow keys left/right and activate with the Enter key. Select the desired item using the arrow keys and activate with Enter.	Click **Index** Click item.

File Management

The R&S SMF uses files to save all instrument data, i.e. system and user data. The user data includes saved instrument settings and lists for the user correction.
The files are stored on the flash card of the instrument. The /var directory can be used to save user-defined data; any subdirectory structure can be created on /var. Some default subdirectories are predefined, but can be changed at any time.
The /opt directory is a protected and therefore unaccessible system directory. The files on this directory contain data that must not be changed. Therefore, this directory should not be accessed, since reconstruction of the system partition will lead to data loss. To prevent inadvertent deletion or overwriting of system files, this directory is not specified in the file menus.

Files can be exchanged via a memory stick. The memory stick has to be connected to the USB interface and accessed via the **File** menu.

The files are accessed in a **File Select** window in the individual menus. Depending on the data type, a file can either be selected or it can be selected and saved:

- Instrument settings can be saved and loaded. In case of saving, the current setting is saved to the specified file.
- Lists, e.g. user correction lists, can be loaded. They can be generated either externally or internally. For internal generation, a new list must be created in the **File Select** window which will then be edited in the list editor of the individual menu.

User Cor. Data...

The files are differentiated according to their extensions; each type of file is assigned a specific file content. The extension is usually of no consequence to the user since access to the files occurs in the individual menus where only the relevant type of file is available.

A button in the individual menu calls up the selection of the **Select/New** and **File Manager** functions.

Select User Correction Data
New User Correction Data
File Manager...
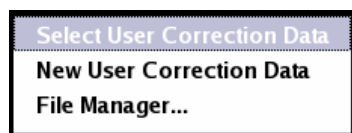
After the **Select/New** selection, a **File Select** window for loading, saving, or creating a file is displayed (see the following section "*File Select Menu*", page 3.24).

After the **File Manager** selection, a menu for managing all files is displayed (see section "*File Manager*", page 3.25).

The complete instrument settings are saved and loaded in the **File** menu which is called up by means of the ⎡File⎤ key (see chapter 4, section "*Storing and Loading Instrument Data – File Key*").

File Select Menu

The **File Select** menu consists of several areas.
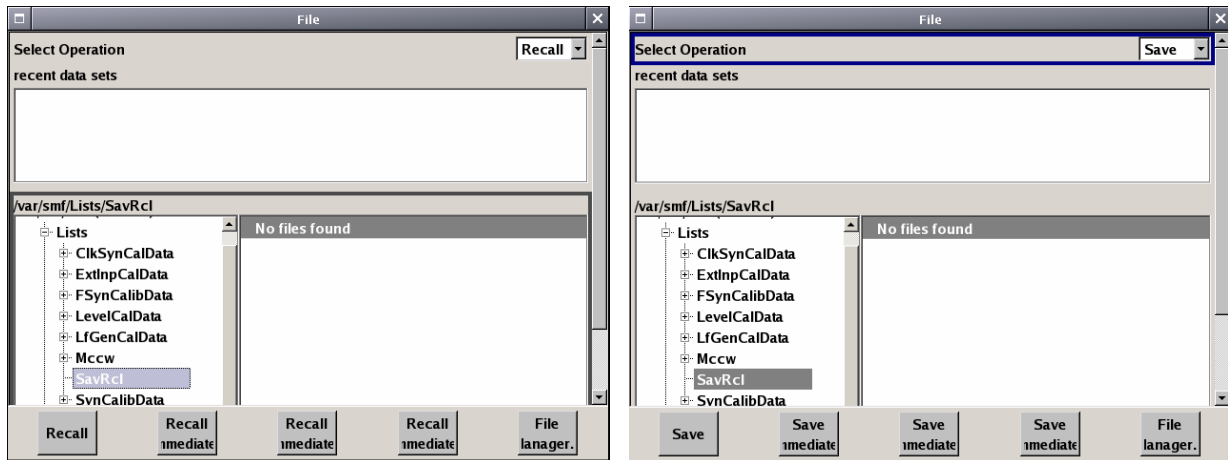
In the upper area, **Recent Data Sets**, the files last used are listed; a maximum of ten files is displayed.

The available drives and directories are displayed on the left side, the files of the selected directory on the right side. The currently selected path is displayed above the windows. Only the relevant files without file extensions are displayed. If the area is opened several times, the path last selected is displayed.

When a file is saved or created, its name is user-selectable; the extension is assigned automatically and cannot be entered. The file is saved to the selected path.

Operation is similar to the operation of menus with several areas (see section "*Selecting and Exiting a Menu Area - Setting Parameters*", page *3.13*): By using the rotary knob or cursor keys, the area is marked; the entry focus is shifted to this area by clicking the rotary knob or using the Enter key. The rotary knob and the up/down cursor keys will then navigate only within this area. By using the left/right cursor keys, it is possible to switch between the directory tree and the file list. The subdirectories of the selected directory will only be displayed after a short delay to allow quick navigation in the directory tree. Pressing the ESC key again shifts the entry focus up one level. The button for saving or loading the file can be selected and pressed. After the setting, e.g. after selecting the file, the menu will be closed automatically.

- **Load file:**
  Mark file and load it by clicking the rotary knob or by pressing the Select button/softkey.

- **Save file:**
  Enter file name in the **File Name:** field. Mark the directory to which the file is to be saved and then click the Save button/softkey.

- **Create file:**
  Enter file name in the **File Name:** field. Mark the directory to which the file is to be saved and then click the Create button/softkey. The created file is empty; it must be filled with the necessary values in the individual editor.

File Manager

The **File Manager** allows general file management such as copying, shifting, renaming, and deleting files as well as generating new directories.

The **File Manager** can be called up in any menu to which files can be saved. Call-up is either at the level of the small selection menu

or via the File Manager button in the **File Select** window.
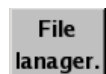
The **File Manager** can also be called up in the **Save/Recall - Setup-Settings** menu.

In the upper area, **File Type**, the **File Manager** allows the type file selection to be displayed. This can be used to process either all files (all files (*:*) selection) or a specific selection of files (e.g. user correction (*.ucor) selection). The table at the end of this section contains a list of the file types.

The available drives and directories are displayed on the left side, the files of the selected directory on the right side. The currently selected path is displayed above the windows. If the area is opened several times, the path last selected is displayed. Unlike the **File Select** window, the **File Manager** displays the full file names including extensions.

The buttons trigger the associated actions such as copying, shifting, or deleting the marked files. Plus, a new directory can be created in the level below the marked directory.

Operation is similar to the operation of menus with several areas (see section "*Selecting and Exiting a Menu Area - Setting Parameters*", page 3.13). By using the rotary knob or cursor keys, the area is marked; the entry focus is shifted to this area by clicking the rotary knob or using the Enter key. The rotary knob and up/down cursor keys will then navigate only within this area. By using the left/right cursor keys, it is possible to switch between the directory tree and the file list. The subdirectories of the selected directory will only be displayed after a short delay to allow quick navigation in the directory tree. Pressing the ESC key again shifts the entry focus up one level. The buttons/softkeys can be selected and activated.

- **Shift file:**
  Mark file and then press the Cut button/softkey. Mark the directory to which the file is to be shifted and then click the Paste button/softkey. If the target directory already contains a file with the same name, a confirmation query is displayed to confirm overwriting of this file.

- **Copy file:**
  Mark file and then press the Copy button/softkey. Mark the directory to which the file is to be copied and then click the Paste button/softkey. If the target directory already contains a file with the same name, a confirmation query is displayed to confirm overwriting of this file.

- **Rename file:**
  Mark file and then press the Rename button/softkey. An entry window for entering the new file name opens. Enter the name and press the Enter key. If a file with the same name already exists, a confirmation query is displayed to confirm overwriting of this file.

- **Delete file:**
  Mark file and then press the Delete button/softkey. Prior to deletion, a confirmation query is displayed which the user must confirm for this file to be deleted.

- **Create new directory:**
  Mark drive or directory level where the new directory is to be created and then press the `Create New Directory` button/softkey. An entry window for entering the directory name opens. Enter the name and press the Enter key.

Table 3-1   List of file extensions for user files the R&S SMF assigns automatically

List type	Contents	File suffix
Instrument State	Instrument settings	*.savrcl
User Correction	User-defined level correction values	*.uco

Remote Access

The R&S SMF can be remote-accessed from an external PC. This allows convenient operation of the Signal Generator from the desktop although the instrument is integrated in a rack somewhere else.

Remote access in contrast to **remote control** does not use remote-control commands but the regular user interface displayed using separate software which is installed on the external PC. The instrument can thus be manually operated from the PC as on the unit itself.

Preconditions for remote access are a connection between signal generator and PC via a LAN network and the installation of the VNC client software on the PC and on the R&S SMF.
Establishing the connection and installation of the remote-control software on the external PC is described in Chapter 1, section "*Connecting the R&S SMF to a Network (LAN)*".

After the connection is established, the current signal generator screen with the block diagram is displayed and the R&S SMF can be remote-accessed from the external PC. The individual functions are operated using the mouse and keyboard. Specific instrument functions can be executed using specific key combinations on the keyboard. Front-panel keys which are not directly available on the keyboard can be substituted by key combinations or by the front panel key emulation panel (see next section).

When the connection is set up, direct control on the R&S SMF is possible while manual remote-control is established, it can be performed alternately with the remote access.

For return to direct operation on the R&S SMF, the connection must be closed. After closing the connection, it is still enabled and can be established again any time (see Chapter 1, section "*Remote Access via an External Controller*")

Legend of Front-Panel Controls

The following table lists all key functions available on the front panel. Key combinations used on the PC keyboard to trigger key functions on the instrument front panel are also described. Keyboard labels are described in alphabetical order.
In addition, a front panel key emulation and an on-screen keyboard can be used for manual operation by mouse only (see below).

Front-panel key	Key of PC keyboard	Function
	Tab key (towards the right) Shift + Tab (towards the left)	Sets the cursor with the rotary knob.
	Enter	Pressing the rotary knob confirms an entry; it has the same function as the ENTER key.
↑↓→←	Arrow keys	Moves the cursor.
*1 / dB(m)	ALT + F12	Confirms entries in the base unit and values without a unit. Selects dBm for the RF level and dB for level offset and level step width.
. / *...#	. / *...#	Enters a period/decimal point. Enters a special character.
+/- / A↔a	- / (shift+) a—z	Enters the sign. Switches between upper-case and lower-case letters.
0-9 / a...z	CTRL+ 0-9 / a...z CTRL	Enters the number/letter.
BACKSPACE	Backspace	Clears the last entry (number, sign or decimal point).
CLOSE	CTRL + G	Closes an active menu.
DIAGRAM	CTRL+ D	Sets the cursor on the block diagram and hides all menus.
ENTER	Enter	Terminates an entry.
ESC	ESC	Selects the next higher menu/selection level. When the editing mode is exited with ESC, the previous value is restored.
FILE	CTRL + S (storage under Windows)	Activates the menu for storing instrument settings.
FREQ	CTRL+ F	Activates the frequency entry.
G/n / dBμV	ALT + F9	Selects the unit Giga/Nano, dBμV for the RF level and dBu for the LF level.
HELP	F1	Opens/closes context-sensitive help.
HIDE	CTRL+ H	Minimizes the active menu. Pressing the respective button in the Winbar opens the menu again.
INFO	CTRL + I	Opens/closes the info window.
k/m / μV	ALT + F11	Selects the units Kilo/Milli and μV for RF levels.
LEVEL	CTRL + L	Activates the level entry.
LOCAL	CTRL + Q	Switches the instrument from remote control to manual control.
M/μ / μV	ALT + F10	Selects the units Mega/Micro and μV for RF levels.
MENU	CTRL + M	Calls the menu selection list.
MOD ON/OFF	CTRL + O	Switches modulation on/off. MOD OFF is indicated in the status line.

Front-panel key	Key of PC keyboard	Function
ON/OFF TOGGLE	CTRL + T	Switches a block or parameter on/off. Toggles between the different possibilities of setting a selection parameter.
PRESET	CTRL + P	Restores a defined basic instrument setup.
REARR	CTRL + A	Arranges open menus automatically.
RF ON/OFF	CTRL + R	Switches the RF output signal on/off. RF OFF is indicated in the status line.
SETUP	CTRL + E	Opens the setup menu for general instrument settings.
Softkey 1 – 8	CTRL + F1 – F8	Triggers the function assigned to the softkey.
WINBAR	CTRL + W	Displays the Winbar in the foreground/background.

Front Panel Key Emulation

The R&S SMF provides a front panel key emulation to enable execution of the front panel key functions by mouse e.g. for remote access. The emulation is called by a right mouse click. The front panel key functions are executed by a mouse click on the associated button.

Contents - Chapter 4 "Instrument Functions"

4 Instrument Functions

Introduction - Instrument Functions

This chapter explains the functions of the signal generator and the options available in the setting menus. The associated IEC/IEEE-bus command is specified for each parameter (where applicable).

The description begins with the general instrument settings which do not directly affect signal generation. The majority of these settings can be accessed by means of front-panel key menus and not by means of function block menus.

The signal generation functions are then described, beginning with the functions which affect the RF signal (**RF Frequency** block), the level control (**Level Control** block), and the analog and digital modulations (**Modulation** block).

The next section describes the LF signal generation (**LF Gen./Noise** block) and the LF output (**LF Output** block).

This is followed by an description about the configuration of the internal pulse generator (**Pulse Gen.** block) and the modulation of the internal or external pulse signal (**Pulse Mod.** block).

The remaining part of this chapter describes the attenuator settings (**Attenuator** block).

The general instrument settings include various functions, such as:

- Setting a defined basic setup using the PRESET key
  (section "*Default Instrument Settings - Preset Key*", page *4.3*)

- Switching from remote control to manual control using the LOCAL key
  (section "*Switching to Manual Control - Local Key*", page *4.22*)

- Configuring the generator and its interfaces in the **Setup** menu - e.g. setting the IEC/IEEE-bus address, starting an adjustment, querying instrument data
  (section "*General Configuration of Instrument - Setup Key*", page 4.4)

- Calling up the online help using the HELP key
  (section "*Help System - Help Key*", page *4.22*)

- Querying messages using the INFO key
  (section "*Messages - Info Key*", page *4.22*)

- Loading and storing complete instrument settings in the **File** menu
  (section "*Storing and Loading Instrument Data - File Key*", page *4.23*)

The RF signal and the reference oscillator are configured in the **RF Frequency** function block:

- CW mode
  (section "*Overview of RF Signal*", page 4.30)

- Frequency and Level Sweep mode
  (section "*Sweep Mode*", page 4.34)

- Reference Oscillator
  (section "*RF Frequency Reference Oscillator*", page 4.39)

The RF level control is configured in the Level Control block:

- RF Level
  (section "*RF Level*", page 4.42)

- RF Level Sweep
  (section "*RF Level Sweep*", page 4.46)

- ALC
  (section "*Automatic Level Control - ALC*", page 4.50)

- User Correction
  (section "*User Correction*", page 4.51)

The analog and external digital modulations are activated in the **Modulation** function block:

- Amplitude Modulation
  (section "*Amplitude Modulation - AM*", page 4.59)

- Frequency Modulation
  (section "*Frequency Modulation - FM*", page 4.61)

- Phase Modulation
  (section "*Phase Modulation*", page 4.61)

- Digital Modulation
  (section "*Digital Modulation*", page 4.67)

- Pulse Modulation
  (section "*Pulse Modulation*", page 4.70)

The internal LF generators, the LF frequency sweep, and the noise generator are configured in the **LF Gen./Noise** function block:

- Lf Gen./Noise
  (section "*LF Gen./Noise*", page 4.70)

- LF Frequency Sweep
  (section "*LF Frequency Sweep Menu*", page *4.78*)

The LF output is configured in the **LF Output** block, section "*LF Output*", page 4.82.

The pulse generation is configured in the **Pulse Gen.** block, section "*Pulse Generator* ", page 4.70.

The attenuator is configured in the **Attenuator** block, section "*Attenuator*", page 4.90.

General Instrument Settings

Overview of General Instrument Settings

The section "General Instrument Settings" describes the settings which do not directly affect signal generation.

Most of these settings can only be accessed by means of menus which are opened using the front panel key.

The general instrument settings affect various functions, such as storing instrument settings using the FILE key or setting the IEC/IEEE-bus address in the menu of the SETUP key.

Default Instrument Settings - Preset Key

The PRESET key calls up a defined instrument setup. All parameters and switching states are preset (also those of inactive operating modes). The default instrument settings provide a reproducible initial basis for all other settings.

Remote-control command：
`*RST`

When the instrument is switched on, it is not the preset state that is active, but rather the instrument state that was set before the instrument was switched off.

User-defined instrument states can be stored and called up in the **File** menu.

The following table gives an overview of the presets for the most important generator settings. The other presets can be found in the information accompanying the IEC/IEEE-bus commands (Chapter "*Remote Control Commands - Description*").

Setting	Preset value
RF frequency	1 GHz
RF level	RF output switched off
Reference frequency	internal, adjustment off
Frequency Offsets	0
Level Offset	0
Modulations	switched off
Uninterrupted level setting	switched off; level attenuator mode: AUTO
Internal level control	Level ALC: OFF
User correction	Level Ucor: OFF
LF output	switched off
Sweep	switched off
IEC/IEEE-bus address	not changed

Table 4 -1 Preset state - important generator settings

General Configuration of Instrument - Setup Key

The $\boxed{\text{SETUP}}$ key opens the **Setup** menu. The Setup menu is divided into several sections:

- The **System** section is used to set general instrument parameters.

- The **Test** section is used to perform function tests.

- The **Environment** section is used to configure the controller interfaces.

- The **Remote** section is used to configure the remote control interfaces.

- The **Protection** is used to set the protection level for service functions.

- The **Settings** section contains the **Save/Recall** menu.

Most submenus of this key can be accessed only via the $\boxed{\text{SETUP}}$ key or the menu tree ($\boxed{\text{MENU}}$ key), with the following exceptions:

- The **Reference Oscillator** submenu can also be called up in the **RF Frequency** block and is therefore described in the section on this block (see section "*RF Frequency Reference Oscillator*", page 4.39).

- The **Save/Recall** submenu can also be called up with the $\boxed{\text{FILE}}$ key and is therefore described in the section on this key (see section "*Storing and Loading Instrument Data - File Key*", page *4.23*).
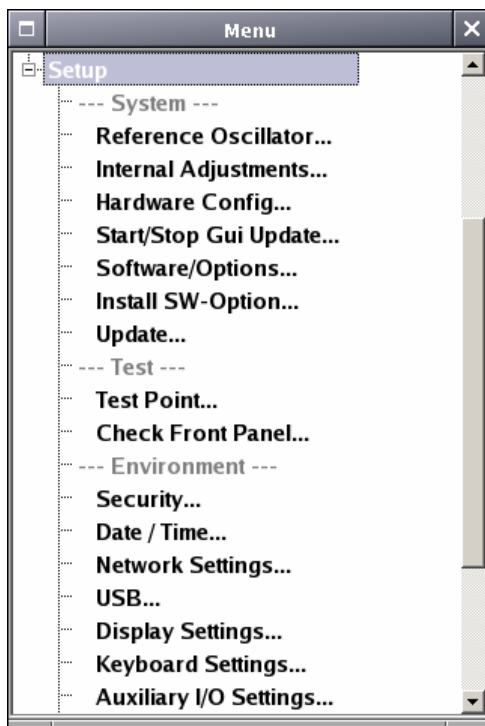
Internal Adjustments - Setup-System

The R&S SMF Signal Generator is extremely accurate thanks to the integrated procedures for adjustments.

All internal adjustments for which no external measuring equipment is needed can be started in the **Internal Adjustments...** menu. The adjustments with external measuring equipment are described in the Service Manual (on CD ROM, supplied with the instrument).

Adjustment is recommended if the temperature range in which the instrument is operated changes, or prior to all applications which require maximum level and frequency accuracy.

During adjustment, a bar indicates the status of progress. If an error occurs, adjustment is terminated and an error message is output in the info line.

Caution:
> *Make sure that the instrument is warm before performing adjustments. The warm-up time is 30 minutes.*

The **Internal Adjustments** menu is opened up using the SETUP or MENU key under **System**.
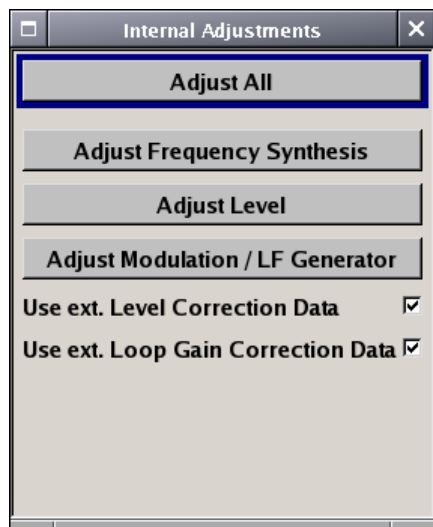
Adjust All

Starts all internal adjustments for which no external measuring equipment is needed. The adjustments with external measuring equipment are described in the Service Manual (supplied).

Remote-control command:
`CAL:ALL?`

Adjust Frequency Synthesis

Performs all adjustments which affect the frequency. This includes adjustment of option R&S SMF-B20, AM/FM/SCAN modulator, LF and Low Phase Noise.

Remote-control command:
`CAL:FREQ:MEAS?`

Adjust Level

Performs all adjustments which affect the level.

Remote-control command：
`CAL:LEV:MEAS?`

Adjust Modulation LF Generator

Performs all adjustments that affect the internal modulation generators.

Remote-control command：
`CAL:LFO:MEAS?`

Use ext. Level Correction Data

Switch on or off use of external level correction data (see service manual, chapter 2, "Adjustment"). This switch can be used in case of corrupt external level correction data.

Remote-control command：
`CAL:LEV:STAT ON`

Hardware Config... - Setup-System

In the **Hardware Config…** menu, the installed assemblies together with their variants and revision states can be displayed for servicing purposes. The **Hardware Config** menu is opened using the SETUP or MENU key under **System**.
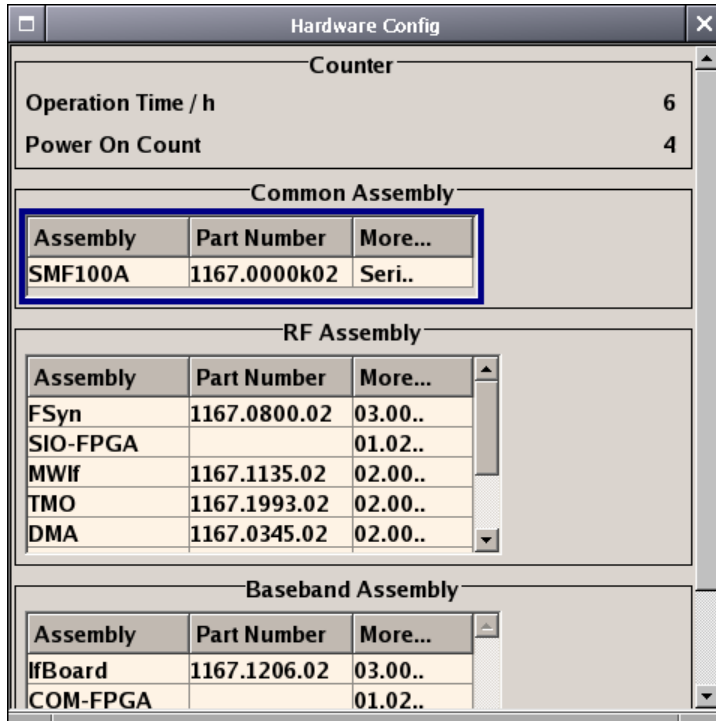
Section **Counter** in the upper part of the menu shows the **Operation Hours** and the number of power-on (**Power On Counter**).

Remote-control command：
```
DIAG:INFO:OTIM?
Response:   "100023"

DIAG:INFO:POC?
Response:   "123"
```

A table below lists the installed assemblies. It is divided into the sections **Common Assembly**, **RF Assembly**, and **Baseband Assembly**:

Assembly	Assembly name
Part Number	Part Number of assembly
More…	Opens a dialog with additional information on serial number, revision, slot of assembly, and used bus by assembly (serial bus or PCI bus).

Remote-control command：
```
DIAG:BGIN?  "MBRD"
Response: "MBRD 1234.5678.02 1.5.3 100023"
```

Gui Update... - Setup-System

In the **Start/Stop Gui Update...** menu, the update of the displayed parameters can be switched off in order to increase speed for certain settings.

The indicated values are not updated and may therefore differ from the internally used values.

Remote-control command:
```
SYST:DISP:UPD OFF
```

Software / Options... - Setup-System

The **Software / Options...** menu shows the firmware version of the instrument software.

Note:
Software options purchased at a later stage can be activated with a key code. The activation code is supplied with the software option. How to install options is described in Chapter 4 of the Service Manual (on CD ROM supplied with the instrument).

The installation of hardware options purchased at a later stage is also described in Chapter 4 of the Service Manual (supplied with the instrument). Most hardware options need to be installed at an authorized Rohde&Schwarz service shop.

The **Software / Options** menu is opened using the SETUP or MENU key under **System**.
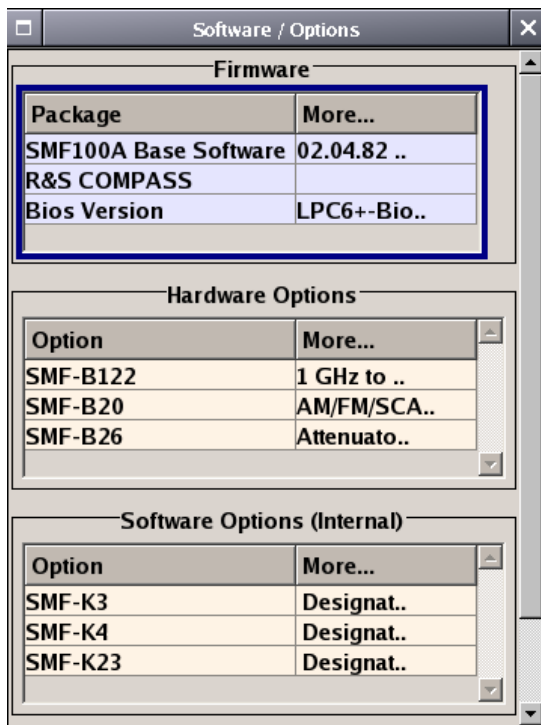
Remote-control commands:
```
*OPT?
```
Response:
```
"???"
```

```
*IDN?
```
Response:
```
"???"
```

The **Firmware** section of the menu shows the firmware version and the version of the package.

Package	Short name of package
More…	Opens a dialog with additional information

The **Hardware** section of the menu shows the implemented hardware options.

Option	Short name of the option
More…	Opens a dialog with additional information

The **Software Options (Internal)** section of the menu shows the installed software options.

Option	Short name of the option
More…	Opens a dialog with additional information

Section **Loaded Modules** is provided for service purposes. It lists all loaded software modules with their versions and offers a short description of each module.

Path	Path
Module	Short name of module
More Info	Opens a dialog with additional information on version, path, module name, and provides a short description of the module.

Install SW-Option... - Setup-System

Newly purchased software options are enabled in the **Install SW-Options...** menu. They are ready to operate after they are enabled by means of a key code supplied with the option.
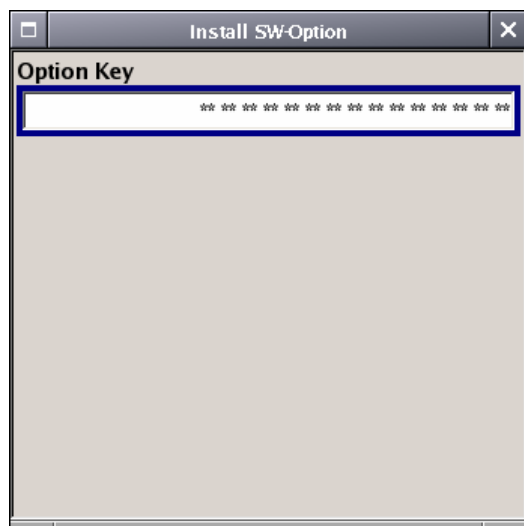
Only if the R&S SMF Signal Generator is equipped with an older firmware version, a firmware update prior to enabling the software option may be required. The information on the valid firmware versions for the purchased software option is provided together with the option. The firmware update is described in the service manual instrument, chapter 4 (on CD ROM, supplied with the instrument).

Update... - Setup System

After a firmware update it is occasionally required to also update the PCI-FPGA. This is enable in the **Update...** menu.

At the first start of the new firmware a message appears during the boot process if a PCI-FPGA update is required, also. A PCI-FPGA update is by pressing the PCI-FPGA button.

> ⚠️ ***Attention:***
>
> *To avoid impairment of instrument functions, the update of the PCI-FPGA must not be cancelled and the instrument must not be switched off during this update.*
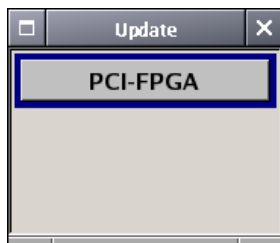
Test Point... - Setup-Test

The **Test Point...** menu provides access to the test points available in the instrument. When activated, the voltage of the selected test point is measured and displayed. A detailed description of the test points can be found in Chapter 3 of the Service Manual (supplied with the instrument).

The **Test Point...** menu is opened using the SETUP or MENU key under **System**.
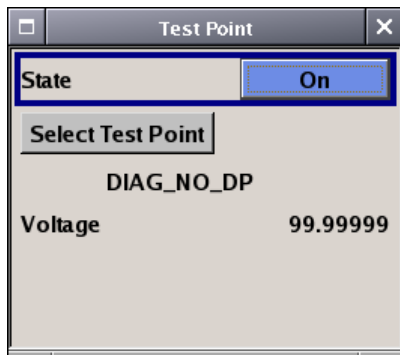
State Test Point

Activates the measurement of the voltage at the selected test point.

Remote-control command: n.a.

Select Test Point   Calls the submenu for selecting the test point. The currently selected
                                         key is shown next to the key.
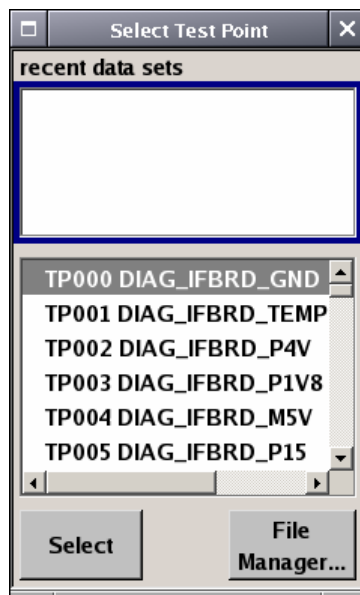
Remote-control commands:
```
DIAG:POIN:CAT? (Command lists all test points)
DIAG:POIN? 'DIAG_CWOP_P5V5R'
(With remote control, voltage measurement starts as
soon as the test point is selected).
```

Voltage Test Point   Displays the measured voltage measurement at the selected test
                                         point.

Remote-control command:
```
DIAG:MEAS:POIN? 'DIAG_CWOP_P5V5R'
Response:    2
```

Check Front Panel - Setup-Test

The **Check Front Panel** menu**..** is used to check whether the front panel keys are working correctly. The menu displays all the front panel keys arranged in the same way as on the front panel. The respective function is executed by pressing the associated key.
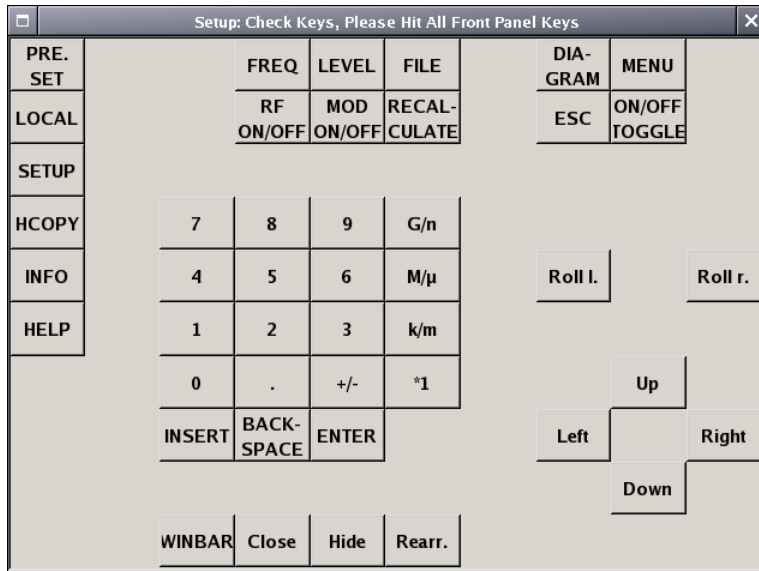
Security - Setup-Environment

The **Security...** menu provides access to the password and mass storage security settings. It is opened using the SETUP or MENU key under **Environment**.

User Name

Displays the user name used for access to the operating system Linux.

Remote-control commands: `n.a.`

USB Device

Enables/disables the USB interfaces. Any device connected to the USB interface is not recognized by the instrument when the interface is disabled.

The setting requires the entry of the security password and is only accepted after the **Accept** button is pressed.

Remote-control commands: `n.a.`

LAN Connection

Enables/disables the ethernet interfaces. Any device connected to the ethernet interface is not recognized by the instrument when the interface is disabled.

The setting requires the entry of the security password and is only accepted after the **Accept** button is pressed.

Remote-control commands: `n.a.`

Security Password

Enters the security password.

Remote-control commands: `n.a.`

Accept

Accepts a new entry or selection and changes the settings accordingly.

Remote-control commands: n.a.

Date and Time - Setup-Environment

The **Date/Time...** menu provides access to the system time and date settings. It is opened using the SETUP or MENU key under **Environment**. The time is used on the internal controller.
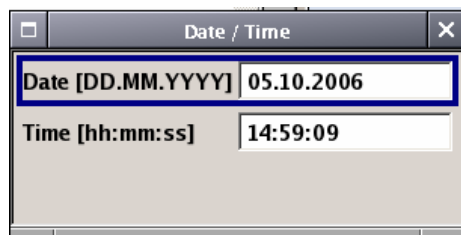
Date

Enters the date in the format day.month.year.

Remote-control command:
`SYST:DATE 2006,04,21`

Time

Enters the time in the format hour.minute.second.

Remote-control command:
`SYST:TIME 18,50,43`

Network Settings - Setup-Environment

The **Network Settings...** menu provides access to the network settings. It is opened using the `SETUP` or `MENU` key under **Environment**. The R&S SMF is equipped with a network interface and can be connected to an Ethernet LAN (local area network). How to connect the signal generator to the network is described in Chapter 1.

> ⚠️ *Caution:*
>
> *We recommend that connection of the instrument to the network be coordinated with the network administrator. Connection errors may affect the entire network.*

The menu is divided into the sections **Common Settings** where the general network environment is defined, **IP Address** where the specific identification of the computer in the network is defined, and **DNS Server Settings** where the DNS server is entered.

New entries are only accepted after the **Accept** button is pressed.

Accept - Network Settings
Accepts a new entry or selection and changes the settings accordingly.

Remote-control command:
```
SYST:COMM:NETW:DNS:SET
SYST:COMM:NETW:COMM:SET
SYST:COMM:NETW:IPAD:SET
```

The indications of the menu are only updated after pressing the **Get System Settings** button.

Get System Settings
Retrieves the current system settings of the instrument.

The indications in the network menu are only updated after pressing this button.

Remote-control command:
```
SYST:COMM:NETW:GET
```

Hostname

Enters the individual computer name of the R&S SMF.

The new entry is only accepted and the hostname changed after the **Accept** button is pressed.

A predefined name is indicated and can be used for network connections.

We recommend that connection of the instrument to the network be coordinated with the network administrator. Connection errors may affect the entire network.

Remote-control command:
`SYST:COMM:NETW:COMM:HOST RSSMF100A123456`

Workgroup

Enters the individual workgroup name of the R&S SMF.

Remote-control command:
`SYST:COMM:NETW:COMM:WORK "TEST_09"`

Domain

Enters the domain of the network.

Remote-control command:
`SYST:COMM:NETW:COMM:DOM ABC.DE`

MAC Address

Indicates the MAC address of the network adapter.

Remote-control command:
`SYST:COMM:NETW:MAC?`

Mode

Selects if the IP address is assigned automatically or manually or if a Peer to Peer connection is used.

The selection is only accepted after the **Accept** button is pressed.

We recommend that connection of the instrument to the network be coordinated with the network administrator. Connection errors may affect the entire network.

        Auto (DHCP)   The IP address is assigned automatically.

                              The network used must support automatic assignment of IP address (DHCP) in order to use this function.

                              Remote-control command:
                              `SYST:COMM:NETW:IPAD:MODE AUTO`

        Static   The IP address is assigned manually.

                              Remote-control command:
                              `SYST:COMM:NETW:IPAD:MODE STAT`

        Peer-to-Peer   A Peer to Peer connection is used.

                              Remote-control command:
                              `SYST:COMM:NETW:IPAD:MODE P2P`

IP Address

(only available for Static and Peer to Peer mode)

Enters the IP address manually.

The new entry is only accepted and the IP address changed after the **Accept** button is pressed.

In case of manual input of IP address we recommend that connection of the instrument to the network be coordinated with the network administrator. Connection errors may affect the entire network.

Remote-control command:
```
SYST:COMM:NETW:IPAD 7.8.9.10
```

Subnet Mask

(only available for Static and Peer to Peer mode)

Enters the Subnet mask.

This number is used together with the IP address to identify the network segment the instrument is in.

The new entry is only accepted and the subnet mask changed after the **Accept** button is pressed.

We recommend that connection of the instrument to the network be coordinated with the network administrator. Connection errors may affect the entire network.

Remote-control command:
```
SYST:COMM:NETW:IPAD:SUBN:MASK 255.255.255.0
```

Def. Gateway

(only available for Static and Peer to Peer mode)

Enters the IP address of the default gateway.

The new entry is only accepted and the default gateway changed after the **Accept** button is pressed.

This address identifies the router on the same network as the instrument that is used to forward traffic to destinations beyond the local network.

We recommend that connection of the instrument to the network be coordinated with the network administrator. Connection errors may affect the entire network.

Remote-control command:
```
SYST:COMM:NETW:IPAD:GAT  456
```

DNS Server Address Mode

Selects if the DNS server address is assigned automatically or manually.

The selection is only accepted after the **Accept** button is pressed.

In case of manual input of DNS server address we recommend that connection of the instrument to the network be coordinated with the network administrator. Connection errors may affect the entire network.

Auto (DHCP)   The DNS server address is assigned automatically.

The network used must support automatic assignment of address (DHCP) in order to use this function.

Remote-control command：
SYST:COMM:NETW:DNS:MODE AUTO

Static   The DNS server address is assigned manually.

Remote-control command:
SYST:COMM:NETW:DNS:MODE STAT

Preferred DNS Server

Enters the preferred DNS server address manually.

The new entry is only accepted and the preferred DNS server address changed after the **Accept** button is pressed.

It is recommended to ask the network administrator to provide the appropriate network settings.

Remote-control command：
SYST:COMM:NETW:DNS:PREF 7.8.9.10

Alternate DNS Server

Enters the alternate DNS server address manually.

This server is used if the DNS server specified in **Preferred DNS Server** is unreachable.

The new entry is only accepted and the alternate DNS server address changed after the **Accept** button is pressed.

It is recommended to ask the network administrator to provide the appropriate network settings.

Remote-control command：
SYST:COMM:NETW:DNS:ALT 7.8.9.10

USB Settings - Setup-Environment

The **USB Mass Storage Device** menu allows to activate or deactivate connected USB mass storage devices. It is opened using the SETUP or MENU key under **Environment**.

Mount USB Mass Storage Device

Activates a connected USB mass storage device (memory stick, external harddisk or CD-ROM). Only one device can be connected at a time.

Remote-control command: `n.a.`

Unmount USB Mass Storage Device

Deactivates a connected USB mass storage device (memory stick, external harddisk or CD-ROM). The interface is protected against unadverted input.

Remote-control command: `n.a.`

Display-Keyboard Settings - Setup-Environment

The **Display** and the **Keyboard Settings...** menu provides access to the settings for the display and an external keyboard. It is opened using the SETUP or MENU key under **Environment**. The keyboard is connected via an USB interface.

Screensaver

Activates/deactivates the screen saver of the instrument display. If activated, the display lamp is shut off when no entries via front panel, external mouse or external keyboard are made for a period of time (Wait Time). The screen saver prolongs the life time of the display lamp.This mode is recommended for preserving the display especially if the instrument is exclusively operated via remote control.

Remote-control command:
`DISP:PSAV:STAT ON`

Wait Time

Enters the idle time that must elapse before the display lamp is shut off when no entries are made.

Remote-control command:
`DISP:PSAV:HOLD 30`

Layout

Selects the keyboard layout for the selected keyboard language. The assignment of some keys depends on the selected layout and language.

Remote-control command:
`KBO:LAY DE`

Language

Selects the keyboard language. The assignment of some keys depends on the selected language.

Remote-control command：
KBO:LAN DE

Auxiliary I/O Settings - Setup-Environment

The **Auxiliary I/O Settings...** menu provides access to the auxiliary settings. It is opened using the SETUP or MENU key under **Environment**.
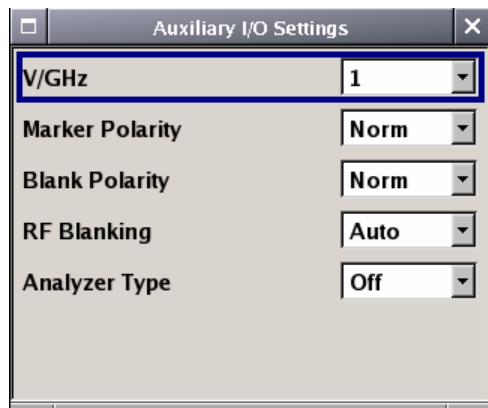
V/GHz

Selects the V/GHz ratio for the output.

Remote-control command:
OUTP:FPR:SCAL S0V5

Marker Polarity

Selects the marker output polarity.

> *Note:*
> *Markers are not supported in this release.*

Remote-control command:
SOUR:SWE:FREQ:MARK:OUTP:POL
SOUR:SWE:POW:MARK:OUTP:POL
SOUR:LFO:SWE:FREQ:MARK:OUTP:POL
SOUR:LFO:SWE:VOLT:MARK:OUTP:POL

Blank Polarity

Selects the polarity of the Blank Marker.

Remote-control command:
OUTP:BLAN:POL NORM

RF Blanking

Selection of the RF blanking method for sweeps with step widths less than 10 MHz.

Remote-control command:
`OUTP:BLAN:MODE ON`

Auto	RF blanking only when the step synthesizer switches to the next step (provides a clean RF spectrum).
On	RF blanking after each step.
Off	No RF blanking.

Analyzer Type

Selects the type of analyzer.

Note:
This feature is not available in this release.

Remote Channel Settings - Setup-Remote

The **Remote Channel Settings** menu provides access to the GPIB and Ethernet settings. The **Remote GPIB...** menu is opened using the `SETUP` or `MENU` key under **Remote**.
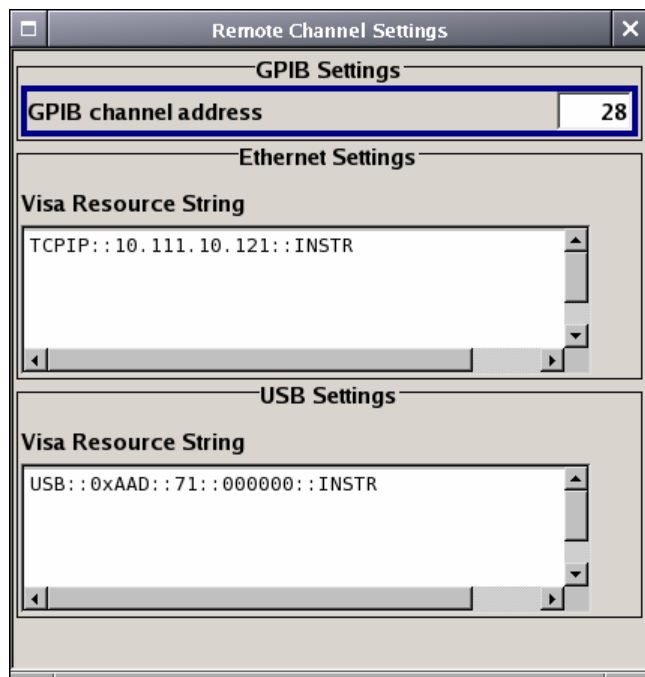
GPIB channel address

Sets the IEC/IEEE-bus address of the instrument.

Remote-control command：
`SYST:COMM:GPIB:SELF:ADDR 28`

Visa Resource String   Indicates the visa resource string. This string is used for remote control of the instrument. A separate string is provided for remote control via LAN and USB interface

Remote-control command:
```
SYST:COMM:NETW:RES?
Response:     TCPIP::192.1.2.3::INSTR
SYST:COMM:USB:RES?
Response:     USB::72::000000::INSTR
```

Protection - Setup-Protection

The **Protection** menu provides access to the unlocking of protected service functions (authorized personnel of R&S Service Departments only). To unlock the lock-out, the correct password has to be entered. After the instrument has been switched on, the lock-out 2 to 5 is automatically activated.

Protection Level 1 can be activated to lock-out internal adjustment. The password is 123456.
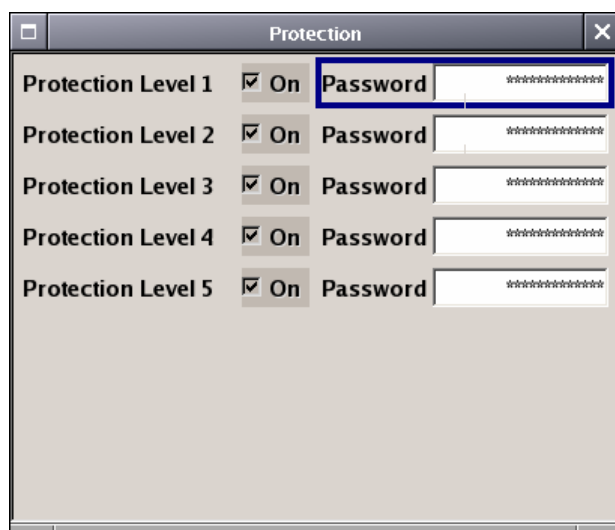
Remote-control command：
```
SYST:PROT1:STAT ON
SYST:PROT1:STAT OFF, 123456
```

Save Recall - Setup-Setting

The **Save/Recall** submenu can also be called up with the FILE key and is therefore described in the section on this key (see section "*Storing and Loading Instrument Data - File Key*", page *4.23*).

Help - Setup-Help

The **Help** submenu offers comprehensive online help for the R&S SMF Signal Generator. A desired topic can be selected via the table of contents (select **Manual**) or the index (select **Index**).

For context-sensitive information about a marked parameter, press the HELP key. For a description of the **Help** menu, refer to the section covering to the HELP key (see section "*Help System - Help Key*", on page 4.22).

Switching to Manual Control - Local Key

In remote control mode, a status message appears in the display header. The rest of the display remains unchanged and shows the current instrument status, i.e. the status which exists under the remote control settings. The instrument can be operated (e.g. menus can be opened). However, it is not possible to enter or change values.

The status message additionally indicates whether the LOCAL key is disabled or enabled (see also Chapter 5, section *"Switch-Over to Remote Control"*).

If the **REMOTE** status message is shown, the LOCAL key switches the instrument from remote control to manual control. The current command must be fully processed before the mode is switched, otherwise the instrument switches immediately back to remote control.

If the **REM-LLO** status message (remote local lockout) is displayed, the instrument can be switched from remote control to manual control by means of remote control only (e.g. with the Visual Basic command `CALL IBLOC (generator%)`); the LOCAL key is disabled. The key is disabled by remote control with the interface message LLO.

When switching from remote to manual control, the display update suppression function, if active (SETUP - **GUI Update is Off**), is automatically deactivated (SETUP - **GUI Update is On**).

Messages - Info Key

The INFO key opens a window containing a detailed description of every message displayed in the info bar, see chapter 3, section *"Info and Status Bar"* and chapter 9, section *"Error Messages"*.

Help System - Help Key

The HELP key opens a browser window containing a context-sensitive description of the highlighted parameter.
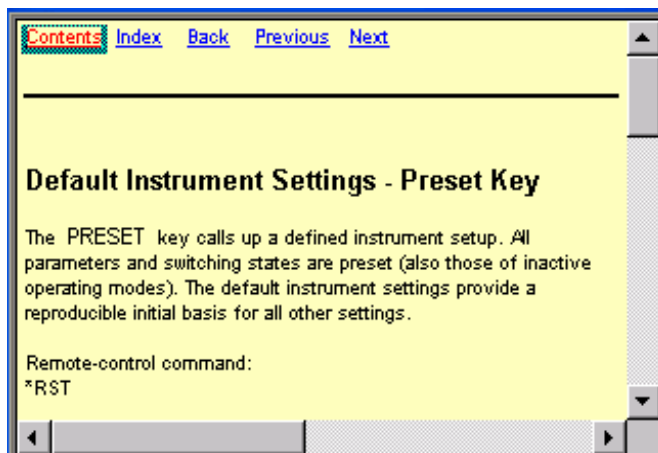
The context-sensitive page which is opened with the HELP key is part of a comprehensive help system. It is possible to move from this context-sensitive page to any page of the help system. The following navigation aids are available:

-   **Contents link**
    The Contents link calls up the contents list. The contents list is used to open the individual help pages. It has a hierarchical structure. The highlighted line indicates where the currently displayed page is within the contents list.

-   **Index link**
    The Index link calls up the index. The index contains an alphabetical list of all terms which refer to functions of the instrument. For example, it contains all parameter names and all IEC/IEEE-bus commands. The associated help page can be opened by selecting an entry.

-   **Back link**
    The Back link calls up the page last viewed.

-   **Internal links in the text**
    They open pages which are directly linked to the described function. In this way it is possible, for example, to call up the description of the IEC/IEEE-bus command for any particular function.

-   **Previous/Next links**
    The Previous/Next links allow scroll through the help pages. The sequence of the described functions corresponds to their position in the menus. The links are highlighted in blue, and can be selected and called up using the rotary knob.

Storing and Loading Instrument Data - File Key

The Signal Generator allows complete instrument settings to be stored in files on the compact flash card. Defined and complex instrument settings can then be reproduced at any time by loading this data. If required, these settings can be loaded to various signal generators.

The FILE key open the menu used to store and load instrument settings in a file. The data can be stored on the compact flash card in a data directory. Additionally there are three intermediate memories in which the current instrument setting can be stored and then called up again by just pressing a key. This makes it possible to switch quickly between defined instrument settings.

All settings which differ from the preset plus the configuration data for the operating elements (e.g. window positions) are stored. When loaded, these referenced settings are implemented and all non-referenced parameters are set to the associated preset value. As a result, the files remain relatively small since they only contain the relevant information. Furthermore, this also allows instrument settings to be transferred easily between different signal generators since once again only the settings which differ from the preset values have to be adjusted.

If a list, e.g. a list of user correction data is used, a reference to this list also stored. The list is also loaded when the associated instrument setting is loaded. If the list has been deleted in the meantime (or it is not available on a different instrument), an error message appears if an attempt is made to access this list after the instrument setting has been loaded. The associated setting is only started after the user has selected an existing list. If the list has been overwritten in the meantime, the new entries will be used.

Note:
 *Lists are stored and loaded in the appropriate menus. For example, the user correction data list is created and stored in the **User Correction** menu.*

When loading an instrument setting, it is possible to select whether the current frequency and level setting is to be retained or whether the stored settings are to be activated. It is possible to delete stored instrument settings.

A file can be copied by loading it with "Recall" and then storing it under a new name.

Settings can be transferred easily between instruments with different equipment options and/or firmware versions because only the settings which differ from the preset values are affected. When settings are loaded, only those which are possible on the instrument are implemented. Error messages indicate the settings which cannot be implemented. The stored file is transferred from one instrument to another using the memory stick.

General file management functions such as copying and moving data are available in the **File Manager** submenu.

File Menu

The settings available in the File menu depend on the operation selected under **Select Operation**.
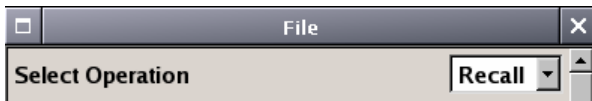
Select Operation   Selects the file function.

	Save...	Calls the menu for storing the current instrument setting.
	Recall...	Calls the menu for calling up a stored instrument setting.

Storing Instrument Settings - File

If **Save** is selected under **Select Operation**, the File menu provides options for storing the current instrument setting in a file.
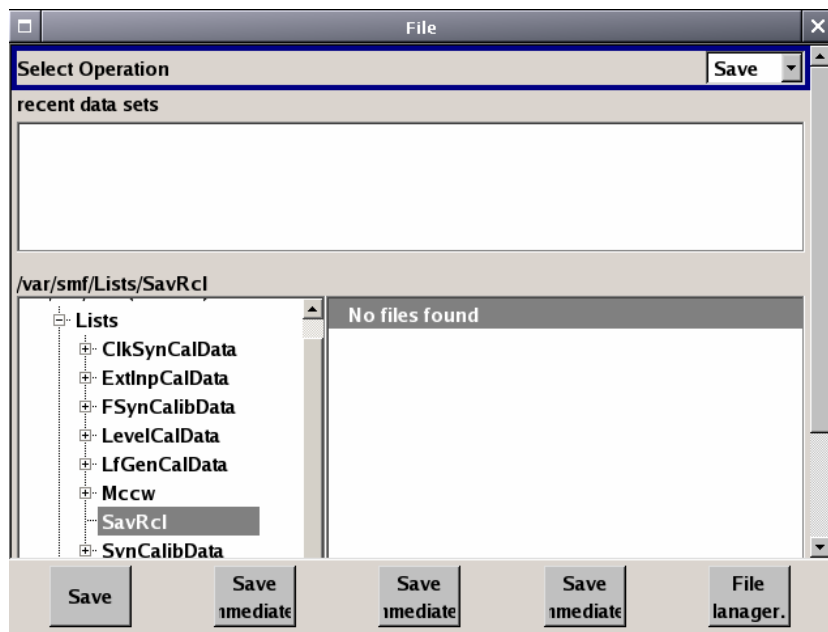
Recent data sets - File

Displays the files last used. The entire path is shown in plain text.

Remote-control command: n.a.

Directory - File

Selects the directory in which the file is to be stored. The window opposite lists all settings files in this directory.

A new directory can be created in the File Manager (**File Manager…** button).

Remote-control command:
MMEM:CDIR "/var/user"
(The path can also be entered when the file is stored.)

File List - File

Displays the files which are in the selected directory.

If a file is highlighted, it is overwritten when the file is stored.

Remote-control command:
MMEM:CAT?

File Name - File

Enter the file name of the file without file extension. This file is then created.

Remote-control command: n.a.
(The file name is entered when the file is stored.)

Save - File

Stores the current instrument settings under the specified path.

Remote-control command:
```
*RCL 1
```

Save Immediate x

Stores the current instrument setting in one of the three intermediate memories.

These instrument settings are retained until a different instrument setting is stored in the intermediate memory. When the instrument is switched off, the contents of the intermediate memories are retained.

Remote-control command:
```
*SAV 1
```

File Manager

Calls the **File Manager** menu.

Directories can be created and files managed in this menu (see the section "*File Manager - File*", page *4.28*).

Remote-control command: n.a.

Loading Instrument Settings - File

If **Recall** is selected under **Select Operation**, the **File** menu provides options for loading complete instrument settings. Here it is possible to select whether the current or stored RF frequency and RF level settings are to be used.
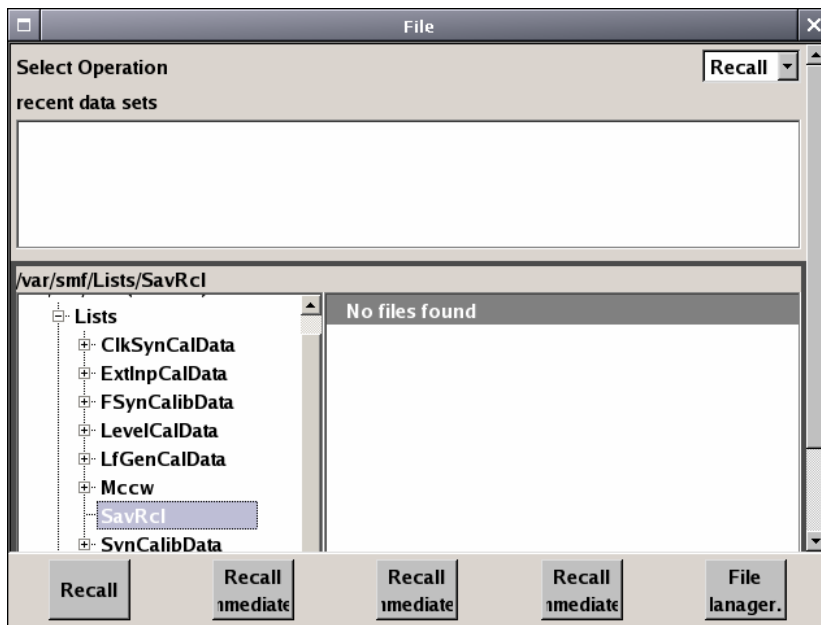
Recent data sets - File

Displays the files last used. The entire path is shown.

If the desired file is in the list, it can be selected in this window.

Remote-control command: n.a.

Directory - File

Selects the directory in which the file with the instrument setting to be loaded is located.

The **Selected file** window lists all the files in this directory.

Remote-control command:
`MMEM:CDIR "/var/user"`

File List - File

Selects the file with the desired instrument configuration.

Remote-control command:
`MMEM:CAT?`

Exclude Frequency - File

The current frequency is retained when a stored instrument setting is loaded.

Remote-control command:
`SOUR:FREQ:RCL EXCL`

Exclude Level - File

The current level is retained when a stored instrument setting is loaded.

Remote-control command:
`SOUR:POW:RCL EXCL`

Recall - File

Loads the selected configuration.

If an instrument setting in which a sweep was activated is stored, the sweep is started when the recall command is called.

If an instrument setting which accesses lists is stored, this list is also loaded.

If the list has been deleted in the meantime, an error message appears when the instrument setting is loaded. If the list has been overwritten in the meantime, the new entries will be used.

Remote-control command:
`*RCL 2`

Recall Immediate

Loads the selected configuration from one of the three intermediate memories.

If an instrument setting in which a sweep was activated is stored, the sweep is started when the recall command is called.

If an instrument setting which accesses lists is stored, this list is also loaded.

If the list has been deleted in the meantime, an error message appears when the instrument setting is loaded. If the list has been overwritten in the meantime, the new entries will be used.

A message appears if no instrument configuration is stored in this memory.

Remote-control command:
`*RCL 1`

File Manager - File

The **File Manager** menu provides all the functions required for file management. Directories can be created, and files copied, deleted, and moved between the directories on the devices (compact flash card and memory stick).
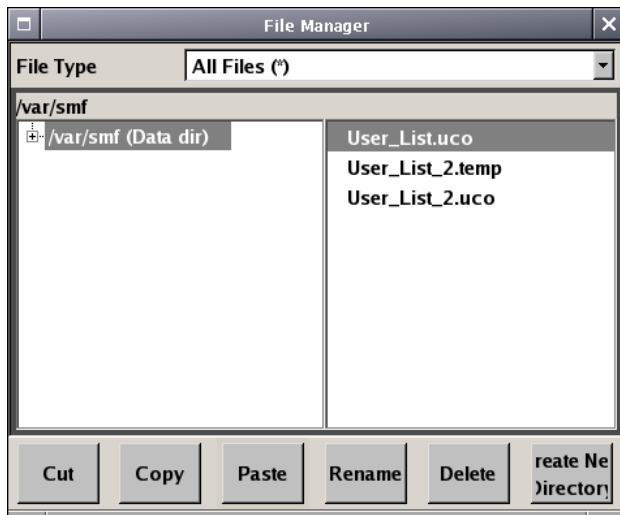
File Type

Selects the file types to be indicated. If a file type with a specific file extension (e.g. user correction list (*.uco)) is selected, only files with this extension are indicated in the selected directory.

Remote-control command: n.a.

Directory

Selects the directory in which the file to be deleted or copied is located. The window to the right lists all files in this directory. The file to be deleted or copied can be highlighted. The path is indicated above the directory window.

Remote-control command:
`MMEM:CDIR "/var/user"`

Files

Selects the file.

Remote-control command: n.a.

Cut

Cuts the selected file. It can be pasted into a different directory using the **Paste** button.

Remote-control command：
`MMEM:DEL '/var/test.savercl'`

Copy

Copies the selected file. It can be pasted into a different or the same directory using the **Paste** button. When pasting the file into the same directory, file name "Copy of <filename>" is given automatically. When pasting the file into a different directory, the original filename is kept.

Remote-control command：
`MMEM:COPY "/var/user/set1.wv","/var/user/set2.wv"`

Paste

Pastes the file that has been copied or cut before.

Remote-control command： n.a.

Rename

Renames the selected file or directory. The new name can be entered in the **New Filename** window.

Remote-control command：
MMEM:MOVE "test02.dm_iqd","set2.dm_iqd"

Delete

Deletes the selected file. Before the file is deleted, a message appears prompting the user to confirm deletion of the file.

Remote-control command：
MMEM:DEL '/var/test.savercl'

Create New Directory

Creates a new directory. The name of the new directory can be entered in the **New Directory** window.

The directory is created as a subdirectory in the selected level.

Remote-control command：
MMEM:MDIR '/var/user/test'

Note:
When the subdirectory is entered, it is possible to enter an absolute path name (e.g. "/var/user//meas") or the path relative to the current directory (e.g. "../MEAS").

RF Signal - RF

Overview of RF Signal

Settings for the RF output signal are made under "RF Frequency". These settings can be accessed in the block diagram by way of the **RF Frequency** function block or by means of the menu with the same name which is opened using the `MENU` key.

The function block is available for the basic unit without any additional equipment options.

The `RF ON/OFF` key can be used to activate and deactivate the output signal irrespective of the current entry focus. The previous state is restored when the signals are reactivated.

Remote-control command:
```
OUTP:STAT OFF
OUTP:STAT ON
```

The activated and deactivated state is indicated in the block diagram by means of the different block color and the status of the **On** checkbox. The disconnected connection to the output is additionally shown when the output is deactivated.

The RF output state can also be set in the **Configure** menu of the **RF Frequency** block:
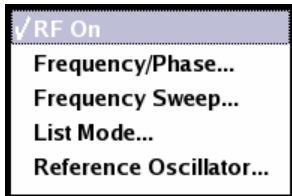
The Cw and Sweep modes are available for generating the RF signal.

CW	The RF signal is generated with the set frequency and level. This is the default mode.
Sweep	The RF signal is generated as a sweep with the set parameters.

Instruments connected downstream can be taken into consideration when setting the frequency and level by entering a frequency and/or level offset and a multiplier factor for the frequency.

Automatic level control ensures maximum level accuracy.

User-specific lists which contain level correction values for any frequency range (user correction) can be created to, for example, compensate the cable attenuation in a test assembly setup.

The RF signal can be also generated in modulated form. Option R&S SMF-B20 provides two internal LF generators, a noise generator and two external modulation inputs **EXT 1** and **EXT 2** at the front of the instrument which are available as the source for analog and/or digital modulations. Option R&S SMF-K23 provides an internal pulse generator.

An external trigger signal for the sweeps can be provided at the **TRIGGER** input or AUX connector. The input **REF IN** is used to input an external instrument reference frequency, and the output **REF OUT** serves as the output of the reference frequency (internal or external).

RF Frequency and Phase

The simplest way to set the RF frequency is to enter it directly in the header of the display.
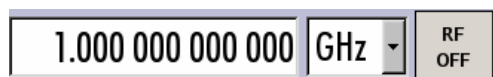
The entry is activated by pressing the ⌑FREQ⌑ key. Changes to the frequency have an immediate effect (without confirmation with the Enter key) on the output signal.

Remote-control command:
```
SOUR:FREQ 100MHz
```

Note:
*The IEC/IEEE-bus command sets the level of the **Freq** display, i.e. an entered frequency offset or multiplier factor is taken into consideration in the frequency value (see below).*

The frequency entered and displayed in the frequency entry field takes any set frequency offset and multiplication factor into consideration, e.g. an offset set for a downstream instrument or a subsequent frequency multiplier. This means that with a frequency offset/multiplier factor the frequency displayed in the header does not correspond to the frequency at the RF output, but rather to the frequency at the output of the downstream instrument. A set frequency offset/multiplier factor is indicated by the **FREQ OFFSET/MULTIPLIER** status message.

This allows the desired frequency at the output of a downstream instrument to be entered in the frequency field. The R&S SMF Signal Generator changes the RF output frequency according to the entered offset/multiplier factor.

However, the frequency entered and displayed in the **Frequency/Phase** menu of the **RF Frequency** function block always corresponds to the RF output frequency. Any frequency offset/multiplier factor is not taken into consideration.

The correlation is as follows:

Freq in header = RF output frequency (= Freq in menu) + Freq offset (= Offset in menu) + Multiplier factor (= Multiplier in menu)
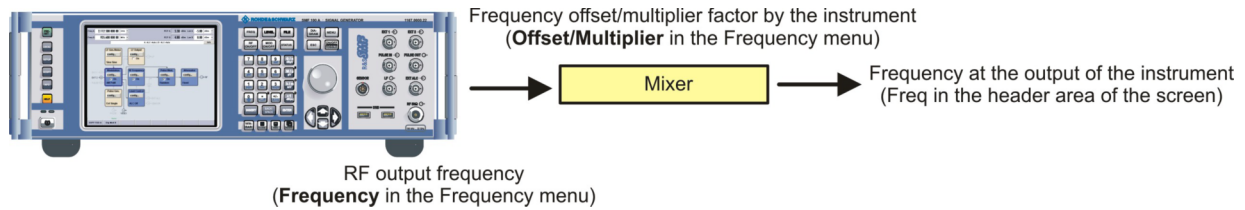
The frequency offset and the multiplier factor are entered in the **Frequency/Phase** menu. Here it is also possible to set the frequency without taking the offset/multiplier into consideration, to set the step width for the frequency entry using the rotary knob, and to set the phase for the RF output signal.

Frequency/Phase Menu

The **Frequency/Phase** menu is opened in the **RF Frequency** function block or using the MENU key under **RF Frequency**.
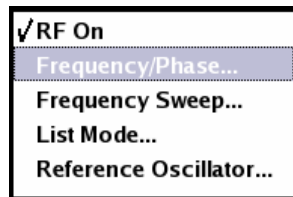
The menu is used to enter the frequency, phase, offset and multiplier factor of the RF output signal. The step width for the rotary knob can also be entered here.
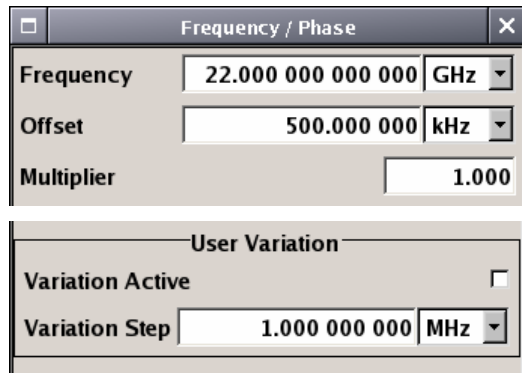
The frequency, offset, and the multiplier factor are set in the top section of the menu.

The step width is used when setting the frequency using the rotary knob with **Variation Active** is activated in the **User Variation** section.

The phase of the RF output signal can be changed in the **Phase Settings** section.

Frequency - RF Frequency

The frequency entered and displayed here corresponds to the frequency at the RF connector, i.e. any offset entry or multiplier factor is not taken into consideration.

Remote-control command：
SOUR:FREQ:FREQ 10GHz

> *Note:*
> *The IEC/IEEE-bus command* SOUR:FREQ *sets the frequency of the* **FREQ** *display, i.e. the frequency containing offset and multiplier.*

Offset - RF Frequency

Sets the frequency offset relative to the RF frequency. The frequency offset of a downstream instrument (e.g. a mixer) is entered.

The entry does not change the RF frequency at the RF output. It only changes the RF frequency displayed in the display header. The value of the RF frequency in the header corresponds to the frequency at the output of the downstream instrument.

Remote-control command：
SOUR:FREQ:OFFS 1GHz

Multiplier - RF Frequency

Sets the value for the multiplication factor of a subsequent downstream instrument.

Remote-control command:
SOUR:FREQ:MULT 50

If the frequency is set using the rotary knob, the step width is defined in the **User Variation** section.

Variation Active - RF Frequency

Activates the user-defined step width used when varying the frequency value with the rotary knob.

ON   The frequency value set with the rotary knob is varied using the user-defined step width which is entered under **Variation Step**.

Remote-control command：
SOUR:FREQ:STEP:MODE USER

OFF   The frequency value set with the rotary knob is varied in steps of one unit at the cursor position (standard operating mode).

Remote-control command:
SOUR:FREQ:STEP:MODE DEC

Variation Step - RF Frequency

Sets the user-defined step width. This step width is used when entering the RF frequency using the rotary knob. Frequency variation with this step width must also be activated with **Variation Active**.

Remote-control command：
SOUR:FREQ:STEP 1MHz

Sweep Mode

The R&S SMF Signal Generator offers four different sweep types (RF frequency sweep, RF level sweep, LF frequency sweep, and LF level sweep) to be activated alternatively. Each type has 5 modes which differ with respect to the sweep cycle mode (continuous, individual and step-by-step) and triggering mode (automatic, internal and external).

The RF frequency sweep is activated in the **RF Frequency block**, see section "*RF Frequency Sweep Menu*", page 4.35.

The RF level sweep is activated in the **Level Control** block, see section "*RF Level Sweep* Menu", page 4.46.

The LF frequency sweep is activated and configured in the **LF Gen./Noise** block, see section "*LF Frequency Sweep Menu*", page 4.78.

Note:
   The **LF Gen./Noise** block is available with option R&S SMF-B20 only.

The LF level sweep is activated in the **LF Output** block, see section "*LF Level Sweep Menu*", page 4.85.

Note:
   The **LF Output** block is available with option R&S SMF-B20 only.

A sweep is set in five basic steps which are shown below taking a frequency sweep as an example:

1. Set the sweep range (**Start Freq** and **Stop Freq** or **Center Freq** and **Span**).

2. Select the sweep spacing (**Spacing**).

3. Set the step width (**Step Lin/Log**) and dwell time (**Dwell Time**).

4. Activate the sweep (**Mode** to **Auto**, **Single**, **Step** or **Extern Single**, **Extern Step**).

5. Trigger the sweep, except for **Auto** mode (**Execute Single Sweep**, **Current Frequency** or **External Trigger Signal**).

RF Frequency Sweep Menu

The **RF Frequency Sweep** menu is opened in the **RF Frequency** function block or using the [MENU] key under **RF Frequency**.

```
√ RF On
  Frequency/Phase...
  Frequency Sweep...
  List Mode...
  Reference Oscillator...
```

The menu is used to activate and configure a sweep for the RF frequency.

RF Frequency Sweep	
State	Off
Mode	Auto
Start Freq	1.000 500 000 000 GHz
Stop Freq	5.000 500 000 000 GHz
Center Freq	3.000 500 000 000 GHz
Span	4.000 000 000 000 GHz
Current Freq	1.763 767 917 399 GHz
Spacing	Logarithmic
Step Log	1.000 %
Count	162
Dwell Time	10.0 ms
Trigger Slope	Positive
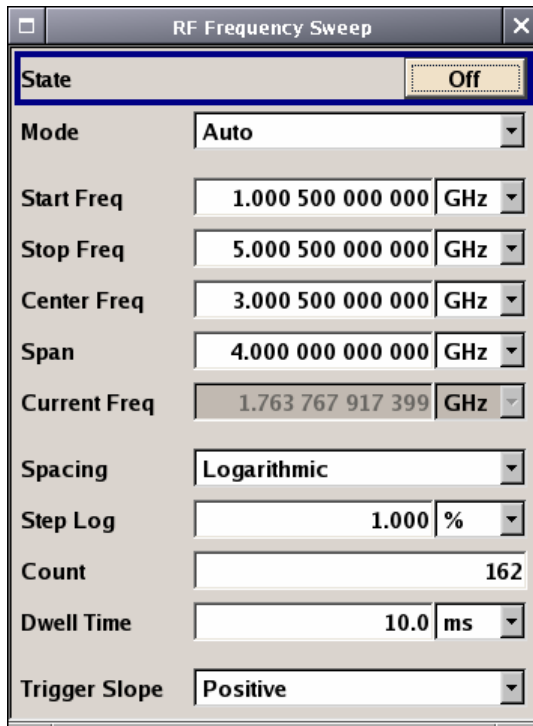
In the top section of the menu, the RF frequency sweep mode is activated and the sweep mode is selected.

The buttons are used to reset the RF frequency sweep (all sweep modes) or to execute the RF frequency sweep (**Single** mode).

The sweep range, sweep spacing, and dwell time are set in the bottom section.

The sweep range of the RF frequency sweep can be entered in two ways, either by entering the **Start** and **Stop** value or by entering the **Center** and **Span**. The two sets of parameters influence each other in the following way:

Start = (Center - Span/2)
Stop = (Center + Span/2)
Center = (Start + Stop)/2
Span = (Stop - Start)

State – RF Frequency Sweep

Activates/deactivates RF sweep mode.

Note:
   Activating the RF frequency sweep automatically deactivates the RF level sweep, LF frequency sweep, and LF level sweep.

Remote-control commands:
SOUR:FREQ:MODE SWE

Mode – RF Frequency Sweep

Selects the sweep instrument operating mode and the sweep mode.

Auto   Sets an automatic repeated sweep cycle. If a different sweep mode was activated prior to the **Auto** mode, the cycle continues from the current sweep setting.

Remote-control commands:
```
SOUR:SWE:FREQ:MODE AUTO
TRIG:FSW:SOUR AUTO
SOUR:FREQ:MODE SWE
```

Single   Sets a single sweep cycle. The sweep is triggered by the **Execute Single Sweep** button.

If a different sweep mode was activated prior to the **Single** mode, the current sweep is stopped. The **Single** sweep always starts at the start frequency when triggered.

Remote-control commands:
```
SOUR:SWE:FREQ:MODE AUTO
TRIG:FSW:SOUR SING
SOUR:FREQ:MODE SWE
SOUR:SWE:FREQ:EXEC
```

Step   Sets a step-by-step sweep cycle.

If this mode is activated, the cursor moves to the value displayed for **Current Freq**. Any variation to the **Current Freq** value triggers a sweep step.

If a different sweep mode was activated prior to the **Step** mode, the current sweep is stopped. The **Step** sweep starts at the current RF frequency when triggered.

Remote-control commands:
```
SOUR:SWE:FREQ:MODE MAN
SOUR:FREQ:MAN 200MHz
SOUR:FREQ:MODE SWE
SOUR:FREQ:MAN 300MHz
SOUR:FREQ:MAN 400MHz
```

Extern Single   Sets a single sweep cycle. The sweep is triggered by an external trigger signal.

If a different sweep mode was activated prior to the **Extern Single** mode, the current sweep is stopped. The **Extern Single** sweep always starts at the start frequency when triggered.

The external trigger signal is input at the rear of the instrument (BNC connector TRIGGER or AUX connector).

Remote-control command:
```
SOUR:SWE:FREQ:MODE AUTO
TRIG:FSW:SOUR EXT
SOUR:FREQ:MODE SWE
```

Extern Step   Sets a single sweep cycle. Each sweep step is triggered by an external trigger signal (trigger source as described under **Extern Single**).

If a different sweep mode was activated prior to the **Extern Step** mode, the current sweep is stopped. The **Extern Step** sweep always starts at the start frequency when triggered.

Remote-control command:
```
SOUR:SWE:FREQ:MODE STEP
SOUR:SWE:FREQ:SPAC LIN
SOUR:SWE:FREQ:STEP:LIN 1MHz
TRIG:FSW:SOUR EXT
SOUR:FREQ:MODE SWE
```

Execute Single Sweep – RF Frequency Sweep

(This feature is available for sweep mode Single only)

Triggers the sweep manually.

Remote-control commands:
```
SOUR:SWE:FREQ:MODE AUTO
TRIG:FSW:SOUR SING
SOUR:FREQ:MODE SWE
SOUR:SWE:FREQ:EXEC
```

Reset Sweep – RF Frequency Sweep

Resets the sweep. The start frequency is set and the next sweep starts from there.

Remote-control command: n.a.

Start Freq - RF Frequency Sweep

Sets the start frequency of the sweep.

Remote-control command：
```
SOUR:FREQ:STAR 100MHz
```

Stop Freq - RF Frequency Sweep

Sets the stop frequency of the sweep.

Remote-control command：
```
SOUR:FREQ:STOP 500MHz
```

Center Freq - RF Frequency Sweep	Sets the center frequency of the sweep.
	Remote-control command：
	`SOUR:FREQ:CENT 300MHz`

Span - RF Frequency Sweep	Sets the span of the sweep.
	Remote-control command：
	`SOUR:FREQ:SPAN 400MHz`

Current Freq - RF Frequency Sweep	Displays the current frequency of the sweep.
	If **Step** is set, the frequency for the next frequency step of the sweep is entered here.
	Remote-control command
	`SOUR:FREQ:MAN 300MHz`

Spacing - RF Frequency Sweep	Selects linear or logarithmic spacing.
	Remote-control command：
	`SOUR:SWE:FREQ:SPAC LIN`

Step Lin/Log – RF Frequency Sweep	Sets the step width for the individual sweep steps. This entry is effective for all sweep modes.
	Step Lin or **Step Log** is displayed depending on whether **Spacing Lin** or **Log** is selected.

	Step Lin	With the linear sweep, the step width is a fixed frequency value which is added to the current frequency. The linear step width is entered in Hz.
		Remote-control command：
		`SOUR:SWE:FREQ:STEP:LIN 1MHz`
	Step Log	With the logarithmic sweep, the step width is a constant fraction of the current frequency. This fraction is added to the current frequency. The logarithmic step width is entered in %.
		Remote-control command:
		`SOUR:SWE:FREQ:STEP:LOG 1PCT`

Count - RF Frequency Sweep	Sets the number of sweep steps.
	Remote-control command:
	`SOUR:SWE:FREQ:POIN 501`

Dwell Time - RF Frequency Sweep	Sets the dwell time. The dwell time determines the duration of the individual sweep steps.
	Remote-control command:
	`SOUR:SWE:FREQ:DWEL 10ms`

Trigger Slope - RF Frequency Sweep	Sets the polarity of the active slope of an applied instrument trigger.
	This setting affects the TRIGGER input (BNC connector at the rear of the instrument).

	Positive	The rising edge of the trigger signal is active.
		Remote-control command: `SOUR:INP:TRIG:SLOP POS`
	Negative	The falling edge of the trigger signal is active.
		Remote-control command: `SOUR:INP:TRIG:SLOP NEG`

RF Frequency Reference Oscillator

In the internal reference mode, the internal reference signal is available at the **REF OUT** connector (rear of instrument). The frequency of the internal reference signal is fixed to 10 MHz. The frequency of the internal reference oscillator can be influenced by means of the **EFC** (External Frequency Control) input at the rear of the instrument (**Frequency Adjustment**; see data sheet for technical information). External frequency control is possible in both **Adjustment State** states (**On** or **Off**).

In the external reference mode, an external signal with selectable frequency and defined level must be input at the **REF IN** connector. This signal is output at the **REF OUT** connector. The **EXT REF** status message appears in the display header.

Reference Oscillator Menu

The **Reference Oscillator** menu is opened in the **RF Frequency** function block or using the MENU key under **RF Frequency**.

The menu is used to select the reference frequency source, to enter the frequency of an external reference signal, and to adjust the reference frequency.
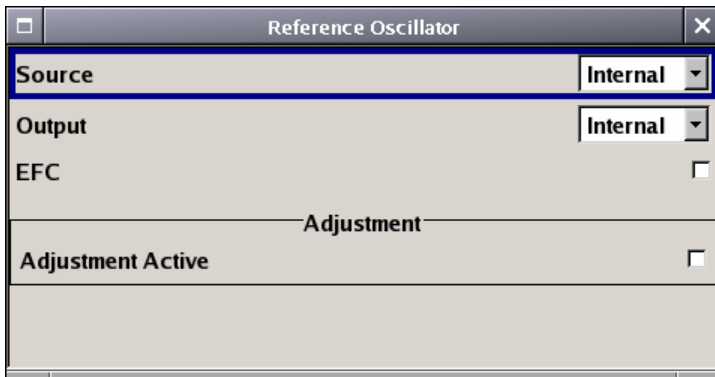
Source - Reference Oscillator

Selects the source of the reference frequency.

Internal   The internal reference signal of 10 MHz is used.

Remote-control command:
SOUR:ROSC:SOUR INT

External   An external reference signal is used. The frequency of the external reference signal must be selected under **External Reference Frequency**.

Remote-control command:
SOUR:ROSC:SOUR EXT

External Reference Frequency - Reference Oscillator

(This feature is available for source mode External only)

Selects the frequency of the external reference signal.

Remote-control command:
SOUR:ROSC:EXT:FREQ 13E6

Synchronization Bandwidth - Reference Oscillator

(This feature is available for source mode External only)

Selects the synchronization bandwidth for an external reference signal. The wideband setting is provided for using good reference sources of high spectral purity.

Narrow   Synchronization bandwidth is approx. 1 Hz.

Remote-control command:
SOUR:ROSC:EXT:SBAN NARR

Wide   Recommended standard mode. Synchronization bandwidth is app. 750 Hz.

Remote-control command:
SOUR:ROSC:EXT:SBAN WIDE

Output - Reference Oscillator

Selects the output for the reference oscillator signal. The external output is only available in case that the external reference frequency is 10 MHz.

Remote-control command:
SOUR:ROSC:OUTP:SOUR EXT

EFC - Reference Oscillator

Activates/deactivates the electronic frequency control.

Remote-control command:
SOUR:ROSC:EFC:STAT ON

Adjustment Active - Reference Oscillator

Selects adjustment mode.

Off   The calibrated adjustment value of the internal reference frequency is used. This value is determined at one of the R&S service shops during calibration.

Remote-control command：
SOUR:ROSC:INT:ADJ:STAT ON

On   A user-defined adjustment value is used. The value is entered under **Adjustment DAC Value**.

This allows the frequency to be adjusted freely.

The instrument is no longer in the calibrated state.

Remote-control command:
SOUR:ROSC:INT:ADJ:STAT OFF

Adjustment DAC value - Reference Oscillator

Enters a user-defined adjustment value for the internal reference frequency. This value is not used unless **Adjustment Active On** is selected.

Remote-control command：
SOUR:ROSC:INT:ADJ:VAL 1400

RF Level

Overview of RF Level

Settings for the RF output level are made under "Level Control". These settings can be accessed in the block diagram by way of the **Level Control** function block, or by means of the menu with the same name which is opened using the ⌐MENU⌐ key.

The function block is available for the basic unit without any additional equipment options.

The activated and deactivated state is indicated in the block diagram by means of the different block color.

The simplest way to set the RF level is to enter it directly in the header of the display.

The entry is activated by pressing the ⌐LEVEL⌐ key. Changes to the level have an immediate effect (without confirmation with the Enter key) on the output signal.

Remote-control command:
SOUR:POW:LEV:IMM:AMPL –30dBm

Note:
   *The IEC/IEEE-bus command sets the level of the **Level** display, i.e. an entered level offset is taken into consideration in the level value (see below).*

---

dBm, dBµV, mV and µV can be used as the level units. The 4 unit keys are labeled with these units.

The level entered and displayed in the **Level** field takes the offset of any downstream attenuators/amplifiers into consideration by way of calculation. This means that with a level offset, the level displayed in the header does not correspond to the level at the RF output, but rather to the level at the output of the downstream instrument.

This allows the desired level at the output of downstream instruments to be entered. The R&S SMF Signal Generator changes the RF output level according to the set offset.

However, the level entered and displayed in the **Level** menu of the **Level Control** function block always corresponds to the RF output level. Any level offset is not taken into consideration.

The correlation is as follows:

Level in header = RF output level (= Level in menu) + Level offset
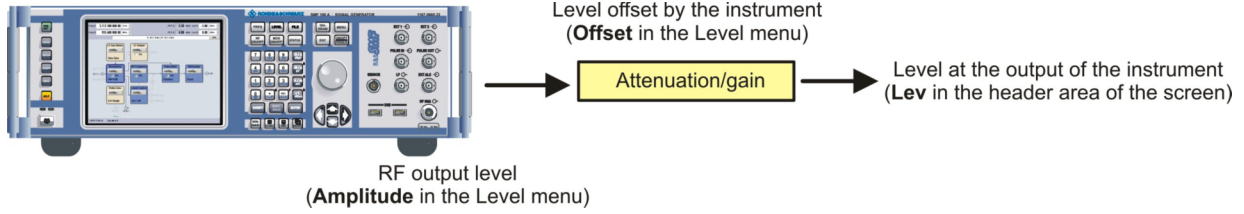
The level offset is entered in the **Level** menu. Here it is also possible to set the level without taking the offset into consideration, and to make other settings, such as offset-free level, level offset, level limit, and power resolution.

Level / EMF / ALC / UCOR Menu

The **Level** menu is opened in the **Level Control** function block or using the MENU key under **Level Control**.
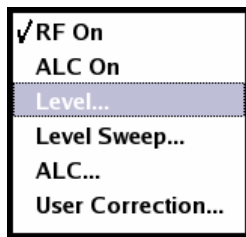
The menu is used to perform the settings regarding the RF level.
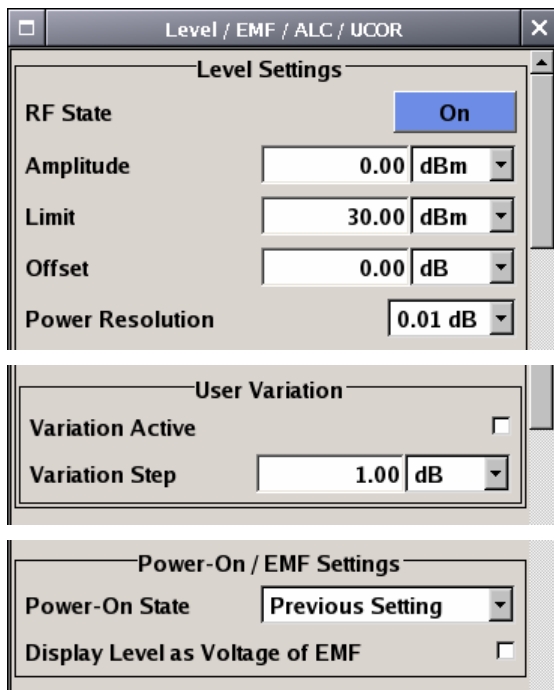
The offset-free level, level offset, level limit, and power resolution are set in the top section of the menu.

The step width which is used when setting the level using the rotary knob (with **Variation Active On**) is set in the **User Variation** section.

The power-on behavior and the level display in the display header are set in the **Power-On / EMF Settings** section.

RF State – RF Level

Activates/deactivates the RF output.

Remote-control command：
SOUR:OUTP:STAT ON

Amplitude - RF Level

Sets the RF level of the RF output connector.

The level entered and displayed here corresponds to the level at the RF output, i.e. any offset entry is not taken into consideration.

Remote-control command:
SOUR:POW:POW 20dBM

Note:

The IEC/IEEE-bus command SOUR:POW:LEV:IMM:AMPL *sets the level of the **Level** display, i.e. the level containing offset.*

Limit - RF Level

Sets the level limit.

The value specifies the upper limit of the level at the RF output connector. A message appears if an attempt is made to set a level above this limit and the level at the RF output is confined to the upper limit. However, the level indication is not influenced.

Remote-control command：
SOUR:POW:LIM:AMPL 30dBm

Offset - RF Level

Sets the level offset relative to the RF level.

The level offset of a downstream instrument (e.g. an attenuator or amplifier) is entered.

The entry does not change the RF level at the RF output. It only changes the RF level displayed in the display header. The RF level in the header corresponds to the level at the output of the downstream instrument.

Remote-control command：
SOUR:POW:LEV:IMM:OFFS 0

Power Resolution - RF Level

Selects the resolution for the level settings.

Remote-control command：
SOUR:POW:RES 0.01

If the level is set using the rotary knob, the step width is defined in the **User Variation** section.

Variation Active – User Variation	Activates the user-defined step width used when varying the level value with the rotary knob.	

        ON   The level value set with the rotary knob is varied using the user-defined step width which is entered under **Variation Step**.

                Remote-control command：
                `SOUR:POW:STEP:MODE USER`

        OFF   The level value set with the rotary knob is varied in steps of one unit at the cursor position (standard operating mode).

                Remote-control command:
                `SOUR:POW:STEP:MODE DEC`

Variation Step – User Variation   Sets the user-defined step width for entering the RF level using the rotary knob. Level variation with this step width must also be activated with **Variation Active**.

        Remote-control command：
        `SOUR:POW:STEP:INCR  1dB`

The power-on behavior and the level display in the display header are set in the **Power-On / EMF Settings** section.

Power-On State - RF Output   Selects the state which the RF output is to assume after the instrument is switched on.

        RF Off   The output is deactivated when the instrument is switched on.

                Remote-control command：
                `OUTP:PON OFF`

        Previous Setting   When the instrument is switched on, the output assumes the same state as it had when the instrument was switched off.

                Remote-control command:
                `OUTP:PON UNCH`

Display Level as Voltage of EMF - RF Level   Activates display of the signal level as voltage of the EMF (no-load voltage). If this setting is deactivated, the level is displayed as a voltage with 50 Ohm (presetting).

        Remote-control command：n.a.

RF Level Sweep

The **Level Sweep** menu is opened in the **Level Control** function block or using the MENU key under **Level Control**.

```
√ RF On
  ALC On
  Level...
  Level Sweep...
  ALC...
  User Correction...
```
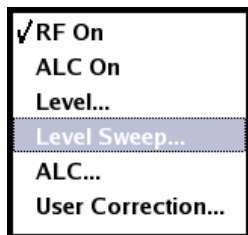
RF Level Sweep Menu

The menu is used to activate and configure a sweep for the RF level.
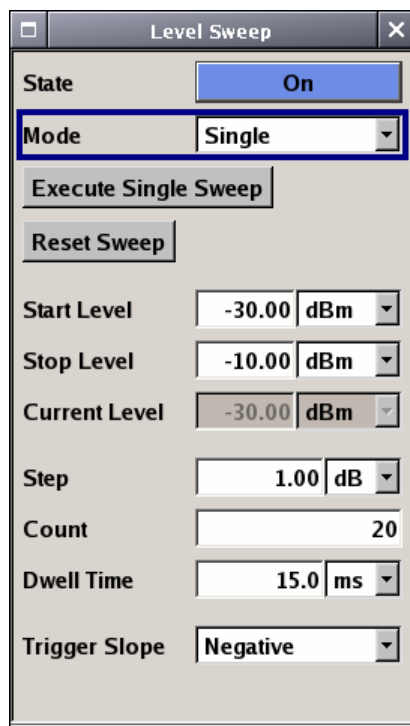
In the top section of the menu, the RF level sweep mode is activated and the sweep mode is selected.

The buttons are used to reset the RF level sweep (all sweep modes) or to execute the RF level sweep (**Single** mode).

The sweep range, dwell time, count, and trigger slope are set in the bottom section.

State - Level Sweep

Activates/deactivates the RF level sweep mode.

Note:
Activating the RF level sweep automatically deactivates the RF frequency sweep, LF frequency sweep, and LF level sweep.

Remote-control commands:
`SOUR:POW:MODE SWE`

Mode - RF Level Sweep

Selects the level sweep instrument operating mode and the sweep mode.

Auto

Sets an automatic repeated sweep cycle. If a different sweep mode was activated prior to the **Auto** mode, the cycle continues from the current sweep setting.

Remote-control commands:
```
SOUR:SWE:POW:MODE AUTO
TRIG:PSW:SOUR AUTO
SOUR:POW:MODE SWE
```

Single

Sets a single sweep cycle. The sweep is triggered by the **Execute Single Sweep** button.

If a different sweep mode was activated prior to the **Single** mode, the current sweep is stopped. The **Single** sweep always starts at the start level.

Remote-control commands:
```
SOUR:SWE:POW:MODE AUTO
TRIG:PSW:SOUR SING
SOUR:POW:MODE SWE
SOUR:SWE:POW:EXEC
```

Step

Sets a step-by-step sweep cycle. Each sweep step is triggered by a variation of the value in the **Current Level** entry window.

If this mode is activated, the cursor moves to the value displayed for **Current Level**. If a different sweep mode was activated prior to the **Step** mode, the current sweep is stopped. The **Step** sweep starts at the current level value.

Remote-control commands:
```
SOUR:SWE:POW:MODE STEP
TRIG:PSW:SOUR SING
SOUR:POW:MAN -16
TRIG:PSW:SOUR SING
SOUR:POW:MODE SWE
SOUR:POW:MAN -16.5
SOUR:POW:MAN -17
```

	Extern Single	Sets a single sweep cycle. The sweep is triggered by an external trigger signal.

If a different sweep mode was activated prior to the **Extern Single** mode, the current sweep is stopped. The **Extern Single** sweep always starts at the start level.

The external trigger signal is input at the rear of the instrument (BNC connector TRIGGER or AUX connector).

Remote-control commands:
```
SOUR:SWE:POW:MODE AUTO
TRIG:PSW:SOUR EXT
SOUR:POW:MODE SWE
```

Extern Step　Sets a step-by-step sweep cycle. Each sweep step is triggered by an external trigger signal (trigger source as described under **Extern Single**). The step width corresponds to the step width of the rotary knob.

If a different sweep mode was activated prior to the **Extern Step** mode, the current sweep is stopped. The **Extern Step** sweep always starts at the start level.

Remote-control command:
```
SOUR:SWE:POW:MODE STEP
SOUR:SWE:POW:STEP 0.5dB
TRIG:PSW:SOUR EXT
SOUR:POW:MODE SWE
```

Reset Sweep - RF Level Sweep

Resets the sweep. The start level is set and the next sweep starts from there.

Remote-control command：n.a.

Execute Single Sweep - RF Level Sweep

Triggers the sweep manually. A manual sweep can only be triggered if **Single** is selected in the **Mode** field.

Remote-control commands：
```
SOUR:SWE:POW:MODE AUTO
TRIG:PSW:SOUR SING
SOUR:POW:MODE SWE
SOUR:SWE:POW:EXEC
```

Start Level - RF Level Sweep

Sets the start level for the level sweep.

Remote-control command：
```
SOUR:POW:STAR -30dBm
```

Stop Level - RF Level Sweep

Sets the stop level for the level sweep.

Remote-control command：
```
SOUR:POW:STOP -10dBm
```

Current Level - RF Level Sweep

Displays the current level. If the level sweep mode is set to **Step**, the value for the current value can be entered.

Remote-control command:
`SOUR:POW:MAN -30dBm`

Step - RF Level Sweep

Sets the step width for the individual sweep steps. This entry is effective for all sweep modes.

With the level sweep, the logarithmic step width is a constant fraction of the current level. This fraction is added to the current level. The logarithmic step width is entered in dB.

Remote-control command:
`SOUR:SWE:POW:STEP 3dB`

Count - RF Level Sweep

Sets the number of sweep steps.

Remote-control command:
`SOUR:SWE:POW:POIN 501`

Dwell Time - RF Level Sweep

Enters the dwell time. The dwell time determines the duration of the individual sweep steps.

Remote-control command：
`SOUR:SWE:POW:DWEL 10ms`

Trigger Slope – RF Level Sweep

Sets the polarity of the active slope of an applied instrument trigger.

This setting affects the TRIGGER input (BNC connector at the rear of the instrument).

Positive   The rising edge of the trigger signal is active.

Remote-control command:
`SOUR:INP:TRIG:SLOP POS`

Negative   The falling edge of the trigger signal is active.

Remote-control command:
`SOUR:INP:TRIG:SLOP NEG`

Automatic Level Control - ALC

Automatic level control (**A**utomatic **L**evel **C**ontrol) can be used with almost all applications, except for pulse modulation with very small pulse width.

The level control status is permanently displayed as a status message in the info line.

ALC-On	Info
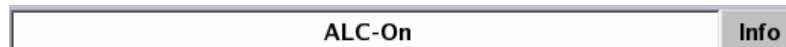
The standard operating status is level control **On**. This provides the highest level accuracy. The preset is **ON**.

Level control can be switched to **Sample & Hold** or **Off** for particular applications.

If **Sample & Hold** is selected, the level is recalibrated for every level and frequency setting. For this purpose, level control is activated briefly at a defined signal, the level adjuster is then held at the attained value and level control is deactivated.

Automatic Level Control Menu

The **Auto Level Control** menu is opened in the **Level Control** function block or using the MENU key under **Level Control**.

```
√ RF On
√ ALC On
  Level...
  Level Sweep...
  ALC...
  User Correction...
```

```
┌──────Automatic Level Control──────┐
State                    [On          ▼]
Rf During Power Search   [Normal    ▼]
          [     Search Once     ]
```
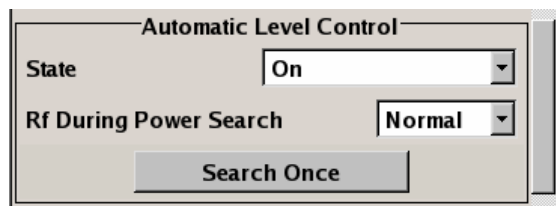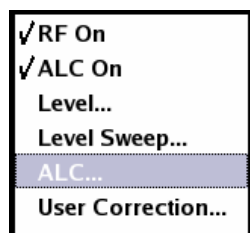
State - ALC		Activates/deactivates internal level control.

	Off (Sample & Hold)	Internal level control is deactivated.
		Remote-control command: `SOUR:POW:ALC OFF`

	On	Internal level control is permanently activated.
		Remote-control command: `SOUR:POW:ALC ON`

Rf During Power Search - ALC	Activates/deactivates the RF output during the power search.
	Remote-control command: `OUT:ALC:SEAR:MODE NORM`

Search Once - ALC	**(Only available for ALC state Sample & Hold)**
	Manually activates level control briefly to allow the level to be calibrated.(Power Search)
	Remote-control command: `SOUR:POW:ALC:SONC`

User Correction

The User Correction function is used to create and activate lists in which level correction values predefined by the user are freely assigned to RF frequencies. Correction is performed by the user-defined table values being added to the output level for the respective RF frequency.

With frequencies which are not contained in the list, the level correction is determined by interpolation of the closest correction values.

The lists are created in the List Editor. Each list is stored in its own file with the predefined file extension ***. uco**. The name of the User Correction file can be freely selected. The files are loaded from the **Lists...** file manager. Externally created tables with pairs of frequency and level values can be converted into User Correction files using the import function. The external files must have the file extension *.txt or *.csv. These file formats are provided e.g. by the Microsoft Excel program. The separators for table columns and for decimal floating-point numerals can be set. In addition, internally created User Correction data can be exported into ASCII files using the export function.

If user correction is activated, the **UCOR** display (User Correction) is shown in the header together with the **Level** display. The RF output level is the sum of both values.

Level + UCOR = Output level

If the offset setting is used at the same time, the **Level** display value is the difference between the values entered for **Level** and **Offset** in the **Level** menu.

Level − **Offset** = **Level** display value

If activated, user correction is effective in all operating modes.

User Correction Menu

The **User Correction** menu is opened either in the **Level Control** function block or using the MENU key under **Level Control**.
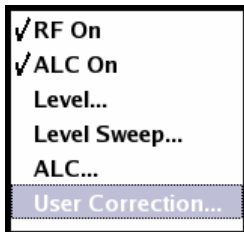
The combined menu **Level / EMF / ALC /UCOR** provides access to function User Correction in the lower section. The menu is used to activate/deactivate user correction, and to create, select, and activate the correction data lists.
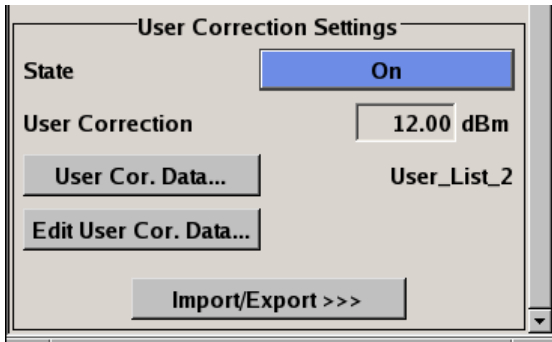
State - User Correction

Activates/deactivates user correction.

The **UCOR** status message appears in the frequency and level display.

Remote-control command:
`SOUR:CORR:STAT ON`

User Correction – User Correction

Indicates the current value for user correction.

Remote-control commands:
`SOUR:CORR:VAL?`

User Correction Data - User Correction

Calls the **File Select** menu for selecting and creating a list or the **File Manager**.

```
Select User Correction Data
New User Correction Data
File Manager...
```
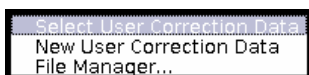
Remote-control command:
```
SOUR:CORR:CSET:CAT?
Response:
'Ucor1', 'Ucor2'

SOUR:CORR:CSET:SEL 'Ucor1'
SOUR:CORR:CSET:DEL 'Ucor2'
```

Edit User Correction Data - User Correction

Calls the editor for editing the selected user correction list. A list consists of any number of frequency/level value pairs. The currently selected list is displayed.
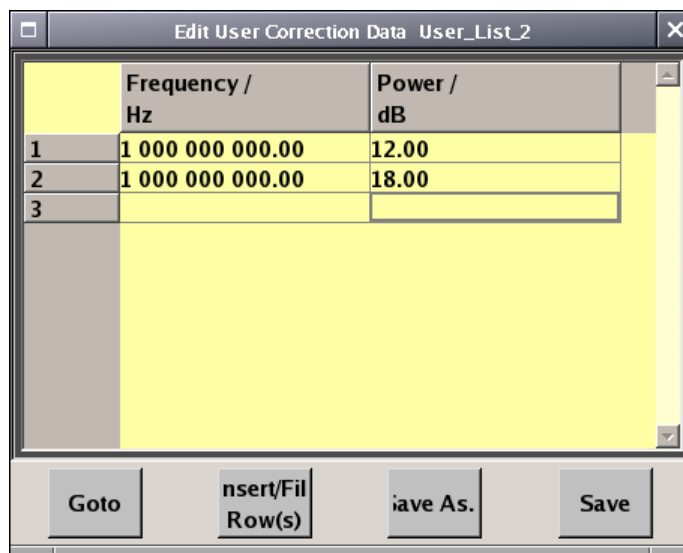
Frequency /Hz   Enter the frequency to which the level correction value applies.

Remote-control command:
```
SOUR:CORR:CSET:SEL 'Ucor1'
SOUR:CORR:CSET:DATA:FREQ 100MHz,...
```

Power /dBm   Enter the level correction value to which the specified frequency applies.

Remote-control command:
```
SOUR:CORR:CSET:SEL 'Ucor1'
SOUR:CORR:CSET:DATA:POW 1dB,0.8dB,...
```

Goto   Selects row for editing.

If **Goto row** is selected, a window opens for entering the requested row.

Remote-control command: n.a.
(it is not possible to change individual positions of the list)

**Fill With
Sensor**

> *Note:*
>   *Power sensors are not supported in this release.*

Calls the menu to activate the filling of the user correction list with level values acquired by the selected power sensors. All level correction values for the given frequency values are entered in the selected list. The list is automatically stored and recalled again after filling.

The menu indicates the relevant generator settings. Only the sensor can be selected in the **Sensor** field of the menu.

The **Execute** button is only enabled if a sensor is detected and the user correction list contains at least one frequency value.

Remote-control command:
CORR:CSET:DATA:SENS1:POW:SONC

(the power sensor used is selected by the suffix in key word SENSe of the command header. Suffix 1 denotes the sensor connected to the SENSOR connector, suffix 2 the sensor connected first to one of the USB interfaces and suffix 3 the sensor connected second to one of the USB interfaces.)

Insert Row(s)   Insert a new row before the marked row.

Remote-control command: n.a.

Save As   Open the file menu to save the list under a new name.

Each list is saved to the R&S SMF Signal Generator flash card as a separate file with the file prefix ***.uco**. The file name and the directory to which the file is saved are user-selectable.

Remote-control command: n.a.

Save The list is saved under its current name.

Remote-control command: n.a.
(the list is automatically saved after the values have been entered)

Import/Export - User Correction

Expands the menu with the area for import and export of user correction files.

Externally edited Excel tables with frequency/level pairs can be imported as text files or CSV files and used for user correction.

On the other hand, internally created user correction lists can be exported as text files or CSV files.

Mode - User Correction

Selects if user correction lists should be imported or exported. The settings offered depend on the selected mode.

Remote-control command:
SOUR:CORR:DEXC:MODE IMP

Extension - User Correction

Selects the file extension of the ASCII file to be imported or exported. Selection TXT (text file) or CSV (Excel file) is available.

Remote-control command:
SOUR:CORR:DEXC:AFIL:EXT TXT

Decimal Point - User Correction

Selects the decimal separator used in the ASCII data between '.' (decimal point) and ',' (comma) with floating-point numerals.

Remote-control command:
SOUR:CORR:DEXC:AFIL:SEP:DEC DOT

Column Separator- User Correction

Selects the separator between the frequency and level column of the ASCII table the user correction list is exported to or imported from.

Remote-control command:
SOUR:CORR:DEXC:AFIL:SEP:COL TAB

Select ASCII Source / Destination - User Correction

Calls the **File Manager** for selecting the ASCII file to be imported into a user correction list (source) or the ASCII file the user correction list is exported (destination) in.

Remote-control command:
SOUR:CORR:DEXC:AFIL:SEL "C:/user/ucor/list1.txt"

Destination / Source - User Correction

Calls the **File Manager** for selecting the user correction list to be exported (source) into an ASCII file or the destination for the ASCII file to be imported (destination) in.

Remote-control command:
SOUR:CORR:DEXC:SEL "C:/user/ucor/list1.txt"

Import / Export - User Correction	Starts the export or import of the selected file.

When import is selected, the ASCII file is imported as user correction list.

When export is selected, the user correction list is exported into the selected ASCII file.

Remote-control command:
SOUR:CORR:DEXC:EXEC

Modulation

Overview of Modulation

The R&S SMF Signal Generator provides analog and digital amplitude modulation, analog and digital frequency modulation, analog and digital phase modulation, and pulse modulation. In addition, the RF signal can be modulated with a wide variety of internal modulations waveforms, e.g. sine waves, triangle/ pulse/ trapeze signals, and noise.

Pulse modulation is available for the basic unit R&S SMF. Amplitude modulation, frequency modulation, phase modulation, and digital modulation require option R&S SMF-B20. This option also provides two LF generators and a noise generator for internal modulation.

Extended pulse modulation features are provided by option R&S SMF-K23, Pulse Generator.

Narrow pulse modulation is provided by option R&S SMF-K3.

Settings for the modulation are made in separate modulation menus. These menus can be accessed in the block diagram by way of the **Modulation** function block or by means of the menu with the same name which is opened using the MENU key.

The MOD ON/OFF key switches the active modulations on and off. Pressing the key again restores the status that was active before the last switch-off. **MOD OFF** is displayed in the info line of the header next to the **Level** field.

Remote-control command:
SOUR:MOD:ALL:STAT OFF

The activated and deactivated state is indicated in the block diagram by means of the different block color and the status of the **On** checkbox. The active modulations are indicated in the block.

Internal Modulation Sources

Two LF generators, a noise generator, and a pulse generator are available as internal modulation sources for a fully equipped instrument. The LF generators supply signals with selectable shapes (see also section "*LF Gen./Noise*", page *4.70*). The noise generator supplies noise with selectable bandwidth and level distribution. The pulse generator provides single and double pulse modulation with selectable pulse widths and periods (see also section "*Pulse Generator*", page 4.88).

The LF generators and the noise generator require option R&S SMF-B20. The pulse generator requires option R&S SMF-K23.

External Modulation Sources

The modulation inputs EXT 1, EXT 2, and PULSE IN at the front of the instrument are provided as the external modulation source for amplitude, frequency, phase, digital, and pulse modulation.

Note:
   The external inputs EXT 1 and EXT 2 require option R&S SMF-B20.

External Analog Modulation Sources

The external analog modulation inputs are configured in the menus of the selected modulation mode (amplitude modulation, frequency modulation, or phase modulation).

Note:
   Regardless of the menu the settings are performed, the settings are valid for all analog modulation modes.

	External Inputs	
	EXT 1	**EXT 2**
Coupling	AC	AC
Impedance	100 kOhm	100 kOhm
Bandwidth	10 MHz	10 MHz

Coupling – External Inputs

Selects the coupling mode (AC or DC) for external feed via the **EXT 1** and/or **EXT 2** input.

Remote-control command：
SOUR:INP:MOD:COUP1 AC

Impedance – External Inputs

Selects the impedance for external feed via the **EXT 1** and/or **EXT 2** input. Selection 50 ohm, 600 ohm, and 100 kohm are available.

Remote-control command：
SOUR:INP:MOD:IMP1 G50

Bandwidth – External Inputs

Selects the bandwidth for the external feed via the EXT 1 and/or EXT 2 input. Selection 200 kHz und 10 MHz are available.

Remote-control command:
SOUR:LFO1:BAND BW10M

External Digital Modulation Sources

The external digital modulation inputs are configured in the **Digital Modulation** menu.

Note:
   The settings are valid for all digital modulation modes (ASK, FSK, PSK).
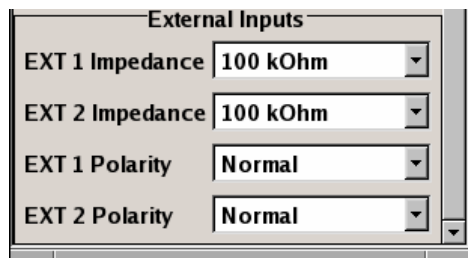
EXT 1/2 Impedance – External Inputs

Selects the impedance for external feed via the **EXT 1** and/or **EXT 2** input. Selection 50 ohm, 600 ohm, and 100 kohm are available.

Remote-control command:
SOUR:INP:MOD:IMP G50

Polarity – External Inputs

Sets the polarity of the external modulation signal.

Normal   The RF level is ON while the level is HIGH.

Remote-control command:
SOUR:DM:EXT:POL1 NORM

Inverse   The RF level is ON while the level is LOW.

Remote-control command:
SOUR:DM:EXT:POL1 INV

Simultaneous Operating of Several Modulations or Other Operating Modes

The table shows the modulation and operating modes which can be activated simultaneously (+) or which deactivate each other (-).

	AM	ASK	FM	FSK	PhiM	PSK	PuM
Amplitude modulation (AM)		+	+	+	+	+	+
ASK	/		+	+	+	+	/
Frequency Modulation (FM)	+	+		/	/	/	+
FSK	+	+	/		/	+	+
Phase Modulation (PhiM)	+	+	/	/		/	+
PSK	+	+	/	/	/		+
Pulse Modulation (PuM)	+	/	+	/	+	+	

Amplitude Modulation - AM

An internal and/or external source can be selected for amplitude modulation. Two LF generators and a noise generator are available as the internal source for a fully equipped instrument. Two-tone AM is possible by simultaneously switching on the external and internal or both internal sources.

Two external input connectors for external feed of analog modulation signals are located on the front panel of the instrument.

Amplitude Modulation Menu

The **Amplitude Modulation** menu is opened in the **Modulation** function block or using the MENU key under **Modulation**.
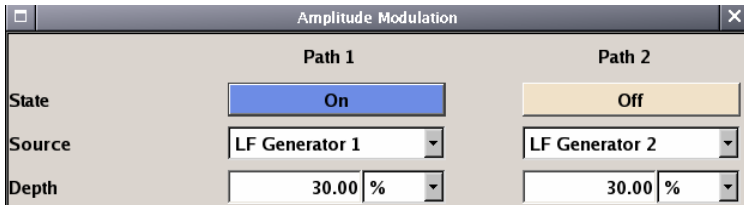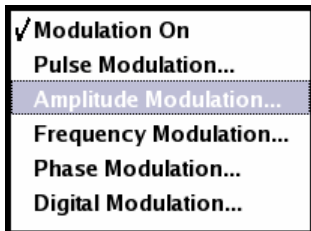
In the upper section of the menu, the amplitude modulation is activated and configured.

Additionally, the scan state and the ratio can be set.
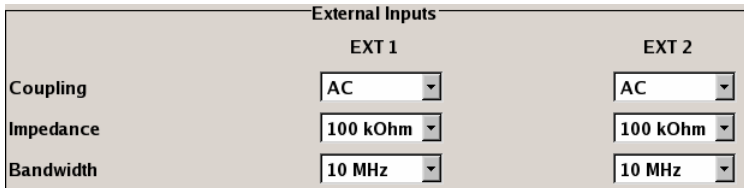
In the **External Inputs** section, the external inputs are configured. These settings affect all modulations which use the same external modulation sources. For a detailed description, see section "*External Modulation Sources*", page 4.57.

The **LF Frequency** field sets the frequency of LF generator 1/2. This setting affects all analog modulations which use the LF generator as the internal modulation source..

State – Amplitude Modulation	Activates/deactivates AM modulation.

Remote-control command:
SOUR:AM1:STAT ON

Source – Amplitude Modulation	Selects the source for the AM signal.

LF Generator 1/2	Selects the internal LF generator (either 1 or 2) as the source for amplitude modulation.

Remote-control command:
SOUR:AM1:SOUR LF1

EXT 1/2	Selects the external input (either **EXT 1** or **EXT 2**) as the source for amplitude modulation.

Remote-control command:
SOUR:AM1:SOUR EXT1

Noise Generator	Selects the internal noise generator as the source for amplitude modulation.

Remote-control command:
SOUR:AM1:SOUR NOIS

Depth – Amplitude Modulation	**(This feature is available for scan state OFF only)**

Sets the modulation depth in percent.

Note:
With two-tone modulation, please observe that the set modulation depth is valid for both signals and the sum modulation depth is determined by doubling the set modulation depth. This results in overmodulation if the maximal value for modulation depth is exceeded (see data sheet).

Remote-control command:
SOUR:AM1:DEPT 20PCT

Sensitivity – Amplitude Modulation	**(This feature is available for scan state ON only)**

Sets the input sensitivity of the EXT input in db/V.

Remote-control command:
SOUR:AM1:SENS 5

Scan State – Amplitude Modulation	Activates/deactivates the logarithmic amplitude modulation.

Remote-control command:
SOUR:AM:SCAN:STAT ON

Ratio – Amplitude Modulation

Sets the path 1/path 2 ratio.

Remote-control command:
```
SOUR:AM:RAT 50 PCT
```

In the **External Inputs** section, the external inputs are configured. These settings affect all modulations which use the same external modulation sources. For a detailed description, see section "*External Analog Modulation Sources*", page 4.57.

LF Frequency Gen.1/2

Sets the frequency of LF generator 1/2. This setting affects all analog modulations which use the LF generator as the internal modulation source.

Remote-control command:
```
SOUR:LFO:FREQ 1kHz
```

Frequency Modulation - FM

Note:
    This modulation mode requires option R&S SMF-B20.

An internal and/or external source can be selected for frequency modulation. Two LF modulation generators and a noise generator are available as internal sources for a fully equipped instrument. Two-tone FM is possible by simultaneously switching on the external and internal or both internal sources.

Two external input connectors for external feed of analog modulation signals are located on the front panel of the instrument.

Note:
    It is not possible to use analog frequency modulation simultaneously with digital frequency modulation or with analog or digital phase modulation.

Frequency Modulation Menu

The **Frequency Modulation** menu is opened in the **Modulation** function block or using the MENU key under **Modulation**.
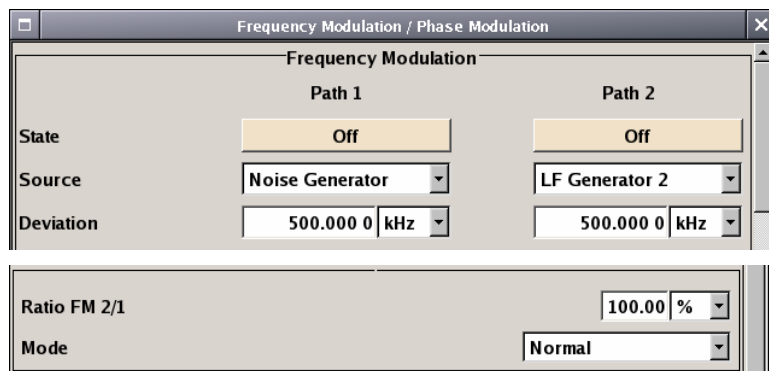
In the upper section of the menu, the frequency modulation is activated and configured.

In the middle section, the frequency of path 2/frequency path 1 ratio and the modulation mode are selected.
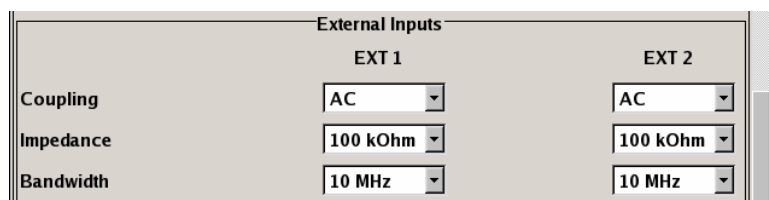
In the **External Inputs** section, the external inputs are configured. These settings affect all modulations which use the same external modulation sources. For a detailed description, see section "*External Modulation Sources*", page 4.57.

The **LF Frequency** field sets the frequency of LF generator 1/2. This setting affects all analog modulations which use the LF generator as the internal modulation source.

State – Frequency Modulation	Activates/deactivates FM.
	Activation of FM deactivates phase modulation.
	Remote-control command:
	`SOUR:FM1:STAT ON`

Source - Frequency Modulation	Selects the source for the FM signal.

	LF Generator 1/2	Selects the internal LF generator (either 1 or 2) as the source for frequency modulation.
		Remote-control command:
		`SOUR:FM1:SOUR LF1`

	EXT 1/2	Selects the external input (either **EXT 1** or **EXT 2**) as the source for frequency modulation.
		Remote-control command:
		`SOUR:FM1:SOUR EXT1`

	Noise Generator	Selects the internal noise generator as source for frequency modulation.
		Remote-control command:
		`SOUR:FM1:SOUR NOIS`

Deviation – Frequency Modulation

Sets the modulation depth in Hz.

The maximal deviation depends on the RF frequency set and the selected modulation mode (see data sheet). It is possible to enter a deviation that is too high for a certain RF frequency or to vary the RF frequency to a range in which the deviation can no longer be set. In this case, the maximum possible deviation is set and an error message is displayed.

Note:
> *The deviation of the internal source must not exceed the deviation of the external source.*

Remote-control command:
`SOUR:FM1:DEV 10kHz`

Ratio FM 2/1 – Frequency Modulation

Sets the deviation of path 2/deviation of path 1ratio.

For example, if the ratio is set to 50%, the deviation of path 2 will become 5 kHz if the deviation of path 1 is set to 10 kHz.

Remote-control command:
`SOUR:FM:RAT 50PCT`

Mode - Frequency Modulation

Selects the mode for the frequency modulation.

Normal   The maximum range for modulation bandwidth and FM deviation is available.

Remote-control command:
`SOUR:FM:MODE NORM`

Low Noise   Frequency modulation with phase noise and spurious characteristics close to CW mode. The range for modulation bandwidth and FM deviation is reduced (see data sheet).

Remote-control command:
`SOUR:FM:MODE LNO`

In the **External Inputs** section, the external inputs are configured. These settings affect all modulations which use the same external modulation sources. For a detailed description, see section "*External Analog Modulation Sources*", page 4.57.

LF Frequency Gen.1/2

Sets the frequency of LF generator 1/2. This setting affects all analog modulations which use the LF generator as the internal modulation source.

Remote-control command:
`SOUR:LFO:FREQ 1kHz`

Phase Modulation - PhiM

Note:
This modulation mode requires option R&S SMF-B20.

An internal and/or external source can be selected for phase modulation. Two LF generators and a noise generator are available as internal sources for a fully equipped instrument. Two-tone PhiM is possible by simultaneously switching on the external and internal or both internal sources.

Two external input connectors for external feed of analog modulation signals are located on the front panel of the instrument.

Note:
*It is not possible to use analog phase modulation simultaneously with digital phase modulation or with analog or digital frequency modulation.*

Phase Modulation Menu

The **Phase Modulation** menu is opened in the **Modulation** function block or using the $\boxed{\text{MENU}}$ key under **Modulation**.

```
√ Modulation On
  Pulse Modulation...
  Amplitude Modulation...
  Frequency Modulation...
  Phase Modulation...
  Digital Modulation...
```
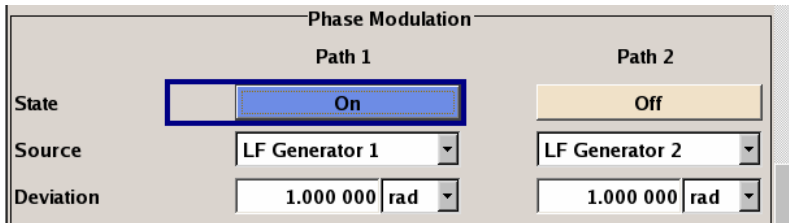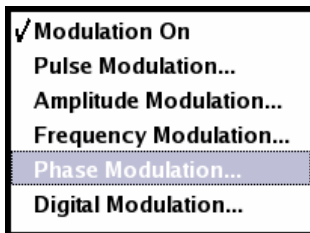
In the upper section of the menu, the phase modulation is activated and configured.
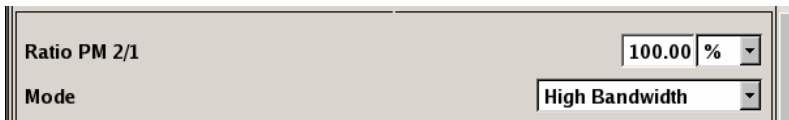
In the middle section, the phase modulation ratio and the modulation mode are selected.
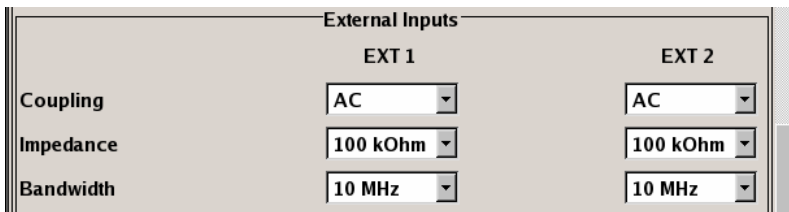
In the **External Inputs** section, the external inputs are configured. These settings affect all modulations which use the same external modulation sources. For a detailed description, see section "*External Modulation Sources*", page 4.57.

| LF Frequency | Gen. 1 | 1.000 00 | kHz | ▾ | Gen. 2 | 1.000 00 | kHz | ▾ | ▴▾ |

The **LF Frequency** field sets the frequency of LF generator 1/2. This setting affects all analog modulations which use the LF generator as the internal modulation source.

State – Phase Modulation

Activates/deactivates the phase modulation.

Activation of phase modulation deactivates frequency modulation.

Remote-control command:
SOUR:PM1:STAT ON

Source – Phase Modulation

Selects the source for the phase modulation signal.

LF Generator 1/2
Selects the internal LF generator (either 1 or 2) as the source for phase modulation.

Remote-control command:
SOUR:PM1:SOUR LF1

EXT 1/2
Selects the external input (either **EXT 1** or **EXT 2**) as the source for phase modulation.

Remote-control command:
SOUR:PM1:SOUR EXT1

Noise Generator
Selects the internal noise generator as source for phase modulation.

Remote-control command:
SOUR:PM1:SOUR NOIS

Deviation – Phase Modulation

Sets the modulation deviation in RAD or degrees.

The maximal deviation depends on the RF frequency set and the selected modulation mode (see data sheet). It is possible to enter a deviation that is too high for a certain RF frequency or to vary the RF frequency to a range in which the deviation can no longer be set. In this case, the maximum possible deviation is set and an error message is displayed.

Remote-control command:
SOUR:PM1:DEV 2.5

Ratio PM 2/1 – Phase Modulation

Sets the deviation of path 2/deviation of path 1 ratio.

For example, if the ratio is set to 50%, the deviation of path 2 will become 5 kHz if the deviation of path 1 is set to 10 kHz.

Remote-control command:
SOUR:PM1:RAT 50PCT

Mode – Phase Modulation   Selects the mode for the phase modulation.

High Bandwidth
The maximum range for modulation bandwidth is available. However, phase noise is increased for low frequencies. The range for PhiM deviation is limited.

This mode is recommended for high modulation frequencies.

Remote-control command:
SOUR:PM:MODE HBAN

High Deviation
The maximum range for PhiM deviation is available. Phase noise is improved for low frequencies compared to **High Bandwidth** mode. The range for modulation frequency is limited (see data sheet).

This mode is recommended for low modulation frequencies and high PhiM deviation.

Remote-control command:
SOUR:PM:MODE HDEV

Low Noise
Phase modulation with phase noise and spurious characteristics close to CW mode. The range for modulation bandwidth and PM deviation is reduced (see data sheet).

Remote-control command:
SOUR:PM:MODE LNO

In the **External Inputs** section, the external inputs are configured. These settings affect all modulations which use the same external modulation sources. For a detailed description, see section "*External Analog Modulation Sources*", page 4.57.

LF Frequency Gen.1/2
Sets the frequency of LF generator 1/2. This setting affects all analog modulations which use the LF generator as the internal modulation source.

Remote-control command:
SOUR:LFO:FREQ 1kHz

Digital Modulation

Note:
    This modulation mode requires option R&S SMF-B20.

An internal and/or external source can be selected for digital modulation. The internal pulse generator source is available as internal source for a fully equipped instrument.

Two external input connectors for external feed of digital modulation signals are located on the front panel of the instrument.


Note:
    Activating a digital modulation mode can deactivate another digital or analog modulation mode. For an overview about the operating modes which operate simultaneously, see "Simultaneous Operating of Several Modulations or Other Operating Modes", page 4.58.

Digital Modulation Menu

The **Digital Modulation** menu is opened in the **Modulation** function block or using the MENU key under **Modulation**.
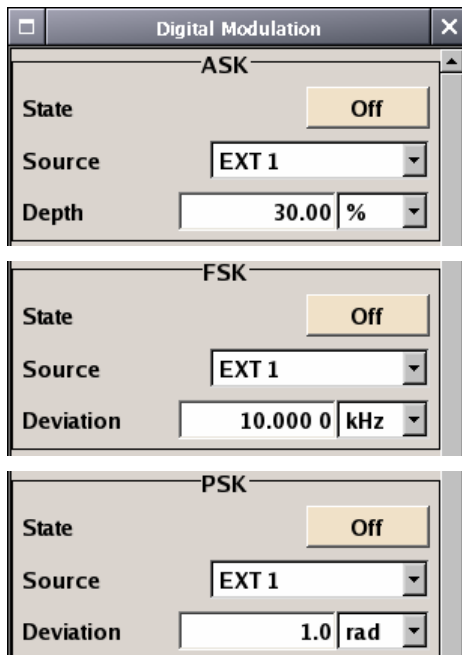
In the **ASK** section, the modulation signal of type ASK (amplitude shift keying) is configured.

In the **FSK** section, the modulation signal of type FSK (frequency shift keying) is configured.

In the **PSK** section, the modulation signal of type PSK (phase shift keying) is configured.
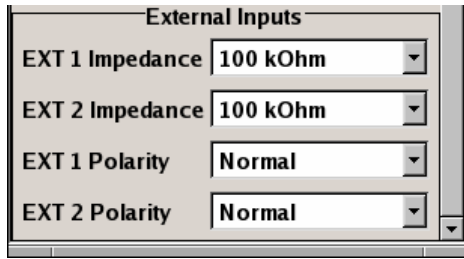
In the **External Inputs** section, the external inputs are configured. These settings affect all modulations which use the same external modulation sources. For a detailed description, see section "*External Modulation Sources*", page 4.57.

State – ASK

Activates/deactivates ASK modulation.

Remote-control command：
SOUR:DM:ASK:STAT ON

Source – ASK

Selects the source for the ASK modulation signal.

EXT 1/2   Selects the external inputs (either **EXT 1** or **EXT 2**) as the source for ASK modulation.

Remote-control command:
SOUR:DM:ASK:SOUR EXT1

Pulse Generator   Selects the internal pulse generator as source for ASK modulation.

Remote-control command:
SOUR:DM:ASK:SOUR PGEN

Random   Selects random pulses generated by the noise generator as the source for ASK modulation.

Remote-control command:
SOUR:DM:ASK:SOUR RAND

Depth – ASK

Sets the modulation depth for ASK modulation.

Remote-control command：
SOUR:DM:ASK:DEPT 100 PCT

State – FSK

Activates/deactivates FSK modulation.

Remote-control command：
SOUR:DM:FSK:STAT ON

Source – FSK

Selects the source for the FSK modulation signal.

EXT 1/2 Selects the external inputs (either **EXT 1** or **EXT 2**) as the source for FSK modulation.

Remote-control command:
SOUR:FSK:SOUR EXT1

Pulse Generator Selects the internal pulse generator as source for FSK modulation.

Remote-control command:
SOUR:FSK:SOUR PGEN

Random Selects random pulses generated by the noise generator as the source for FSK modulation.

Remote-control command:
SOUR:FSK:SOUR RAND

Deviation – FSK

Sets the frequency deviation for FSK modulation.

Remote-control command:
SOUR:DM:FSK:DEV 5Hz

State – PSK

Activates/deactivates PSK modulation.

Remote-control command:
SOUR:DM:PSK:STAT ON

Source – PSK

Selects the source for the PSK modulation signal.

EXT 1/2 Selects the external inputs (either **EXT 1** or **EXT 2**) as the source for PSK modulation.

Remote-control command:
SOUR:PSK:SOUR EXT1

Pulse Generator Selects the internal pulse generator as source for PSK modulation.

Remote-control command:
SOUR:PSK:SOUR PGEN

Random Selects random pulses generated by the noise generator as the source for PSK modulation.

Remote-control command:
SOUR:PSK:SOUR RAND

Deviation – PSK   Sets the frequency deviation for PSK modulation.

Remote-control command:
`SOUR:DM:PSK:DEV 30RAD`

In the **External Inputs** section, the external inputs are configured. These settings affect all modulations which use the same external modulation sources. For a detailed description, see section "*External Digital Modulation Sources*", page 4.58.

Pulse Modulation

External and internal pulse modulation is available for the basic unit without additional equipment options. A standard pulse generator is available for internal modulation.

The external signal is input via the PULSE IN connector at the front of the instrument. The connector can be used as trigger input for internal pulse modulation. The external pulse signal is output at the VIDEO connector at the back of the instrument.

Internal Pulse Modulation with extended features, e.g. generation of double pulse, requires option R&S SMF-K23, Pulse Generator. The pulse signal is output at the PULSE OUT connector at the front of the instrument.


Narrow pulse modulation is provided by option R&S SMF-K3.

Note:
> *It is not possible to use pulse modulation simultaneously with digital amplitude modulation or with digital frequency modulation.*


Pulse Modulation Menu

The **Pulse Modulation** menu is opened in the **Modulation** function block or using the MENU key under **Modulation**.
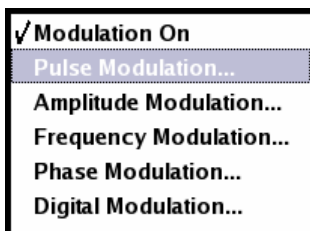
Note:
> *The menu differs according to the selected internal or external modulation source.*
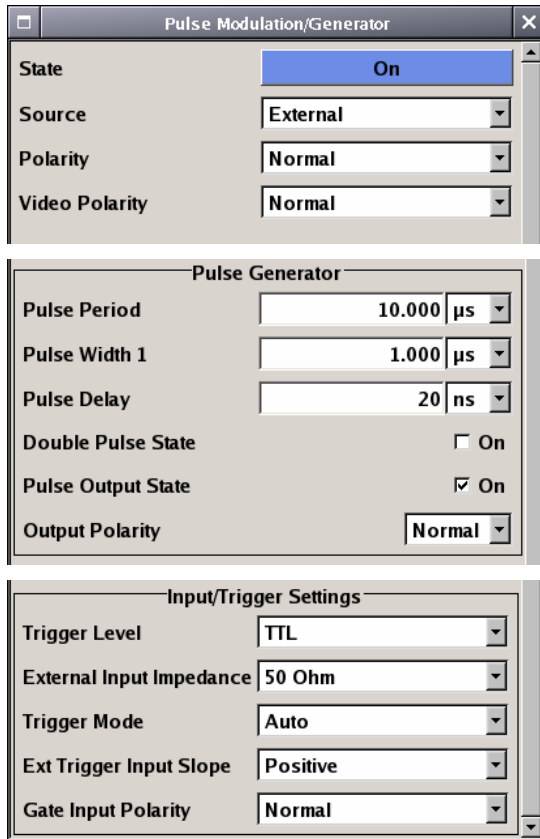
The upper section is where the pulse modulation is activated and configured.

In the **Pulse Generator** section, the pulse generator signal is configured. For a detailed description, see section "*Pulse Generator*", page 4.88.

In the **Input/Trigger Settings** section, the external input and trigger are configured.

State - Pulse Modulation

Activates/deactivates pulse modulation. If modulation source **Pulse Generator** is selected (requires option R&S SMF-K23), the pulse generator has to be switched on, in addition.

Remote-control command:
SOUR:PULM:STAT ON

Selects the source for the pulse modulation signal.

Source - Pulse Modulation

	Pulse Generator	Selects the internal pulse generator option with enhanced functions (option R&S SMF-K23). The characteristics of the generated pulse can be set in a wide range, double pulse generation is possible.

Remote-control command:
SOUR:PULM:SOUR COD |
| | **External** | Selects the external source. The external modulation signal is input via the **PULS IN** connector.

Remote-control command:
SOUR:PULM:SOUR EXT |

	Random	Selects random pulses generated by the noise generator as the source for pulse modulation.
		Remote-control command: SOUR:PULM:SOUR RAND

Polarity - Pulse Modulation

(This feature is available for source mode External only)

Selects the polarity of the external modulation signal.

	Normal	The RF level is ON while the level is HIGH.
		Remote-control command: SOUR:PULM:POL NORM
	Inverse	The RF level is ON while the level is LOW.
		Remote-control command: SOUR:PULM:POL INV

Video Polarity - Pulse Modulation

Selects the polarity of the internal pulse video signal.

	Normal	The RF level is ON while the level is HIGH.
		Remote-control command: SOUR:PULM:OUTP:VID:POL NORM
	Inverse	The RF level is ON while the level is LOW.
		Remote-control command: SOUR:PULM:OUTP:VID:POL INV

In the **Pulse Generator** section, the pulse generator signal is configured. For a detailed description, see section "*Pulse Generator*", page 4.88.

In the **Input/Trigger Settings** section, the external input and trigger are configured.

Trigger Level – Input/Trigger Settings

Selects the external trigger level.

Remote-control command:
SOUR:PULM:TRIG:EXT:LEV M2V5

External Input Impedance – Input/Trigger Settings

Selects the impedance for external pulse trigger.

Remote-control command:
SOUR:PULM:TRIG:EXT:IMP G50

Trigger Mode –
Input/Trigger Settings

Selects the trigger mode for external pulse modulation.

Auto   The pulse modulation is generated continuously.

Remote-control command:
SOUR:PULM:TRIG:MODE AUTO

Ext Single   The pulse modulation is triggered by an external trigger event. The trigger signal is supplied via the **PULSE IN** connector.

Remote-control command:
SOUR:PULM:TRIG:MODE EXT

Ext Gated   The pulse modulation is gated by an external gate signal. The signal is supplied via the **PULSE IN** connector.

Remote-control command:
SOUR:PULM:TRIG:MODE EGAT

Ext Trigger Input Slope –
Input/Trigger Settings

Selects the active slope of the external trigger signal.

Positive   The pulse generator is triggered on the positive slope of the external signal.

Remote-control command:
SOUR:PULM:TRIG:EXT:SLOP POS

Negative   The pulse generator is triggered on the negative slope of the external signal.

Remote-control command:
SOUR:PULM:TRIG:EXT:SLOP NEG

Gate Input Polarity –
Input/Trigger Settings

Selects the active level of the gate signal.

Remote-control command:
SOUR:PULM:TRIG:GAT:POL NORM

LF Gen./Noise

The **LF Gen./Noise** block provides two internal LF generators and a noise generator which can be used as internal modulation sources for analog modulations (amplitude modulation, frequency modulation, phase modulation). The LF/Noise generators can also be used as the signal source for the LF output at the front of the instrument.

Note:
    The internal LF/Noise generators require option R&S SMF-B20.

Both LF generators providing sinusoidal signals in the frequency range 0.1 Hz to 10 MHz with selectable signal shapes e.g. sine waves, triangle/ pulse/ trapezoid signals.

The LF frequency settings for the LF generator can be made in the **LF Gen./Noise** menu, **LF Output** menu, and analog modulation menus.

A change to the frequency of the LF generator automatically has an effect on modulation if the LF generator is selected as the modulation source. For example, a change to the frequency of the first LF generator automatically has an effect on the amplitude modulation if the first LF generator is selected as the AM modulation source (i.e. LF Generator 1 is selected as **Source**). On the other hand, changing the frequency in the **Amplitude Modulation** menu has an effect to the LF output signal.

The LF frequency sweep mode is activated in the **LF Frequency Sweep** menu. The LF level sweep is activated in the **LF Level Sweep** menu of the **LF Output** block.

The Noise generator supplies noise with selectable bandwidth and level distribution.

LF Generator/Noise Menu

The **LF Generator/Noise** menu is opened in the **LF Gen./Noise** function block or using the MENU key under **LF Gen./Noise**.
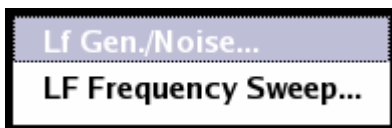
The menu is used to perform the settings regarding the LF and noise generation.

In the **LF Gen. 1** section, the frequency and waveform shape settings for the first LF generator can be made.

In the **LF Gen. 2** section, the settings for the second LF generator can be made according to **LF Gen.1**.

In the **Noise Generator** section, the settings for the level distribution and the bandwidth for the noise can be made.

Frequency – LF Generator

Sets the frequency of LF generator 1/2. This setting affects all analog modulations which use the LF generator as the internal modulation source.

Remote-control command:
```
SOUR:LFO:FREQ 1kHz
```

Shape - LF Generator

Selects the waveform shape of the LF signal.

Remote-control command:
```
SOUR:LFO2:SHAP SQU
```

Period – LF Generator

(This feature is available for shape mode Pulse, Triangle, or Trapezoid only)

Sets the period of the generated shape. The period determines the repetition frequency of the internal signal.

Remote-control command:
```
SOUR:LFO1:SHAP:PULS:PER 10s
SOUR:LFO1:SHAP:TRIA:PER 13s
SOUR:LFO1:SHAP:TRAP:PER 100s
```

Pulse Width – LF Generator

(This feature is available for shape mode Pulse only)

Sets the width of the generated pulse. The width determines the pulse length.

Remote-control command:
`SOUR:LFO2:SHAP:PULS:WIDT 10s`

Pulse Duty Cycle – LF Generator

(This feature is available for shape mode Pulse only)

Sets the duty cycle for the shape pulse.

Remote-control command:
`SOUR:LFO2:SHAP:PULS:DCYC 50PCT`

Triangle Period – LF Generator

(This feature is available for shape mode Triangle only)

Sets the period of the generated triangle shape.

```
Remote-control command:
LFO1:SHAP:TRIA:PER 13s
```

Triangle Rise – LF Generator

(This feature is available for shape mode Triangle only)

Sets the triangle shape rise time.

Remote-control commands:
`SOUR:LFO1:SHAP:TRI:RISE 13s`

Trapezoid Period – LF Generator

(This feature is available for shape mode Trapezoid only)

Sets the period of the generated trapezoid shape.

```
Remote-control command:
LFO2:SHAP:TRAP:PER 50s
```

Trapezoid Rise – LF Generator

(This feature is available for shape mode Trapezoid only)

Sets the trapeze shape rise time.

Remote-control command:
`SOUR:LFO1:SHAP:TRAP:RISE 50us`

Trapezoid Fall – LF Generator

(This feature is available for shape mode Trapezoid only)

Sets the fall time for the trapeze shape of the LF generator.

Remote-control command:
`SOUR:LFO1:SHAP:TRAP:FALL 200us`

Trapezoid High – LF Generator

(This feature is available for shape mode Trapezoid only)

Sets the high time for the trapeze shape of the LF generator.

Remote-control command:
`SOUR:LFO1:SHAP:TRAP:HIGH 50s`

The settings for the noise source are offered in the **Noise Generator** section of the menu. The settings affect all analog modulations which use the noise generator as the internal modulation source.

Distribution - Noise   Selects the noise power density distribution of the noise.

                     Gaussian   The noise power density has a Gaussian distribution.

                                 Remote-control command:
                                 `SOUR:NOIS:DIST GAUS`

                     Equal   The noise power density has an even distribution.

                                 Remote-control command:
                                 `SOUR:NOIS:DIST EQU`

Bandwidth - Noise   Enters the noise bandwidth. Distinct bandwidth settings between 100 kHz and 10 MHz in 100 kHz steps (range 100 .. 1 MHz), 1 MHz (range 1 MHz .. 5 MHz) and 5 MHz (5 MHz … 10 MHz) are possible.

The noise signal is generated within the set frequency bandwidth. The noise level in the frequency band is indicated at **Noise level (System Bandwidth)**.

Remote-control command:
`SOUR:NOIS:BWID 300kHz`

Noise Density - Noise   Indicates the level of the noise signal for a bandwidth of 1 Hz.

Remote-control command:
`SOUR:NOIS:LEV:REL?`

Noise Level - Noise   Indicates the level of the noise signal per Hz in the total bandwidth.

Remote-control command:
`SOUR:NOIS:LEV:ABS?`

LF Frequency Sweep Menu

The **LF Frequency Sweep** menu is opened in the **LF Gen./Noise** function block or using the $\boxed{\text{MENU}}$ key under **LF Gen./Noise**.
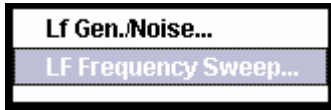
The menu is used to activate and configure a sweep for the LF frequency.
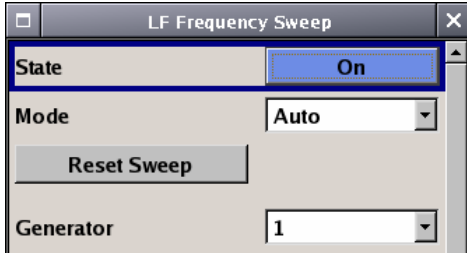
In the top section, the LF sweep mode is activated and the sweep mode is selected. The buttons are used to reset the LF sweep (all sweep modes) or to execute the LF sweep (**Single** mode).
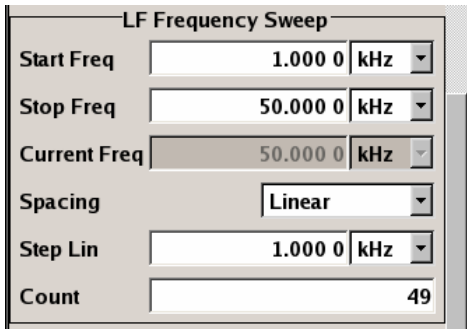
In the **LF Frequency Sweep** section, the sweep range, sweep spacing, and other settings regarding the sweep can be done.
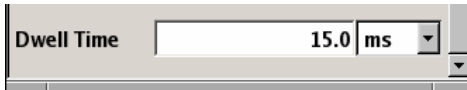
In the bottom section, the dwell time and the trigger slope can be set.

State - LF Frequency Sweep

Activates/deactivates LF sweep mode.

Note:
  Activating the LF frequency sweep automatically deactivates the RF frequency sweep, RF level sweep, and LF level sweep.

Remote-control commands:
SOUR:LFO:FREQ:MODE SWE

Mode - LF Frequency Sweep   Selects the sweep instrument operating mode and sweep mode.

Auto   Sets an automatic repeated sweep cycle. If a different sweep mode was activated prior to the **Auto** mode, the cycle continues from the current sweep setting.

Remote-control commands:
```
SOUR:LFO:SWE:FREQ:MODE AUTO
TRIG:LFFS:SOUR AUTO
SOUR:LFO:FREQ:MODE SWE
```

Single   Sets a single sweep cycle. The sweep is triggered by the **Execute Single Sweep** button.

If a different sweep mode was activated prior to the **Single** mode, the current sweep is stopped. The **Single** sweep always starts at the start frequency.

Remote-control commands:
```
SOUR:LFO:SWE:FREQ:MODE AUTO
TRIG:LFFS:SOUR SING
SOUR:LFO:FREQ:MODE SWE
SOUR:LFO:SWE:FREQ:EXEC
```

Step   Sets a step-by-step sweep cycle. Each sweep step is triggered by a variation of the value in the **Current Freq** entry window.

If this mode is activated, the cursor moves to the value displayed for **Current Freq**. If a different sweep mode was activated prior to the **Step** mode, the current sweep is stopped. The **Step** sweep starts at the current LF frequency.

Remote-control commands:
```
SOUR:LFO:SWE:FREQ:MODE MAN
SOUR:LFO:FREQ:MAN 12kHz
SOUR:LFO:FREQ:MODE SWE
SOUR:LFO:FREQ:MAN 14kHz
SOUR:LFO:FREQ:MAN 16kHz
```

Extern Single   Sets a single sweep cycle. The sweep is triggered by an external trigger signal.

If a different sweep mode was activated prior to the **Extern Single** mode, the current sweep is stopped. The **Extern Single** sweep always starts at the start frequency.

The external trigger signal is input at the rear of the instrument (BNC connector TRIGGER or AUX connector).

Remote-control command:
```
SOUR:LFO:SWE:FREQ:MODE AUTO
TRIG:LFFS:SOUR EXT
SOUR:LFO:FREQ:MODE SWE
```

Extern Step   Sets a step-by-step sweep cycle. Each sweep step is triggered by an external trigger signal (trigger source as described under **Extern Single**). The step width corresponds to the step width set for the rotary knob.

If a different sweep mode was activated prior to the **Extern Step** mode, the current sweep is stopped. The **Extern Step** sweep always starts at the LF start frequency.

Remote-control commands:
```
SOUR:LFO:SWE:FREQ:MODE STEP
SOUR:LFO:SWE:FREQ:SPAC LIN
SOUR:LFO:SWE:FREQ:STEP:LIN 1MHz
TRIG:LFFS:SOUR EXT
SOUR:LFO:FREQ:MODE SWE
```

Execute Single Sweep - LF Sweep

Triggers the sweep manually. A manual sweep can only be triggered if **Mode Single** is selected.

Remote-control commands
```
SOUR:LFO:SWE:FREQ:MODE AUTO
TRIG0:SWE:SOUR SING
SOUR:LFO:FREQ:MODE SWE
SOUR:LFO:SWE:FREQ:EXEC
```

Reset Sweep - LF Frequency Sweep

Resets the sweep. The start frequency is set and the next sweep starts from there.

Remote-control command: n.a.

Generator - LF Frequency Sweep

Sets the source for the LF sweeps.

Remote-control command:
```
SOUR:LFO:SWE:LFS LF1
```

Start Freq - LF Frequency Sweep

Sets the start frequency for the LF sweeps.

Remote-control command：
SOUR:LFO:FREQ:STAR 100kHz

Stop Freq - LF Frequency Sweep

Sets the stop frequency for the LF sweeps.

Remote-control command：
SOUR:LFO:FREQ:STOP 200kHz

Current Freq - LF Frequency Sweep

Displays the current frequency.

If **Step** is set, the frequency for the next frequency step of the sweep is entered here.

Remote-control command
SOUR:LFO:FREQ:MAN 15kHz

Spacing - LF Frequency Sweep

Selects linear or logarithmic sweep spacing.

Remote-control command：
SOUR:LFO:SWE:FREQ:SPAC LIN

Step Lin/Log - LF Frequency Sweep

Sets the step width for the individual sweep steps. This entry is effective for all sweep modes.

Step Lin or **Step Log** is displayed depending on whether **Spacing Lin** or **Log** is selected.

Step Lin   With the linear sweep, the step width is a fixed frequency value which is added to the current frequency. The linear step width is entered in Hz.

Remote-control command：
SOUR:LFO:SWE:FREQ:STEP:LIN 1kHz

Step Log   With the logarithmic sweep, the step width is a constant fraction of the current frequency. This fraction is added to the current frequency. The logarithmic step width is entered in %.

Remote-control command:
SOUR:LFO:SWE:FREQ:STEP:LOG 1PCT

Count - LF Frequency Sweep

Sets the number of sweep steps.

Remote-control command:
SOUR:LFO:SWE:FREQ:POIN 501

Dwell Time - LF Frequency Sweep

Sets the dwell time. The dwell time determines the duration of the individual sweep steps.

Remote-control command：
```
SOUR:LFO:SWE:FREQ:DWEL 10ms
```

Trigger Slope - LF Frequency Sweep

Sets the polarity of the active slope of an applied instrument trigger.

This setting affects the TRIGGER input (BNC connector at the rear of the instrument or AUX connector).

Positive   The rising edge of the trigger signal is active.

Remote-control command:
```
SOUR:INP:TRIG:SLOP POS
```

Negative   The falling edge of the trigger signal is active.

Remote-control command:
```
SOUR:INP:TRIG:SLOP NEG
```

LF Output

The LF Output function block is used to configure the LF output.

The internal LF generators, the noise generator, or the external inputs **EXT 1** and **EXT 2** can be selected as source.

Note:
*   The LF Output requires option R&S SMF-B20.*

LF Output Menu

The **LF Output** menu is opened in the **LF Output** function block or using the $\boxed{\text{MENU}}$ key under **LF Output**.
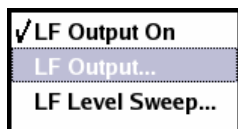
The menu is used to perform the settings regarding the LF output.
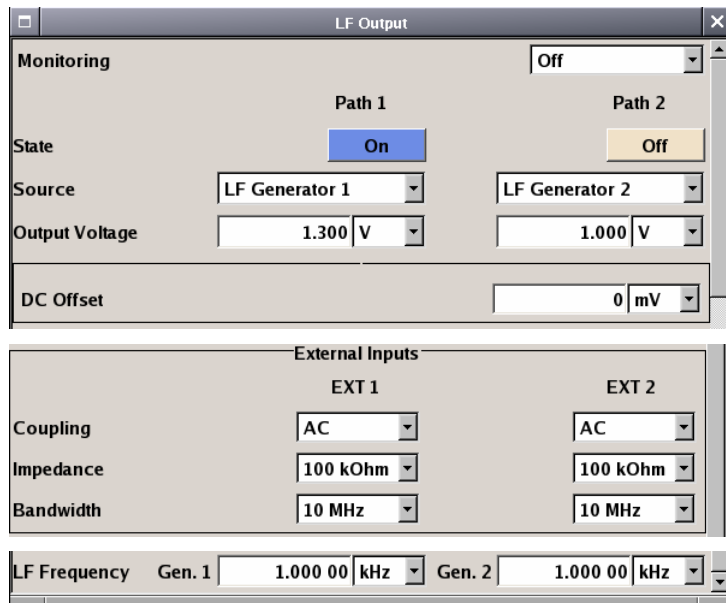
In the upper section of the menu, the LF output is activated and configured.

In the **External Inputs** section, the external inputs are configured. For a detailed description, see section "*External Modulation Sources*", page 4.57.

The **LF Frequency** field displays the LF frequency as adjusted in the **LF Gen./Noise** menu. This value can also be changed.

Monitoring - LF Output

Selects the LF output monitoring mode. The settings for the LF output are synchronized to amplitude modulation or frequency/phase modulation settings.

Remote-control command:
SOUR:LFO:MON:MODE AM

State - LF Output

(This feature is available for monitoring mode Off only)

Activates/deactivates the LF Output.

The selected modulation signal is output at the LF output connector at the front of the instruments.

Remote-control command：
SOUR:LFO1:STAT ON

Source – LF Output

(This feature is available for monitoring mode Off only)

Selects the internal and/or external source to be used for the LF output signal.

	LF Generator 1/2	Selects one of the internal LF generators as the source for the LF output signal.
		Remote-control command: `SOUR:LFO1:SOUR LF1`
	EXT 1/2	Selects one of the external inputs as the source for the LF output signal.
		Remote-control command: `SOUR:LFO1:SOUR EXT1`
	Noise Generator	Selects the internal noise signal. The LF output signal is noise either with gaussian distribution or equal distribution.
		Remote-control command: `SOUR:LFO1:SOUR NOIS`

Output Voltage - LF Output

(This feature is available for monitoring mode Off only)

Sets the output voltage of the LF output. The entered value determines the peak voltage.

Remote-control command:
`SOUR:LFO1:VOLT 1 V`

DC Offset - LF Output

(This feature is available for monitoring mode Off only)

Sets a DC offset at the LF Output.

Remote-control command:
`SOUR:LFO:OFFS  -0.5V`

In the **External Inputs** section, the external inputs are configured. For a detailed description, see section "*External Analog Modulation Sources*", page 4.57.

LF Frequency Gen.1/2 – LF Output

Displays the LF frequency as adjusted in the **LF Gen./Noise** menu. This value can also be changed.

Remote-control command:
`SOUR:LFO2:FREQ 1E3`

LF Level Sweep Menu

The **LF Level Sweep** menu is opened in the **LF Output** function block or using the ⬚MENU⬚ key under **LF Output**.

| √ LF Output On |
| LF Output... |
| LF Level Sweep... |

The menu is used to activate and configure a sweep for the LF level.
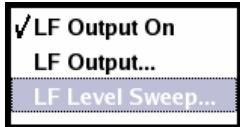
LF Level Sweep	✕
State	On
Mode	Auto ▾
Reset Sweep	
Generator	1 ▾
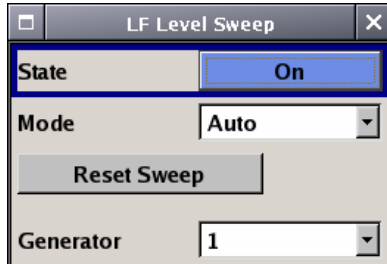
In the top section, the LF level sweep mode is activated and the sweep mode is selected. The buttons are used to reset the LF level sweep or to execute the LF sweep (**Single** mode).

─LF Level Sweep─		
Start Level	1.000	V ▾
Stop Level	3.000	V ▾
Current Level	1.000	V ▾
Step	0.100	V ▾
Count		20
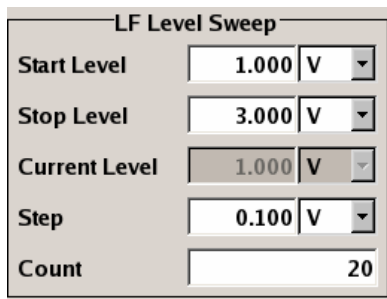
In the **LF Level Sweep** section, the sweep range, sweep spacing, and other settings regarding the sweep can be done.

| Dwell Time | 10.0 | ms ▾ |
| Trigger Slope | Negative | ▾ |
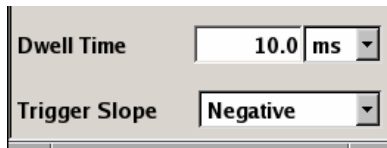
In the bottom section, the dwell time and the trigger slope can be set.

State - LF Level Sweep

Activates/deactivates LF level sweep mode.

Note:
  Activating the LF level sweep automatically deactivates the RF frequency sweep, RF level sweep, and LF frequency sweep.

Remote-control commands:
SOUR:LFO:VOLT:MODE SWE

Mode - LF Level Sweep

Selects the sweep instrument operating mode and sweep mode.

Auto   Sets an automatic repeated sweep cycle. If a
                      different sweep mode was activated prior to the
                      Auto mode, the cycle continues from the current
                      sweep setting.

                      Remote-control commands:
                      ```
                      SOUR:LFO:SWE:VOLT:MODE AUTO
                      TRIG:LFVS:SOUR AUTO
                      SOUR:LFO:VOLT:MODE SWE
                      ```

Single   Sets a single sweep cycle. The sweep is triggered
                      by the **Execute Single Sweep** button.

                      If a different sweep mode was activated prior to the
                      Single mode, the current sweep is stopped. The
                      Single sweep always starts at the start frequency.

                      Remote-control commands:
                      ```
                      SOUR:LFO:SWE:VOLT:MODE AUTO
                      TRIG:LFVS:SOUR SING
                      SOUR:LFO:VOLT:MODE SWE
                      SOUR:LFO:SWE:VOLT:EXEC
                      ```

Step   Sets a step-by-step sweep cycle. Each sweep step
                      is triggered by a variation of the value in the **Current
                      Freq** entry window.

                      If this mode is activated, the cursor moves to the
                      value displayed for **Current Freq**. If a different
                      sweep mode was activated prior to the **Step** mode,
                      the current sweep is stopped. The **Step** sweep
                      starts at the current LF frequency.

                      Remote-control commands:
                      ```
                      SOUR:LFO:SWE:VOLT:MODE STEP
                      TRIG:LFVS:SOUR SING
                      SOUR:LFO:VOLT:MAN 12kHz
                      TRIG:LFVS:SOUR SING
                      SOUR:LFO:VOLT:MODE SWE
                      SOUR:LFO:VOLT:MAN 14kHz
                      SOUR:LFO:VOLT:MAN 16kHz
                      ```

Extern Single   Sets a single sweep cycle. The sweep is triggered
                      by an external trigger signal.

                      If a different sweep mode was activated prior to the
                      Extern Single mode, the current sweep is stopped.
                      The **Extern Single** sweep always starts at the start
                      frequency.

                      The external trigger signal is input at the rear of the
                      instrument (BNC connector TRIGGER or AUX
                      connector).

                      Remote-control command:
                      ```
                      SOUR:LFO:SWE:VOLT:MODE AUTO
                      TRIG:LFVS:SOUR EXT
                      SOUR:LFO:VOLT:MODE SWE
                      ```

	Extern Step	Sets a step-by-step sweep cycle. Each sweep step is triggered by an external trigger signal (trigger source as described under **Extern Single**). The step width corresponds to the step width set for the rotary knob.

If a different sweep mode was activated prior to the **Extern Step** mode, the current sweep is stopped. The **Extern Step** sweep always starts at the LF start frequency.

Remote-control commands:
```
SOUR:LFO:SWE:VOLT:MODE STEP
SOUR:LFO:SWE:VOLT:STEP:LIN 2
TRIG:LFVS:SOUR EXT
SOUR:LFO:VOLT:MODE SWE
```

Execute Single Sweep - LF Level Sweep

Triggers the sweep manually. A manual sweep can only be triggered if **Mode Single** is selected.

Remote-control commands
```
SOUR:LFO:SWE:VOLT:MODE AUTO
TRIG:LFVS:SOUR SING
SOUR:LFO:VOLT:MODE SWE
SOUR:LFO:SWE:VOLT:EXEC
```

Reset Sweep - LF Level Sweep

Resets the sweep. The start frequency is set and the next sweep starts from there.

Remote-control command: n.a.

Generator - LF Level Sweep

Sets the source for the LF level sweep.

Remote-control command：
```
SOUR:LFO:SWE:VOLT:LFS LF2
```

Start Level- LF Level Sweep

Sets the start frequency.

Remote-control command：
```
SOUR:LFO:VOLT:STAR 5V
```

Stop Level - LF Level Sweep

Sets the stop frequency.

Remote-control command：
```
SOUR:LFO:VOLT:STOP 6V
```

Current Level - LF Level Sweep

Displays the current frequency.

If **Step** is set, the frequency for the next frequency step of the sweep is entered here.

Remote-control command:
```
SOUR:LFO:VOLT:MAN 15kHz
```

Step - LF Level Sweep Sets the step width for the individual sweep steps.

Remote-control command:
SOUR:LFO:SWE:VOLT:STEP:LIN 5V

Count - LF Level Sweep Sets the number of sweep steps.

Remote-control command：
SOUR:LFO:SWE:VOLT:POIN 25

Dwell Time - LF Level Sweep Sets the dwell time. The dwell time determines the duration of the individual sweep steps.

Remote-control command：
SOUR:LFO:SWE:VOLT:DWEL 10ms

Trigger Slope - LF Level Sweep Sets the polarity of the active slope of an applied instrument trigger.

This setting affects the TRIGGER input (BNC connector at the rear of the instrument or AUX connector).

Positive The rising edge of the trigger signal is active.

Remote-control command:
SOUR:INP:TRIG:SLOP POS

Negative The falling edge of the trigger signal is active.

Remote-control command:
SOUR:INP:TRIG:SLOP NEG

Pulse Generator

Settings for the internal pulse generator can be accessed in the block diagram by way of the **Pulse Gen.** function block, or by means of the menu with the same name which is opened using the MENU key.

The pulse generator provides single and double pulse modulation with selectable pulse widths and periods. The signal is output at the PULSE OUT connector.
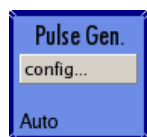
Note:
    The pulse generator is available with option R&S SMF-K23 only.

Pulse Generator Menu

The **Pulse Generator** menu is opened in the **Pulse Gen.** function block or using the MENU key under **Pulse Gen**. The same settings regarding the pulse generator as well as the settings regarding the pulse modulation can be made in the **Pulse Modulation** menu of the **Modulation** block, see section "*Pulse Modulation Menu*", page 4.70.
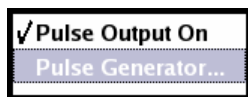
Pulse Output On
Pulse Generator...

Pulse Generator		
Pulse Period	10.000	µs
Pulse Width 1	1.000	µs
Pulse Delay	20	ns
Double Pulse State	□ On	
Pulse Output State	☑ On	
Output Polarity	Normal	

Pulse Period – Pulse Generator

Sets the period of the generated pulse. The period determines the repetition frequency of the internal signal.

Remote-control command:
SOUR:PULM:PER 2MS

Pulse Width 1/2 – Pulse Generator

Sets the width of the generated pulse. The width determines the pulse length. The pulse width must be at least 20 ns less than the set pulse period.

Remote-control command:
SOUR:PULM:WIDT 2MS

Pulse Delay – Pulse Generator

Sets the pulse delay. The pulse delay determines the time that elapses after a trigger event before pulse modulation starts. The pulse delay is not effective for double pulse generation.

Remote-control command:
SOUR:PULM:DEL 1MS

Double Pulse State – Pulse Generator

Activates/deactivates the double pulse generation. The two pulses are generated in one pulse period.

Remote-control command:
SOUR:PULM:DOUB:STAT ON

Double Pulse Delay – Pulse Generator	**(For Double Pulse only)**
	Sets the delay from the start of the first pulse to the start of the second pulse.
	Remote-control command: `SOUR:PULM:DOUB:DEL 1MS`
Pulse Output State – Pulse Generator	Activates/deactivates the pulse generator output.
	Remote-control command: `SOUR:PGEN:OUTP:STAT ON`
Output Polarity – Pulse Generator	Sets the polarity of the output signal (**PULSE OUT** connector).
	Remote-control command: `SOUR:PGEN:OUTP:POL INV`

The **Input/Trigger Settings** are described in section "*Pulse Modulation Menu*", page 4.70.

Attenuator

Settings for the attenuator can be accessed in the block diagram by way of the Attenuator function block, or by means of the menu with the same name which is opend using the MENU key.
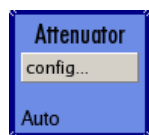
Note:
    The attenuator is available with option R&S SMF-B26 or B27 only.

Attenuator menu

The menu is used to set the attenuator for the RF output.
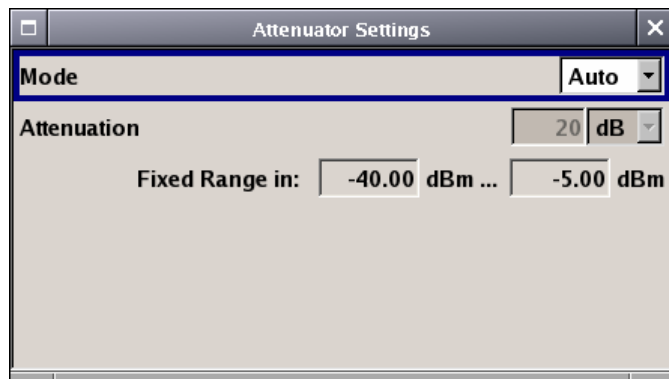
Mode – Attenuator Settings

Sets the attenuator mode at the RF output.

Auto

The mechanical attenuator switches in steps of 10 dB at fixed points.

Remote-control command:
```
OUTP:AMOD AUTO
```

Fixed

The attenuator is fixed at the current position.

Remote-control command:
```
OUTP:AMOD FIX
```

Attenuation – Attenuation Settings

Sets the attenuation. To enter a value in this field, the attenuator mode **Fixed** has to be selected. If **Auto** is selected, this field is read-only.

Remote-control commands:
```
SOUR:POW:ATT 20dB
```

Fixed Range in: - Attenuation Settings

Displays the level range in which the level is set without interruption for the attenuator mode **Fixed** setting.

Remote-control commands:
```
OUTP:AFIX:RANG:LOW?
OUTP:AFIX:RANG:UPP?
```

Contents Chapter 5 - Remote Control - Basics

5 Remote Control - Basics

Introduction - Remote Control Basics

This chapter provides:

- Instructions on how to set up the signal generator for remote control operation.
- A general introduction to remote control of programmable instruments. This includes the description of the command structure and syntax according to the SCPI standard, the description of command execution and of the status registers.

In chapter "*Remote Control - Commands*" all remote control functions are described in detail. The subsystems are listed by alphabetical order according to SCPI.

The instrument is equipped with the following interfaces for remote control:

- IEC/IEEE bus interface according to standard IEC 625.1/IEEE 488.2

Note:
> *This feature is only available with option R&S SMF-B83.*

- LAN interface: the network card uses 100 MHz Ethernet IEEE 802.3u; the protocol is based on the VXI-11 standard.
- USB interface type B available on the rear panel (option R&S SMF-B84)

The connectors are located at the rear of the instrument and permit a connection to a controller for remote control either directly or via a local area network (LAN). The remote control interfaces and their interface functions are described in Chapter "*Maintenance and Remote Control Interfaces*".

SCPI (**S**tandard **C**ommands for **P**rogrammable **I**nstruments) 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.
Not all of the commands supported by the instrument are taken from the SCPI standard, however, their syntax follows SCPI rules.

This section assumes basic knowledge of programming and operation of the controller. A description of the interface commands can be obtained from the relevant manuals.

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.

The program examples for IEC/IEEE-bus programming are all written in VISUAL BASIC. A condition for programming in VISUAL BASIC is that the modules NIGLOBAL (Niglobal.bas) and VBIB32 (Vbib_32.bas) are added to the projects.

Getting Started

The short and simple operating sequence given below permits fast putting into operation of the instrument and setting of its basic functions. As a prerequisite, the IEC/IEEE-bus address, which is factory-set to 28, must not have been changed.

➢ Connect instrument and controller using IEC/IEEE-bus cable and switch them on.

➢ Write and start the following program on the controller:

```
CALL IBFIND("DEV1", generator%)         'Open port to the instrument
CALL IBPAD(generator%, 28)              'Inform controller about instrument address
CALL IBWRT(generator%, "*RST;*CLS")     'Reset instrument
CALL IBWRT(generator%, "FREQ 50MHz")    'Set frequency to 50 MHz
CALL IBWRT(generator%, "POW -7.3dBm")   'Set output level -7.3m dBm
CALL IBWRT(generator%, "OUTP:STAT ON")  'Switch on RF output
CALL IBWRT(generator%, "AM1:STAT ON")   'Switch on AM
CALL IBWRT(generator%, "AM:SOUR LF1")   'Set AM modulation source LF1
CALL IBWRT(generator%, "LFO:FREQ 15kHz") 'Set modulation frequency to 15 kHz
CALL IBWRT(generator%, "AM 30PCT")      'Set AM modulation depth 30%
```

An amplitude-modulated signal is now applied at the RF-output of the instrument.

➢ To return to manual control, press the LOCAL key at the front panel.

Switchover to Remote Control

On power-on, the instrument is always in the manual operating state and can be operated via the front panel controls or via mouse and external keyboard.

In case of remote control via the IEC/IEEE bus, the instrument is set to remote control (REMOTE status) by means of an addressed command.
With remote control via Ethernet, remote control is not automatically set by means of a command. The instrument must be explicitly set to the REMOTE state, e.g. by sending the interface command `&GTR` (go to remote).

In the REMOTE state, instrument control from the front panel or via mouse and keyboard is disabled. Menus can be opened, however, e.g. to verify settings. Buttons and setting fields are displayed in gray and cannot be activated. REMOTE is displayed in the status line.

The instrument remains in the REMOTE mode until local control is selected either manually with the LOCAL key on the front panel or with the interface command `&GTL` via the remote-control interface.

Switching from manual operation to remote control and vice versa does not affect the remaining instrument settings.

In the remote control mode, the front-panel keys and an external mouse or keyboard that may be connected can be disabled with command `:SYST:KLOC ON`. Menus cannot be opened in this case and switchover from remote control to manual operation is only possible by means of a remote-control command. Inadvertent switchover with the LOCAL key is not possible in this case.

Operation of the LOCAL key alone can be disabled with interface command `&LLO`.

Remote Control via IEC/IEEE Bus

Note:
Remote control via IEC/IEEE bus is only available with option R&S SMF-B83.

To be able to control the instrument via the IEC/IEEE bus, instrument and controller must be linked by an IEC/IEEE-bus cable. An IEC/IEEE-bus card, the card drivers and the program libraries for the programming language used must be provided in the controller.

The controller must address the instrument with the set IEC/IEEE-bus address. The IEC/IEEE bus address of the instrument is factory-set to 28. It can be changed manually in the **Environment - GPIB** menu or via IEC/IEEE bus with command `SYSTem:COMMunicate:GPIB: ADDRess`. Addresses 0 to 30 are permissible.

Manually: **Setup - Remote - GPIB ...**
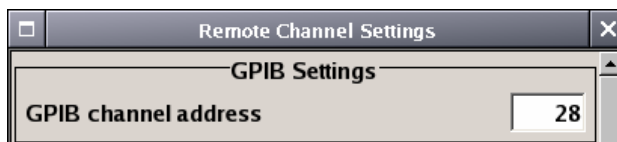
Via IEC/IEEE bus:

```
CALL IBFIND("DEV1", generator%)                   'Open port to the instrument

CALL IBPAD(generator%, 28)                        'Inform controller about old address

CALL IBWRT(generator%, "SYST:COMM:GPIB:ADDR 18")  'Set instrument to new address

CALL IBPAD(generator%, 18)                        'Inform controller about new address
```

Sending the first command starts remote control operation.

Return to manual operation is possible via the front panel or the IEC/IEEE bus.

Manually: ➢ *Press the* $\boxed{LOCAL}$ *key.*

Notes:
   Before the transition, command processing must be completed as otherwise transition to remote control is performed immediately.

   The $\boxed{LOCAL}$ *key can be disabled by the interface message &LLO (see Section "IEC/IEEE Bus Messages") in order to prevent unintentional transition. In this case, transition to manual mode is only possible via the IEC/IEEE bus.*

   The $\boxed{LOCAL}$ *key can be enabled again by deactivating the REN line of the IEC/IEEE bus (see Section "IEC/IEEE Bus Messages").*

Via IEC/IEEE bus: ...

`CALL IBLOC(generator%)`   'Set instrument to manual operation

                             ...

Remote Control via LAN Interface

For remote control via a network, the PC and the instrument must be connected via the LAN interface to a common network with TCP/IP network protocol.
Connection of the Signal Generator to a network and the querying of a computer name is described in section "*Connection to the Network*".

Software for instrument control and the VISA program library must be installed on the controller. Instrument control is via the VXI-11 standard protocol.
Only the IP address or the computer name is required for link setup. The IP address/computer name is part of the "visa resource string" used by the programs for identification and control of the instrument. The visa resource string has the form:

TCPIP::ipaddr::inst0::INSTR

ipaddr has to be replaced by the IP address or the computer name of the instrument.

For instance, if the instrument has the IP address 192.1.2.3, TCPIP::192.1.2.3::inst0::INSTR is the valid resource name. Specification of **inst0** in the resource name is optional. In this example, also TCPIP::192.1.2.3::INSTR is therefore a valid resource name.

A resource name with computer name could be TCPIP::RSSM1::INSTR, for instance.
TCPIP designates the network protocol used and **INSTR** indicates that the VXI-11 protocol is used.
If several instruments are connected to the network, each instrument has its own IP address and associated resource name. The controller identifies these instruments by means of the resource name.

In the example below, the program 'Measurement & Automation Explorer' from National Instruments is used for setting up an Ethernet remote-control link. Link setup with this program is easy and first tests can be performed. The R&S Signal Generator is preconfigured for networks using DHCP (dynamic host configuration protocol). If this configuration is used, the computer name must be entered at the position of the IP address. It is also possible to assign a fixed IP address to the instrument.

Setting up Control of the Signal Generator in the 'Measurement & Automation Control' Program.

➢ Start program on the controller

➢ Open the **Create new** menu with the right mouse key.
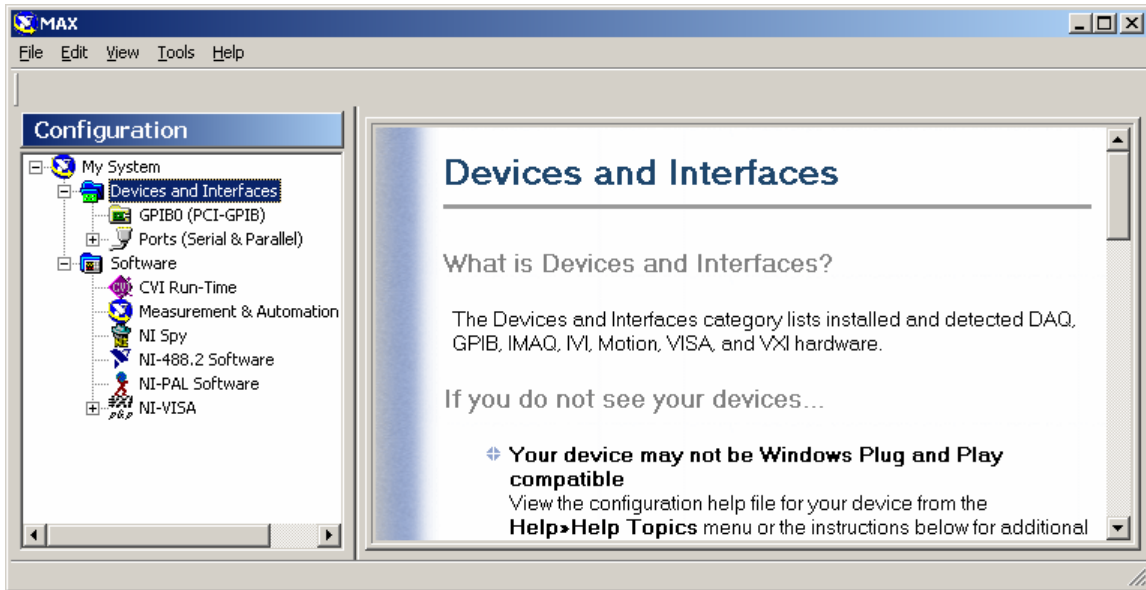
➢ Select **TCP/IP Resource** and open the next page of the **Create new** menu with the right mouse key.
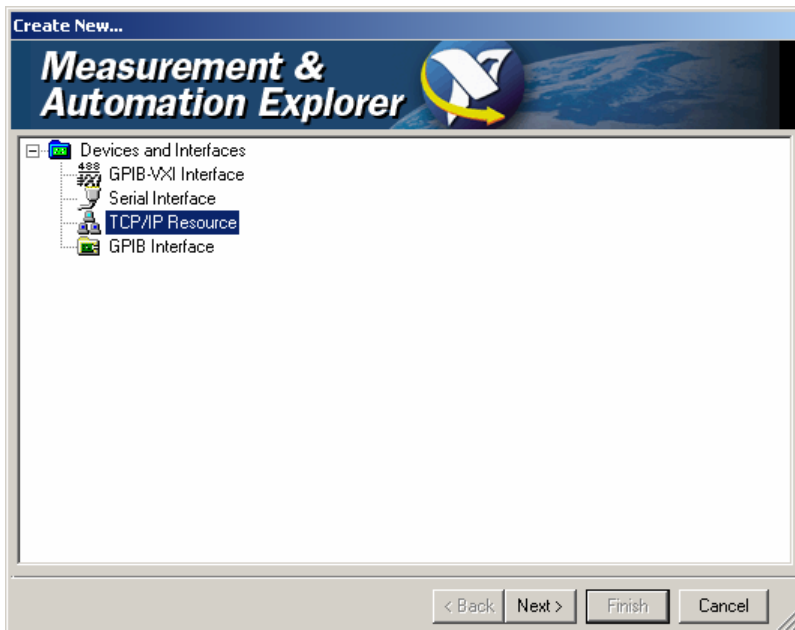
➢ Enter the IP address of the Signal Generator and select **VXI-11 Instrument**
  (the computer name may be entered instead).
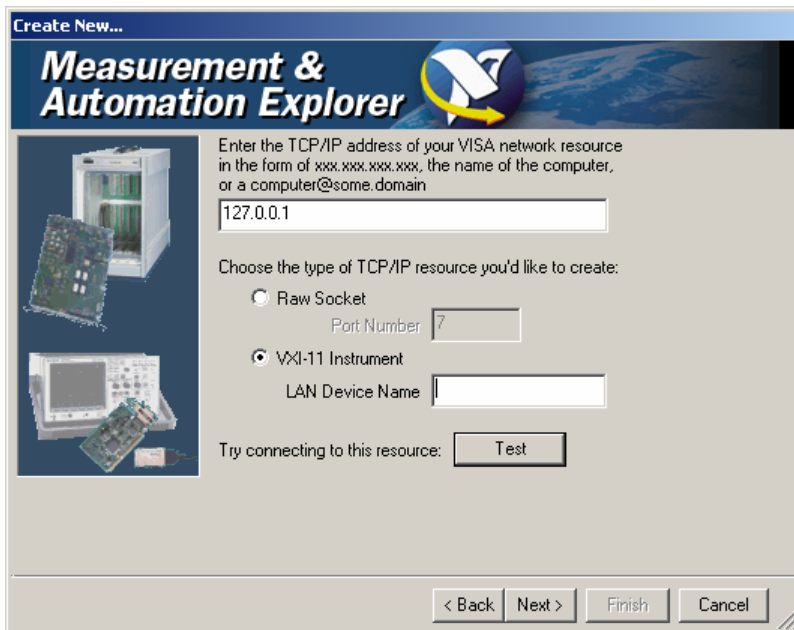
➢ Press the **Test** button
  A message indicates whether the link to the Signal Generator can be set up or not. If a connection cannot be set up, check whether the controller and the instrument are connected to the network (network cable) and switched on. Correct spelling of the IP address or the computer name can also be checked. For further error location, inform the network administrator. In large networks, specification of additional addresses may be required for link setup, e.g. gateway and subnet mask, which are known to the network administrator.
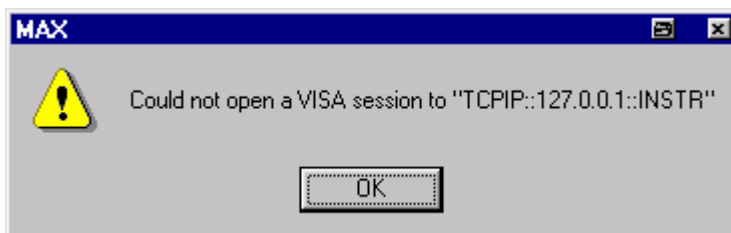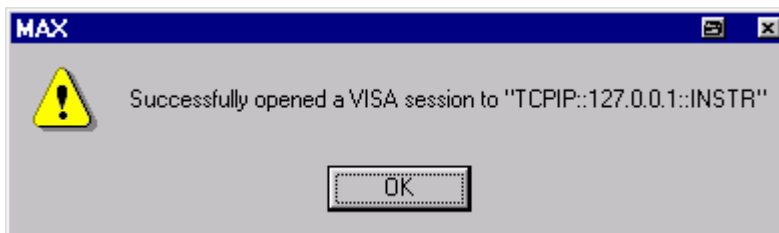
➢ Press the **Next** button. An alias name for the instrument can be entered in the next window. This name must not be mistaken for the computer name. It is only used for instrument identification within the program and displayed in the menu as an option in case of an Ethernet link.
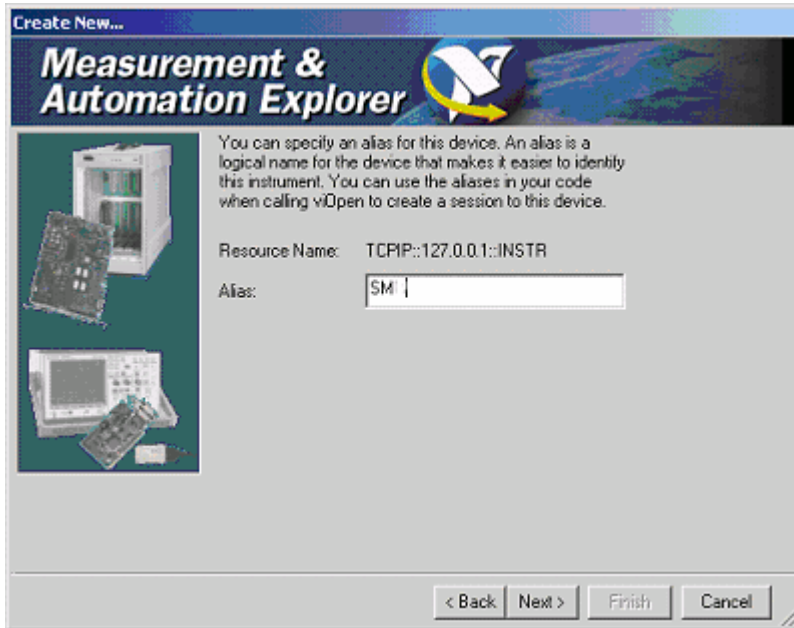
➢ Press **Next** and then the **Finish** button.
The instrument is now registered in the program and can be addressed via the resource or alias name.
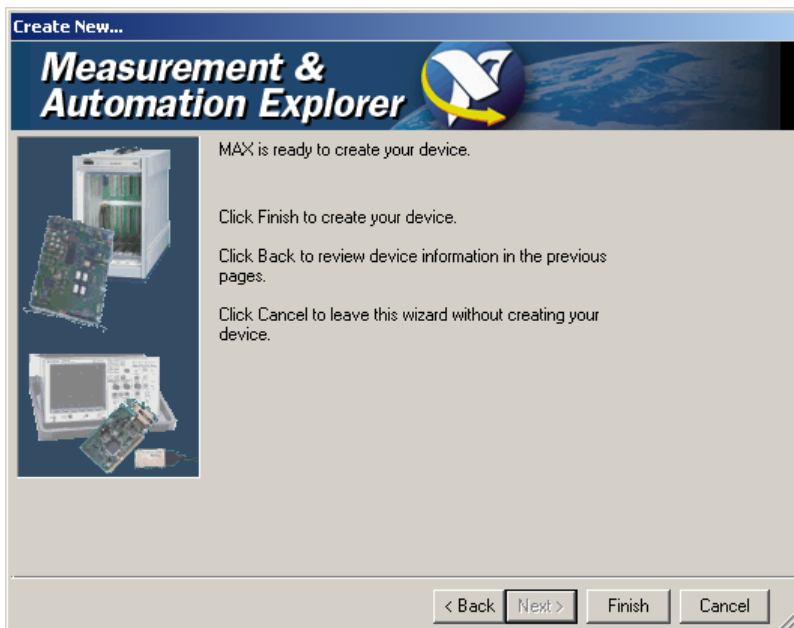
Starting the Measurement & Automation program for remote control of the Signal Generator

➢ Start program on the controller

➢ In the **Configuration** window**,** open **Instruments and Interfaces** and select R&S **SM** (= Alias) under **VISA Ethernet Devices**.

➢ Open the menu by clicking **Open VISA Session** with the right mouse key.
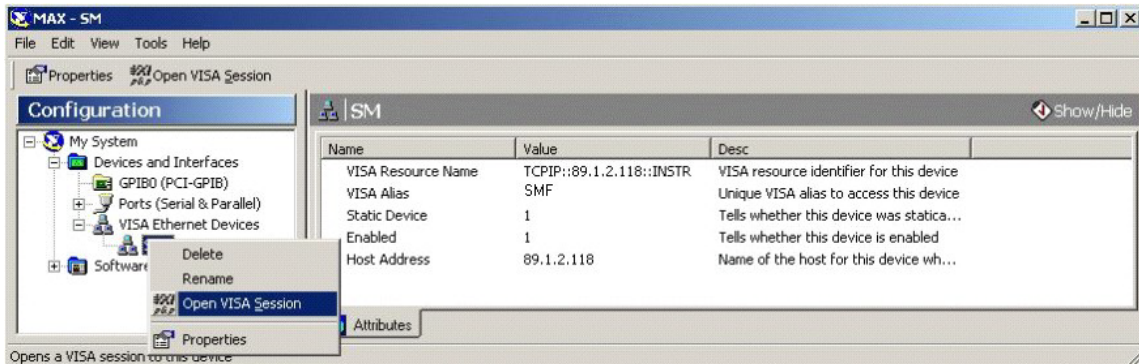
➢ On the **viWrite** tab under **Basic I/O**, commands can be sent to the instrument; instrument responses are displayed on the **viRead** tab
(for further program operation refer to the online help of the program).
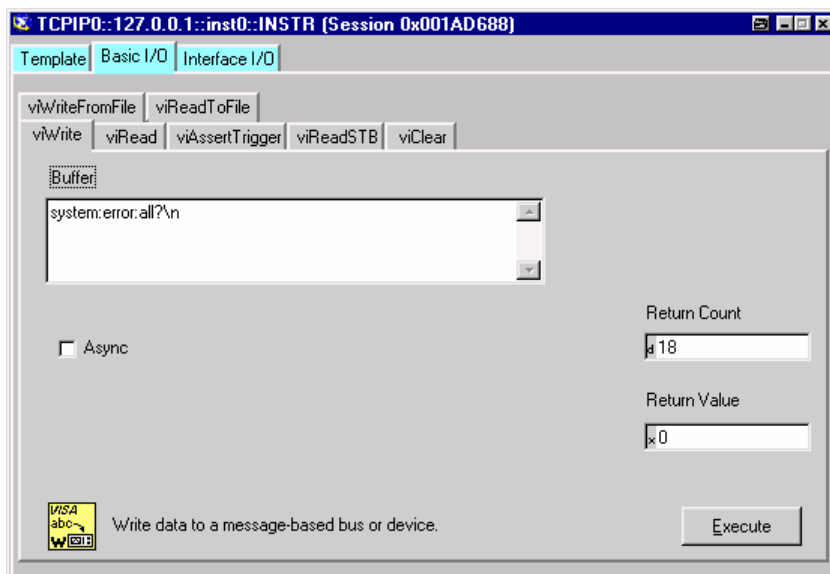
Return to manual operation is possible via the front panel or the LAN interface.

Manually: ➤ *Press the* LOCAL *key.*

> ***Notes:***
>   *The* LOCAL *key can be disabled by the universal command &LLO (see Section "IEC/IEEE Bus Messages") in order to prevent unintentional transition. In this case, transition to manual mode is only possible via remote   control.*
>
>   *The* LOCAL *key can be enabled again by the interface message &NREN (see Section "IEC/IEEE Bus Messages").*

Via IEC/IEEE bus: ...

```
CALL IBLOC(generator%)    'Set instrument to manual operation
```

...

Interface and Device Messages

The messages transferred via the data lines of the IEC/IEEE-bus (see Section "*IEC/IEEE Bus Interface*") or via a TCP/IP network can be divided into two groups:

– **interface messages** and
– **device messages.**

Interface Messages

Interface messages are transferred on the data lines of the IEC/IEEE bus, the ATN control line being active. They are used for communication between controller and instrument and can only be sent by a computer which has the function of an IEC/IEEE bus controller.

Interface commands can be further subdivided into

- **universal commands**
- **addressed commands**

Universal commands act on all devices connected to the IEC/IEEE-bus without previous addressing, addressed commands only act on devices previously addressed as listeners. The interface messages relevant to the instrument are listed in Section "IEC/IEEE Bus Messages".
If an Ethernet connection is present, signalling via a hardware control line is not required. The IEC/IEEE-bus interface commands are emulated (see "IEC/IEEE Bus Messages").

Device Messages (Commands and Device Responses)

Device messages are transferred on the data lines of the IEC/IEEE-bus, the "ATN" control line not being active. ASCII character set is used.
If an Ethernet connection is present, signalling via a hardware control line is not required.
The device messages are equal for the different interfaces (IEC/IEEE bus and Ethernet). A distinction is made according to the direction in which they are sent:

Commands
(Program
Messages)

are messages the controller sends to the instrument. They operate the device functions and request information.

The commands are subdivided according to two criteria:

1. According to the effect they have on the instrument:

Setting commands   cause instrument settings such as a reset of the instrument or setting the frequency.

Queries   cause data to be provided for output on the IEC/IEEE bus, e.g. for identification of the device or polling a parameter value. Queries are formed by directly appending a question mark to the header.

2. According to their definition in standard IEEE 488.2 and SCPI:

Common Commands   are exactly defined as to their function and notation in standard IEEE 488.2. They refer to functions such as management of the standardized status registers, reset and selftest.

Device-specific Commands   refer to functions depending on the features of the instrument such as frequency setting. A majority of these commands has also been standardized by the SCPI committee Device-specific extensions following the SCPI rules are permitted by the standard.

Device responses
(Response
Messages and
Service Request)

are messages the instrument sends to the controller after a query. They can contain measurement results, instrument settings and information on the instrument status (cf. Section "*Responses to Queries*").

Structure and syntax of the device messages are described in the following Section.

SCPI Command Structure and Syntax

The commands consist of a so-called header and, in most cases, one or more parameters. The 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.

Note:

   The commands used in the following examples are not in every case implemented in the instrument.

Common Commands   Common commands consist of a header preceded by an asterisk "*" and one or more 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.

Device-specific commands

   Hierarchy: Device-specific commands are of hierarchical structure (see figure below). 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: `SOURce`

   This key word denotes the command system `SOURce`.

   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: `SOURce:FM:EXTernal:COUPling AC`

   This command lies in the fourth level of the SOURce. It sets the coupling of the external signal source to AC.
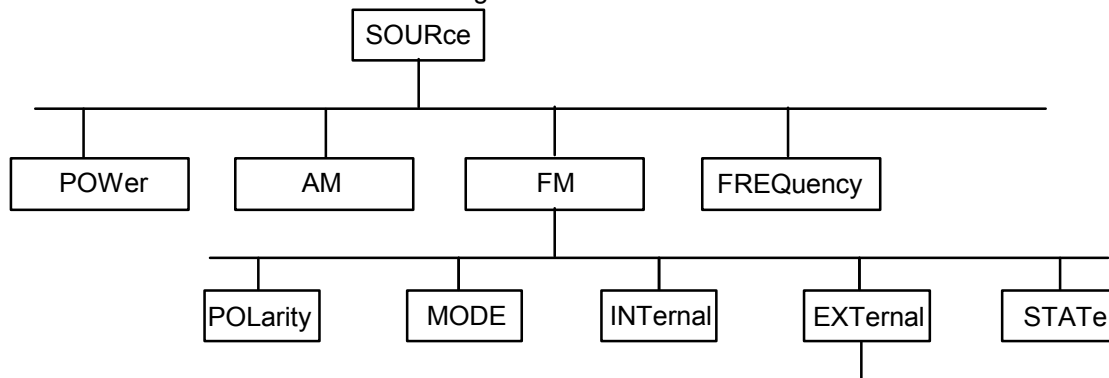
Example for the tree structure of the SCPI command systems; the `SOURce` system

---

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

Example:

SOURce:FREQuency:MODE
This command contains key word MODE in the third command level. It defines instrument operating mode.

SOURce:FREQuency:STEP:MODE
This command contains key word MODE in the fourth command level. It defines whether the user-defined step width is used for frequency variation with the rotary knob (manual control) and with frequency values UP/DOWN (remote control) or not.

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

Example:
[SOURce]:POWer[:LEVel][:IMMediate]:OFFSet 1

This command immediately sets the offset of the signal to 1 dB. The following command has the same effect:

POWer:OFFSet 1

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= STAT:QUES:ENAB 1

Note:
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.

Parameters:
Parameters 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. For a description of the types of parameter, refer to Section "*Parameters*".

Example: SOURce:FREQency? MAXimum   Answer: 22000000000

This query requests the maximal value for the frequency.

Numeric suffix:
If a device features several functions or features of the same kind, e.g. several 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:
SOURce:LFOutput2:FREQuency 1.5kHz
This command sets the frequency of secondLF generator frame.

Structure of a Command Line

A command line may consist of one or several commands. It is terminated by an EOI together with the last data byte.

Several commands in a command line 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: `"SOURce:FREQuency:CENTer 500000000;:OUTPut:STATe ON"`

This command line contains two commands. The first command is part of the SOURce system and is used to specify the center frequency of the output signal of RF output. The second command is part of the OUTPut system and sets the attenuation of the output signal of RF output.

If the successive commands belong to the same system, having one or several levels in common, the command line can be abbreviated. To this end, the second command after the semicolon starts with the level that lies below the common levels. The colon following the semicolon must be omitted in this case.

Example: `"SOURce:POWer:STARt -20dBm;:SOURce:POWer:STOP 3dBm"`

This command line is represented in its full length and contains two commands separated from each other by the semicolon. Both commands are part of the SOURce command system, subsystem POWer, i.e. they have two common levels.
When abbreviating the command line, the second command begins with the level below SOURce:FM. The colon after the semicolon is omitted.

The abbreviated form of the command line reads as follows:

`"SOURce:POWer:STARt -20dBm;STOP 3dBm"`

However, a new command line always begins with the complete path.

Example: `"SOURce:POWer:STARt -20dBm"`

`"SOURce:POWer:STOP 3dBm"`

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.

1. The requested parameter is transmitted without header.

    Example: `SOURce:AM:EXTernal:COUPling?`   Answer: `AC`

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

    Example: `SOURce:FREQuency? MAX`   Answer: `1E3`

3. Boolean values are returned as 0 (for OFF) and 1 (for ON).

    Example: `OUTPut:STATe?`   Answer (for ON): `1`

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

    Example: `SOURce:AM:SOURce?`   Answer (for EXTernal): `EXT1`

Parameters

Most commands require a parameter to be specified. The parameters must be separated from the header by a "white space". Permissible parameters are numerical values, Boolean parameters, text, character strings and block data. The type of parameter required for the respective command and the permissible range of values are specified in the command description.

Numerical values Numerical 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 values must be in the value range –9.9E37 to 9.9E37. The exponent is introduced by an "E" or "e". Entry of the exponent alone is not allowed.

Units In the case of physical quantities, the unit can be entered. Permissible unit prefixes are G (giga), MA (mega), MOHM and MHZ are also permissible), K (kilo), M (milli), U (micro) and N (nano). If the unit is missing, the basic unit is used.

Example:
`SOURce:FREQuency 1.5 kHz = SOURce:FREQuency 1.5E3`

Some settings allow relative values to be stated in percent. According to SCPI, this unit is represented by the `PCT` string.

Example:
`SOURce:SWEep:FREQuency:STEP:LOGarithmic 5PCT`

Special numeric values

The parameters MINimum, MAXimum, DEFault, UP and DOWN are interpreted as special numerical values.
In the case of a query, the associated numerical value is provided.

Example:
Setting command: `SOURce:LFOutput:VOLTage MAXimum`
Query: `SOURce:LFOutput:VOLTage?`   Answer: `4`

MIN/MAX `MINimum` and `MAXimum` denote the minimum and maximum value

DEF `DEFault` denotes a preset value. 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`) 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 division by zero, subtraction or addition of infinite and the representation of missing values.

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. ON or OFF is returned by a query.

Example:
Setting command: `:SOURce:AM:STATe ON`
Query: `:SOURce:AM:STATe?`   Answer: `1`

Text

Text parameters observe the syntax 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: `:SOURce:SWEep:POWer:MODE`   `MANual`
Query: `:SOURce:SWEep:POWer:MODE?`   Answer: `MAN`

Strings

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

Example: `CORR:CSET "UCOR1"`   or   `:CORR:CSET 'UCOR1'`

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 with definite length has the following structure:

Example: `MMEMory:DATA test_file.wv, #45168xxxxxxxx`

Test_file.wv denotes the name of the file to which the data are written. The comma is followed by the binary data block. The hash symbol # 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.

The format of the binary files within the block depends on the IEC/IEEE-bus command
`SOURce:CORRection:CSET:DATA:FREQuency|:POWer`

use the IEEE-754 format for double precision floating point numbers. Each number is represented by 8 bytes.

Example:
a# = 125.345678E6
b# = 127.876543E6

```
CALL IBWRT(generator%, "SOURCE:CORRECTION:CSET:DATA:FREQ
#216" + MKD$(a#) + MKD$(b#))
```

- #' in the command string introduces the binary block,
- '2' indicates that 2 digits specifying the length will follow next,
- 16' is the length of the binary block (in bytes), here: 2 double precision floating point number with 8 bytes each.
- The actual binary data follow now. As the function IBWRT requires a text string, MKD$ is used for the type conversion.

The following ASCII format has the same effect:

```
CALL IBWRT(generator%, "SOURce:CORRection:CSET:DATA:FREQ
125.345678E6, 127.876543E6")
```

Overview of Syntax Elements

The following survey offers an overview of the syntax elements.
:   The colon separates the key words of a command. In a command line the separating semicolon marks the uppermost command level.
;   The semicolon separates two commands of a command line. 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.

Instrument Model and Command Processing

The block diagram in the figure below 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".
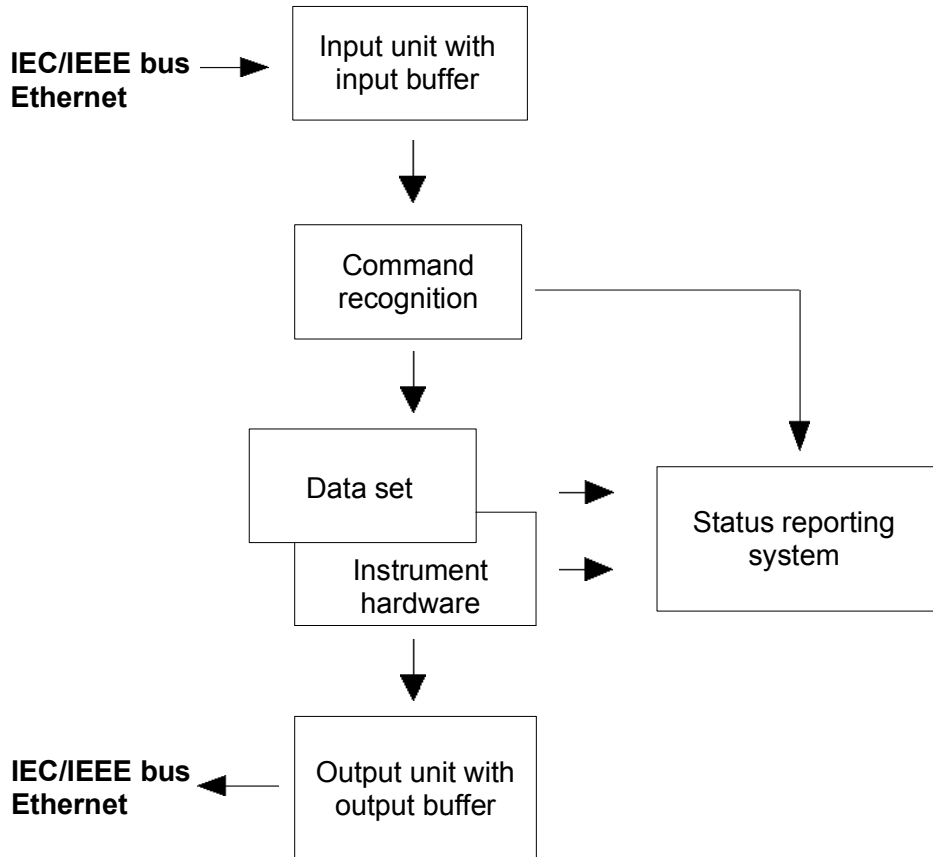
Instrument model in the case of remote control via IEC/IEEE bus or TCP/IP network

Input Unit

The input unit receives commands character by character from the IEC/IEEE bus or via the Ethernet 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 is 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 a DCL clears the input buffer and immediately initiates a message to the command recognition.

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 a DCL is serviced with priority, a GET (Group Execute Trigger), e.g., is only executed after the commands received before. Each recognized command is immediately transmitted to the data set 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 command line 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 or a DCL, it also requests the data set to perform the necessary instrument hardware settings. Subsequently it is immediately prepared to process further commands. This means that new commands can already be serviced while the hardware is still being set ("overlapping execution").

Data Base and Instrument Hardware

The expression "instrument hardware" denotes the part of the instrument fulfilling the actual instrument function - signal generation etc. The controller is not included. The term "database" 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. As this is only ever effected at the end of a command line, the order of the setting commands in the command line is not relevant.

The data are only checked for their compatibility among each other and with the instrument hardware immediately before they are transmitted to the instrument hardware. If the detection is made that execution is not possible, an "execution error" is signaled to the status reporting system. All alterations of the data set are canceled, the instrument hardware is not reset. Due to the delayed checking and hardware setting, however, impermissible instrument states can be set for a short period of time within one command line without this leading to an error message. At the end of the command line, however, a permissible instrument state must have been reached again.

Status Reporting System

The status reporting system collects information on the instrument state and makes it available to the output unit on request. The exact structure and function are described in section "*Status Reporting System*".

Output Unit

The output unit collects the information requested by the controller, which it receives from the data set 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 set management, the output unit sends the error message "Query UNTERMINATED" to the status reporting system. No data are sent on the IEC/IEEE bus or via the Ethernet, the controller waits until it has reached its time limit. This behavior is specified by SCPI.

Command Sequence and Command Synchronization

What was said above makes clear that overlapping execution is possible in principle for all commands. Equally, setting commands within one command line are not absolutely serviced in the order in which they have been received.
In order to make sure that commands are actually carried out in a certain order, each command must be sent in a separate command line.In order to prevent an overlapping execution of commands, one of 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 and has settled. By suitable programming, the controller can be forced to wait for the respective action to occur (see table).

Synchronization with *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.	- 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.

Status Reporting System

The status reporting system stores information on errors which have occurred. This information is stored in the error queue. The error queue can be queried via IEC/IEEE bus or via the 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).

The IST flag ("Individual STatus") and the parallel poll enable register (PPE) allocated to it are also part of the status reporting system. The IST flag, like the SRQ, combines the entire instrument status in a single bit. The PPE fulfills an analog function for the IST flag as the SRE for the service request.

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.

Overview of the Status Register

The following figure shows the status registers used in the Signal Generator.

SRQ

RQS/MSS
ESB
MAV

SRE

STB

Error Queue Output Buffer

-&- 7 | Power on
-&- 6 | User Request
-&- 5 | Command Error
-&- 4 | Execution Error
-&- 3 | Device Dependent Error
-&- 2 | Query Error
-&- 1 | Request Control
-&- 0 | Operation Complete

ESE   ESR

PPE

& = logical AND
⊕ = logical OR
   of all bits

IST flag
(response to parallel poll)
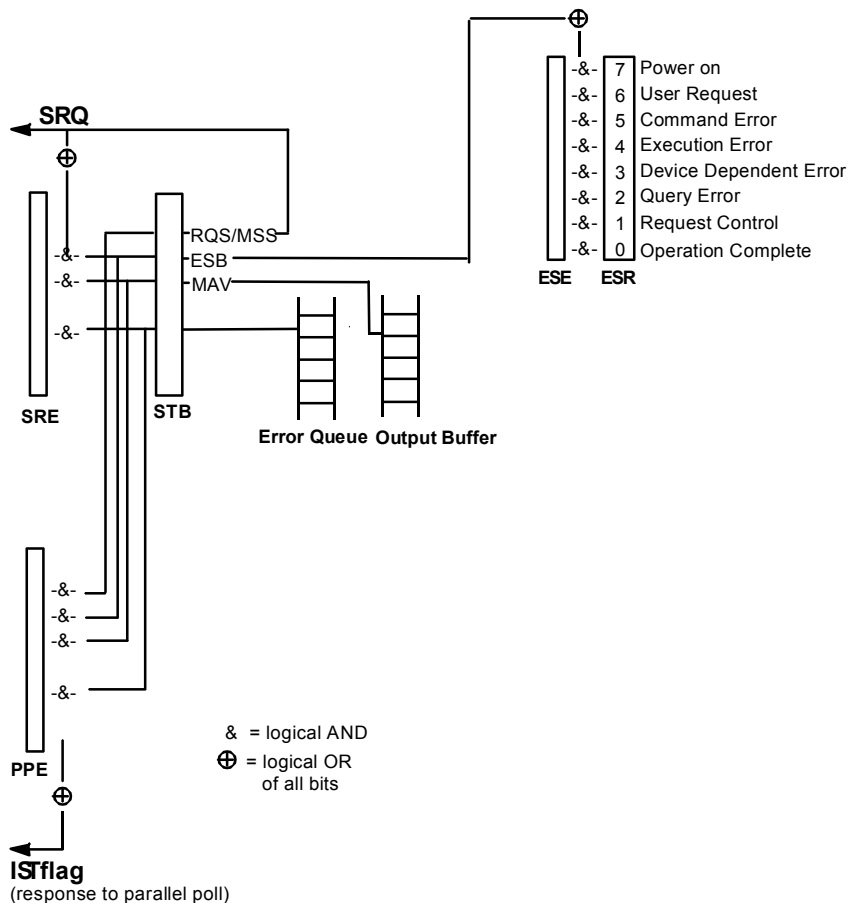
Overview of status registers

Status Byte (STB) and 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 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 out using the command "*STB?" or a serial poll.

The STB is linked to the SRE.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 on the IEC/IEEE bus or via the Ethernet, which triggers an interrupt in the controller if this is appropriately configured and can be further processed there.
The SRE can be set using command "*SRE" and read using "*SRE?".

Meaning of the bits used in the status byte

Bit no.	Meaning
0...1	Not used
2	**Error Queue not empty** 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.
3	Not used
4	**MAV bit** (Message available) 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.
5	**ESB bit** 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.
6	**MSS bit** (Master-Status-Summary-Bit) The bit is set if the instrument triggers a service request. This is the case if one of the other bits of this register is set together with its mask bit in the service request enable register SRE.
7	Not used

IST-Flag and Parallel Poll Enable Register (PPE)

By analogy with the SRQ, the IST flag combines the entire status information in a single bit. It can be queried by means of a parallel poll (cf. Section "*Parallel Poll*") or using the command "*IST?".

The parallel poll enable register (PPE) determines which bits of the STB contribute to the IST flag. The bits of the STB are ANDed with the corresponding bits of the PPE, with bit 6 being used as well in contrast to the SRE. The IST flag results from the ORing of all results. The PPE can be set using commands "*PRE" and read using command "*PRE?".

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

The ESR is defined in IEEE 488.2.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?".

Meaning of the bits used 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 which is undefined or syntactically incorrect is received. An error message with a number between -100 and -200, which denotes the error in greater detail, is entered into the error queue.
6	**User Request** This bit is set on pressing the LOCAL key, i.e., when the instrument is switched over to manual control.
7	**Power On** (supply voltage on) This bit is set on switching on the instrument.

Application of the Status Reporting System

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

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 section "*Overview of the Status Register*", 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 the error queue or the output buffer. In order to use the possibilities of the service request effectively, all bits should be set to "1" in the enable registers SRE and ESE.

Example:

Use command "`*OPC`" to generate an SRQ

➢ `CALL IBWRT(generator%, "*ESE 1")`　　　　set bit 0 of ESE (Operation Complete)

➢ `CALL IBWRT(generator%, "*SRE 32")`　　　set bit 5 of 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 such that a service request is initiated in the case of malfunction. The program should react appropriately to the service request.

Serial Poll

In a serial poll, just as upon the command "`*STB`", the status byte of an instrument is queried. However, the query is made 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 for instruments which do not adhere to SCPI or IEEE 488.2.

The VISUAL BASIC command for executing a serial poll is "`IBRSP()`". The serial poll is mainly used to obtain a fast overview of the state of several instruments connected to the IEC/IEEE bus or via the Ethernet .

Parallel Poll

In a parallel poll, the controller uses a single command to request up to eight instruments to transmit one bit of information each on the data lines, i.e., to set the data line allocated to each instrument to a logical "0" or "1". In addition to the SRE register, which determines the conditions under which an SRQ is generated, there is a parallel poll enable register (PPE). This register is ANDed with the STB bit by bit, considering bit 6 as well. The results are ORed, the result is possibly inverted and then sent as a response to the parallel poll of the controller. The result can also be queried without parallel poll by means of the command "`*IST?`".

The instrument first has to be set for the parallel poll using the VISUAL BASIC command "`IBPPC()`". This command allocates a data line to the instrument and determines whether the response is to be inverted. The parallel poll itself is executed using "`IBRPP()`".

The parallel poll method is mainly used to find out quickly which one of the instruments connected to the IEC/IEEE bus has sent a service request. To this effect, SRE and PPE must be set to the same value.

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 register queried. 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.

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 looked at in the ERROR menu via manual control or queried via the IEC/IEEE bus or via the Ethernet using command `"SYSTem:ERRor?"`. Each call of `"SYSTem:ERRor?"` provides <u>one</u> 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.

Reset Values of the Status Reporting Systems

Commands `*RST`, `*DCL` and `SYSTem:PRESet` and switching on the supply voltage also affect the status reporting system. None of the commands, except for `*RST` and `SYSTem:PRESet` influences the functional instrument settings. In particular, DCL does not change the instrument settings.

Resetting the Status Reporting System

Event / Effect	Switching on supply voltage — Power-On-Status-Clear 0	1	DCL,SDC (Device Clear, Selected Device Clear)	*RST or SYSTem:PRESet	STATus:PRESet	*CLS
Clear STB,ESR	–	yes	–	–	–	yes
Clear SRE,ESE	–	yes	–	–	–	–
Clear PPE	–	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 command line, i.e. immediately following a <PROGRAM MESSAGE TERMINATOR> clears the output buffer

Contents - Chapter 6 "Remote-Control Commands"

6 Remote Control - Commands

In the following, all remote control commands for the R&S SMF will be presented in detail with their parameters and the ranges of numerical values.

An introduction to remote control and the status registers of the R&S SMF is given in chapter 5, "*Remote Control Basics*".

Command Description

Notation

All commands implemented in the instrument are first listed in tables and then described in detail, arranged alphabetically according to the command subsystems. The notation is adapted to the SCPI standard. The SCPI conformity information is included in the individual description of the commands.

Table of Commands

Command:	In the command column, the table provides an overview of the commands.
Parameter:	The parameter column indicates the requested parameters together with their specified range.
Unit:	The unit column indicates the basic unit of the physical parameters.
Remark:	In the remark column an indication is made on: – whether the command does not have a query form, – whether the command has only one query form

Individual description   The individual description contains the complete notation of the command. An example for each command, the *RST value and the SCPI information are included as well.
The options that are required to execute the command are listed. In case of dependencies between commands they are also indicated.

Upper/lower case notation   Upper/lower case letters are used to mark the long or short form of the key words of a command in the description (see Chapter 5). The instrument itself does not distinguish between upper and lower case letters.

Special characters| 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: `SOURce:FREQuency:CW|:FIXed`

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

`SOURce:FREQuency:CW 1E3` = `SENSe:FREQuency:FIXed 1E3`

        A vertical stroke in parameter indications marks alternative possibilities in the sense of "or". The effect of the command is different, depending on which parameter is used.

Example: Selection of the parameters for the command

```
SOURce:COUPling  AC | DC
```

If parameter AC is selected, only the AC content is fed through, in the case of DC, the DC as well as the AC content.

[ ]   Key words in square brackets can be omitted when composing the header (cf. Chapter 5, Optional Keywords). The full command length must be accepted by the instrument for reasons of compatibility with the SCPI standards.
Parameters in square brackets can be incorporated optionally in the command or omitted as well.

{ }   Parameters in braces can be incorporated optionally in the command, either not at all, once or several times.

**Description of
parameters**   Due to the standardization, the parameter section of SCPI commands consists always of the same syntactical elements. SCPI has therefore specified a series of definitions, which are used in the tables of commands. In the tables, these established definitions are indicated in angled brackets (<...>) and will be briefly explained in the following (see also Chapter 5, Section "Parameters").

<Boolean>   This keyword refers to parameters which can adopt two states, "on" and "off". The "off" state may either be indicated by the keyword **OFF** or by the numeric value 0, the "on" state is indicated by **ON** or any numeric value other than zero. Parameter queries are always returned the numeric value 0 or 1.

<numeric_value>
<num>   These keywords mark parameters which may be entered as numeric values or be set using specific keywords (character data).

The following keywords given below are permitted:

MINimum   This keyword sets the parameter to the SMFllest possible value.

MAXimum   This keyword sets the parameter to the largest possible value.

DEFault   This keyword is used to reset the parameter to its default value.

UP   This keyword increments the parameter value.

DOWN   This keyword decrements the parameter value.

The numeric values associated to MAXimum/MINimum/DEFault can be queried by adding the corresponding keywords to the command. They must be entered following the quotation mark.

Example: `SOURce:FREQuency? MAXimum`

returns the maximum possible numeric value of the center frequency as result.

<arbitrary block program data>
                 This keyword is provided for commands the parameters of which consist of a binary data block.

Common Commands

The common commands are taken from the standard IEEE 488.2 (IEC 625.2). Identical commands have an identical effect in different instruments. The headers of these commands consist of an asterisk "*" followed by three letters. Many common commands affect the status reporting system, which is described in detail in Chapter 5.

Command	Parameters	Default unit	Remark
*CLS			Clear status; no query
*ESE	0...255		Event status enable
*ESR?	0...255		Standard event status query; query only
*IDN?			Identification query; query only
*IST?	0...255		Individual status query; query only
*OPC			Operation complete
*OPT?			Option identification query; query only
*PRE	0...255		Parallel poll register enable
*PSC	0 | 1		Power on status clear
*RCL	1...10		Recall
*RST			Reset; no query
*SAV	1...10		Save
*SRE	0...255		Service request enable
*STB?			Status byte query; query only
*TRG			Trigger; no query
*TST?			Self test query; query only
*WAI			Wait to continue; no query

*CLS

CLEAR STATUS sets the status byte (STB), the standard event register (ESR), and the EVENt part of the QUEStionable and OPERation register to zero. The command does not change the enable and transition parts of the registers. It deletes the output buffer.

*ESE 0...255

EVENT STATUS ENABLE sets the event status enable register to the specified value. The *ESE? query command returns the content of the event status enable register in decimal form.

*ESR?

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

*IDN?

IDENTIFICATION QUERY queries the instrument identification. The instrument type, serial number and firmware version are returned. Example:

Rohde&Schwarz,SMF100A,1141.2005k02/000000,1.45.0.3-01.06.05 (Release)

*IST?

INDIVIDUAL STATUS QUERY returns the content of the IST flag in decimal form (0 | 1). The IST flag is the status bit which is sent during a parallel poll.

*OPC

OPERATION COMPLETE sets bit 0 in the event status register when all previous commands have been processed. This bit can be used to trigger a service request.

*OPC?

OPERATION COMPLETE QUERY returns a 1 when all previous commands have been processed. It is important to ensure that the timeout set at the IEC/IEEE bus is long enough.

*OPT?

OPTION IDENTIFICATION QUERY queries the options configured in the instrument and returns a list of the installed options. The options are separated by commas.

*PRE 0 ... 255

PARALLEL POLL REGISTER ENABLE sets the parallel poll enable register to the specified value. The *PRE? query command returns the content of the parallel poll enable register in decimal form.

*PSC 0 | 1

POWER ON STATUS CLEAR determines whether the content of the ENABle registers are retained or reset at power on.

Parameters: **0**

The content of the status registers is retained at power on. If the status registers ESE and SRE are configured accordingly, this may cause a service request to be triggered at power on.

                             1

The content of the status registers is reset at power on.

The **query** *PSC? retrieves the contents of the Power-on-Status-Clear flag. The answer is either 0 or 1.

*RCL 0...10

RECALL calls up the instrument status which was stored under the specified number using the *SAV command. "0" corresponds to the power-on state. This command can also be used to call up the 3 intermediate instrument states which are stored with *SAV.

*RST

RESET resets the instrument to a defined default state. The command has the same effect as pressing the PRESET key. The default setting is given in the description of the commands.

*SAV

SAVE stores the current device state under the specified number (see also *RCL). The command is used to store the 3 intermediate instrument states and to store the current instrument state internally when the instrument is switched off. This state is then restored at power on.

*SRE 0 ... 255

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

*STB?

> **READ STATUS BYTE QUERY** reads out the content of the status byte in decimal form.

*TRG

> **TRIGGER** triggers all actions which are waiting for a trigger event. Specific trigger events can be triggered by means of the "TRIGger" command system (sweeps).

*TST?

> **SELF TEST QUERY** triggers all self tests of the instrument and outputs an error code in decimal form (see Service Manual supplied with the instrument).

*WAI

> **WAIT-to-CONTINUE** does not allow subsequent commands to be processed until all previous commands have been executed and all signals are in their transient condition.

CALibration Subsystem

The CALibration system contains the commands for adjustment. Adjustment is triggered by the query commands. The response "0" indicates error-free adjustment, and the response "1" means that an error occurred during adjustment.

Command	Parameters	Default unit	Remark
CALibration:ALL[:MEASure]?			Query only
CALibration:FREQuency[:MEASure]?			Query only
CALibration:LEVel[:MEASure]?			Query only
CALibration:LEVel:STATe	ON | OFF		
CALibration:LFOutput[:MEASure]			

CALibration:ALL[:MEASure]?

The command starts all internal adjustments for which no external measuring equipment is needed.

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

Example: CAL:ALL?
         'starts the adjustment of all functions for the entire instrument.

         Response: 0
         'adjustment has been performed successfully.

*RST value	Resolution	Options	SCPI
-	-		Compliant

CALibration:FREQuency[:MEASure]?

The command starts all adjustments which affect the frequency. The command is a query command and therefore has no *RST value.

Example: CAL:FREQ?
         'starts the adjustments for maximum frequency accuracy.

         Response: 0
         'the adjustments have been performed successfully.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

CALibration:LEVel[:MEASure]?

The command starts all adjustments which affect the level.

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

Example: CAL:LEV?

'starts the adjustments which affects the level.

Response: 0

'the adjustments have been performed successfully.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

CALibration:LEVel:STATe   ON | OFF

The command switches on or off use of external level correction data. This switch can be used in case of corrupt external level correction data.

Example: CAL:LEV:STAT ON

'switches on use of external level correction data.

*RST value	Resolution	Options	SCPI
ON	-		Device-specific

CALibration:LFOutput[:MEASure]?

The command performs all adjustments which affect the internal modulation generators.

Example: CAL:LFO?

'starts the adjustments for the modulation generators.

Response: 0

'the adjustments have been performed successfully.

*RST value	Resolution	Options	SCPI
-	-	R&S SMF-B20	Device-specific

DIAGnostic Subsystem

The DIAGnostic system contains the commands used for instrument diagnosis and servicing. SCPI does not define any DIAGnostic commands; the commands listed here are all device-specific. All DIAGnostic commands are query commands which are not influenced by *RST.

Command	Parameters	Default unit	Remark
DIAGnostic:BGINfo?	<module name>		Query only
DIAGnostic:BGINfo:CATalog?			Query only
DIAGnostic:INFO:OTIMe?			Query only
DIAGnostic:INFO:POCounter?			Query only
DIAGnostic:POINt:CATalog?			Query only
DIAGnostic[:MEASure]:POINt?	<point name>		Query only

DIAGnostic:BGINfo? <module name>

The command checks the modules available in the instrument using the variant and revision state.

If the command is sent without parameters being specified, a complete list of all modules is returned (the various entries are separated by commas). The length of the list is variable and depends on the instrument equipment configuration.

If the command is sent with parameters, a list of the specified modules is returned (the various entries are separated by commas). A list of modules names can be called up using the DIAG:BGIN:CATalog? command.

Each entry for one module consists of four parts which are separated by space characters:

Module name   Module stock number incl. variant   Module revision   Module serial number.

Example: DIAG:BGIN:CAT?
                'queries the instrument configuration.

Response: MBRD,SSYN,....
                'returns the data of all available modules.

DIAG:BGIN? 'MBRD'
                'queries the configuration of the motherboard.

Response: MBRD 1234.5678.02 1.5.3 100023
                'module motherboard with stock number 1234.5678.02 has revision 1.5.3 and serial number 100023.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic:BGINfo:CATalog?

The command queries the names of the assemblies available in the instrument.

A complete list of all assemblies is returned (the various entries are separated by commas). The length of the list is variable and depends on the instrument equipment configuration.

Example: DIAG:BGIN:CAT?
          'queries the names of the assemblies.

          Response: MBRD,SSYN,....

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic:INFO:OTIMe?

The command queries the number of operation hours

Example: DIAG:INFO:OTIM?
          'queries the operation hours.

          Response: 100023
          'the instrument was operated for 100023 hours up to now.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic:INFO:PCOunter?

The command queries the number of power-on events.

Example: DIAG:INFO:POC?
          'queries the number of power on events.

          Response: 123
          'the instrument was switched on for 123 times up to now.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic:POINt:CATalog?

The command queries the test points available in the instrument. A detailed description of the test points can be found in chapter 3 , section "Trouble Shooting" of the Service Manual (on CD-ROM, supplied with the instrument).

Example: DIAG:POIN:CAT?
          'queries the test points available in the instrument.

          Response: 'DIAG_IQOP3_LCM_CAL_I,DIAG_IQOP3_LCM_I,...'

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DIAGnostic[:MEASure]:POINt?

The command triggers voltage measurement at the specified test point and returns the measured voltage. A description of the test points can be found in chapter 3 , section "Trouble Shooting" of the Service Manual (on CD-ROM, supplied with the instrument).

A list of the available test points can be queried using the `DIAG:POIN:CAT?` command.

Example: `DIAG:POIN? 'DIAG_NO_DP'`
                'triggers measurement at the test point `DIAG_NO_DP`.

                Response: `0.5`
                'the voltage at the test point is 0.5 volt.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DISPlay Subsystem

The DISPlay subsystem contains the commandos to set the power-save mode of the instrument.

Command	Parameters	Default unit	Remark
DISPlay:PSAVe:HOLDoff	1...60		
DISPlay:PSAVe[:STATe]	ON | OFF		

DISPlay:PSAVe:HOLDoff   1...60

The command sets the wait time for the screen-save mode of the display. The available value range is 1 to 60 minutes, the resolution 1 minute. The entry is dimensionless.

Example: `DISP:PSAV:HOLD 10`
                'sets the wait for the screen saver to 10 minutes.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

DISPlay:PSAVe[:STATe]   ON | OFF

This command activates/deactivates the screen-save mode of the display. With the screen-save mode activated, the display including backlight is completely switched off after the elapse of the wait time (see command `DISPlay:PSAVe:HOLDoff`) when no entries via front panel, external mouse or external keyboard are made.

This mode is recommended for preserving the display especially if the instrument is exclusivelyoperated via remote control.

Example: `DISP:PSAV:STAT ON`
                'activates the screen saver mode.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

FORMat Subsystem

The FORMat subsystem contains the commands which determine the format of the data that the R&S Signal Generator returns to the controller. This affects all query commands which return a list of numerical data or block data. Reference is made to this in the descriptions of the commands.

Command	Parameters	Default unit	Remark
FORMat[:DATA]	ASCii | PACKed		
FORMat:BORDer	NORMal | SWAPped		
FORMat:SREGister	ASCii | BINary | HEXadecimal | OCTal		

FORMat[:DATA] ASCii | PACKed

The command determines the data format which the R&S Signal Generator uses to return data. When data is transferred from the control computer to the instrument, the instrument detects the data format automatically. In this case, the value set here is irrelevant.

Parameters: **ASCii**
'Numerical data is transferred as plain text separated by commas.

PACKed
'Numerical data is transferred as binary block data. The format within the binary data depends on the command. The various binary data formats are explained in the description of the parameter types.

Example: `FORM:ASC`
'the data is transferred as ASCII data.

*RST value	Resolution	Options	SCPI
ASCii	-		Compliant

FORMat:BORDer NORMal | SWAPped

The command determines the sequence of bytes within a binary block. This only affects blocks which use the IEEE754 format internally.

Parameters: **NORMal**
'the R&S Signal Generator expects (with setting commands) and sends (with queries) the least significant byte of each IEEE754 floating-point number first, and the most significant byte last.

SWAPped
'the R&S Signal Generator expects (with setting commands) and sends (with queries) the most significant byte of each IEEE754 floating-point number first, and the least significant byte last.

Example: `FORM:BORD SWAP`
'the data is transferred with the most significant bit first.

*RST value	Resolution	Options	SCPI
NORMal	-		Compliant

FORMat:SREGister ASCii | BINary | HEXadecimal | OCTal

The command determines the numerical format which is returned when the status registers are queried.

Parameters: **ASCii**

'the register content is returned as a decimal number.

BINary

'the register content is returned as a binary number. #B is placed in front of the number.

HEXadecimal

'the register content is returned as a hexadecimal number. #H is placed in front of the number.

OCTal

'the register content is returned as an octal number. #Q is placed in front of the number.

Example: `FORM:SREG HEX`

'the register content is returned as a hexadecimal number.

*RST value	Resolution	Options	SCPI
ASCii	-		Compliant

MMEMory Subsystem

The MMEMory subsystem (<u>M</u>ass <u>Mem</u>ory) contains the commands for managing files and directories as well as for loading and storing complete instrument settings in files.
The files are stored on the compact flash card of the instrument. The /var directory can be used to save user-defined data; any subdirectory structure can be created on /var. Some default subdirectories are predefined, but can be changed at any time.
The default directory is determined using the command `MMEMory:CDIR`.

Note:
The /opt directory is a protected and therefore unaccessable system director. The files on this directory contain data that must not be changed. Therefore, this directory should not be accessed, since reconstruction of the system partition will lead to data loss.

To enable files in different file systems to be used, the following file naming conventions should be observed:
The file name can be of any length and no distinction is made between uppercase and lowercase letters. The file and the optional file extension are separated by a dot. All letters and numbers are permitted (numbers are, however, not permitted at the beginning of the file name). Where possible, special characters should not be used. Use of the slashes "\" and "/" should be avoided since they are used in file paths. A number of names are reserved by the operating system, e.g. CLOCK$, CON, AUX, COM1...COM4, LPT1...LPT3, NUL and PRN.

In the R&S Signal Generator all files in which lists and settings are stored are given a characteristic extension. The extension is separated from the actual file name by a dot (see the following table containing a list of the file types).

The two characters "*" and "?" function as "wildcards", i.e. they are used for selecting several files. The "?" character represents exactly one character, while the "*" character represents all characters up to the end of the file name. "*.*" therefore stands for all the files in a directory.

When used in conjunction with the commands, the parameter <file_name> is specified as a string parameter with quotation marks. It can contain either the complete path or only the file name. The same applies for the parameters <directory_name> and <path>. Depending on how much information is provided, either the values specified in the parameter or the values specified with the command `MMEM:CDIR` (default directory) are used for the path setting in the commands.
In the example below, the current instrument setting is always stored in the file `'test1.ss'` in the directory 'user' on the internal flash card.

`MMEM:STOR:STAT 0,"/var/user/test1.ss"`
> If the complete path is specified, the file is stored in the specified path.

`MMEM:CDIR  '/var/user'`
`MMEM:STOR:STAT 0,"test1.ss"`
> If the parameter only contains the file name, the file is stored in the default directory which was selected with the `MMEM:CDIR` command.

List of file extensions assigned automatically in R&S Signal Generator

List type	Contents	File suffix
Instrument State	Instrument settings	*.savrcl
User Correction	User-defined level correction values	*.uco

Command	Parameters	Default unit	Remark
MMEMory:CATalog?	<path>		Query only
MMEMory:CATalog:LENGth?			Query only
MMEMory:CDIRectory	<directory_name>		No query
MMEMory:COPY	<file_name>,<file_name>		No query
MMEMory:DATA	<file_name>[,<block>]		
MMEMory:DCATalog?			Query only
MMEMory:DCATalog:LENGth?			Query only
MMEMory:DELete	<file_name>		No query
MMEMory:MDIRectory	<directory_name>		No query
MMEMory:MOVE	<file_name>,<file_name>		No query
MMEMory:MSIS	<msus>		
MMEMory:RDIRectory	<directory_name>		
MMEMory:STORe:STATe	0,<file_name>		

MMEMory:CATalog? <path>

This command reads out the subdirectories and files in the specified directory. If no directory is specified, the default directory selected with the `MMEM:CDIR` command is read out.

The response has the following format:

```
<used_bytes_in_this_directory>,<free_bytes_on_this_disk>,
<file_name>,<file_type>,<filesize_in_bytes>,
<file_name>,<file_type>,<filesize_in_bytes>, …
```

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

Parameters:	**<file_name>**
	File or directory name

                                    <file_type>
                                    File type. There are the following file types: DIR (directory), ASCii (ASCII file), BINary (Binary file), and STATe (file with instrument settings).

                                    <filesize_in_bytes>
                                    File size. The size "0" is returned for a directory.

Example:	`MMEM:CAT? '/var'`
	'reads out all files at the highest directory level of the compact flash card.

                        Response:

                        "'127145265,175325184,"test,DIR,0","temp,DIR,0","readme.txt,ASC,1324","state. savracl,STAT,5327","waveform.wv,BIN,2342"

                        'the directory `var/` contains the subdirectories `'test'` and `'temp'` as well as the files `'readme.txt'`, `'state.savrcl'` and `'waveform.wv'` which have different file types.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:CATalog:LENGth? <path>

This command reads out the number of files in the specified directory. If no directory is specified, the default directory selected with the `MMEM:CDIR` command is read out.

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

Example:	`MMEM:CAT:LENG? 'var/'`
	'reads out the number of files at the highest directory level of the compact flash card.

                        Response: 1
                        'there is 1 file at the highest directory level of the memory stick.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

MMEMory:CDIRectory <directory_name>

This command changes the default directory. This directory is used for all subsequent MMEM commands if no path is specified with them. It is also possible to change to a higher directory using two dots '..' .

Example: `MMEM:CDIR 'test'`

              'changes from the current directory level to the subdirectory `'test'`.

*RST value	Resolution	Options	SCPI
/Var	-		Compliant

MMEMory:COPY <source>[,<destination>]

This command copies the first specified file to the second specified file. Instead of just a file, this command can also be used to copy a complete directory together with all its files.

If <destination> is not specified, <source> is copied to the `MMEM:CDIR` directory. Files which already exist with the same name in the destination directory are overwritten without an error message.

It is also possible to specify the path using another parameter. The command is:
 MMEMory:COPY <file_source><msus_source>[,<file_destination>,<msus_destination>]

The command triggers an event and therefore has no query form and no *RST value.

Example: `MMEM:COPY 'var/user/test1.savrcl,'var/temp'`

              'copies the file `'test1.savrcl'` in the USER directory on the internal flash card to the TEMP directory without changing the file name.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:DATA   <file_name>[,<binary block data>]
MMEMory:DATA?   <file_name>

This command writes the block data <binary block data> to the file identified by <file_name>. The IEC/IEEE-bus terminator should be set to EOI in order to ensure correct data transfer.

The associated query command transfers the specified file from the R&S Signal Generator to the IEC/IEEE bus and then on to the control computer. It is important to ensure that the intermediate memory on the control computer is large enough to take the file. In this case, the setting for the IEC/IEEE-bus terminator is irrelevant.

This command can be used to read/transfer stored instrument settings directly from/to the instrument.

The binary data block has the following structure: #234<block_data>
\#   always comes first in the binary block
<number>   indicates how many digits the subsequent length entry has (2 in example)
<number> indicates the number of subsequent bytes (34 in example)
<binary block data>   binary block data for the specified length

Example: MMEM:DATA 'TEST1.savrcl',#3767<binary data>
                'writes the block data to the file 'test1.savrcl'.

                MMEM:DATA? 'TEST1.SAVRCL'
                'sends the data of the file 'Test1.savrcl' from the R&S Signal Generator to the control computer in the form of a binary block.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:DCATalog? <path>

This command reads out the subdirectories of the specified directory. If no directory is specified, the default directory selected with the MMEM:CDIR command is read out. The directories are output in a list (the list entries are separated by commas).

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

Example: MMEM:DCAT?
                'reads out the subdirectories of the current directory.

                Response: 'test', 'wave', 'digital'
                'the subdirectories 'test', 'wave' and 'digital' exist in the current directory.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

MMEMory:DCATalog:LENGth? <path>

This command reads out the number of subdirectories in the specified directory. If no directory is specified, the directory selected with the `MMEM:CDIR` command is read out.

Example: `MMEM:DCAT:LENG`

                         'reads out the number of subdirectories in the current directory.

                      Response: 3
                         'there are 3 subdirectories in the current directory.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

MMEMory:DELete <file_name>

This command deletes the specified file.

The command triggers an event and therefore has no query form and no *RST value.

Example: `MMEM:DEL 'var/USER/TEST1.SAVRCL'`

                       'deletes the file `'Test1.savrcl'` in the USER directory on the internal flash card.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:MDIRectory <directory_name>

The command creates a new subdirectory in the specified directory. If no directory is specified, a subdirectory is created in the default directory. This command can also be used to create a directory tree.

The command triggers an event and therefore has no query form and no *RST value.

Example: `MMEM:MDIR 'carrier'`

                       'creates the subdirectory `'carrier'` in the current directory.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

MMEMory:MOVE <file_source>,<file_destination>

This command renames an existing file if no path is specified for <file_destination>. Otherwise the file is moved to the specified path and stored under the original file name or, if specified, a new file name.

It is also possible to specify the path using another parameter. The command is:
 MMEMory:MOVE <file_source><msus_source>[,<file_destination>,<msus_destination>]

The command triggers an event and therefore has no query form and no *RST value.

Example: MMEM:MOVE 'test1.savrcl','keep1.savrcl
            'renames the file 'test1.savrcls' as 'keep1.savrcl'.

            MMEM:MOVE 'test1.savrcl','\SMF_one\keep1.savrcl
             'moves the file 'test1.savrcl' to the subdirectory 'SMF_one' and stores it there under the name 'keep1.savrcl'.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:MSIS <msus>

The command is without effect for the Linux operating system of R&S SMF.

*RST value	Resolution	Options	SCPI
-	-		Compliant

MMEMory:RDIRectory <directory_name>

The command deletes the specified subdirectory in the specified directory. If no directory is specified, the subdirectory with the specified name is deleted in the default directory.

The command triggers an event and therefore has no query form and no *RST value.

Example: MMEM:RDIR 'carrier'
            'deletes the subdirectory 'carrier' in the current directory.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

MMEMory:STORe:STATe 0,<file_name>

This command stores the current instrument setting in the specified file. If 0 is specified, the current instrument setting is stored directly in the specified file. The intermediate instrument settings can be stored using the *SAV command.

If a number other than 0 is specified, the instrument setting must first be stored in an internal memory with the same number using the common command *SAV.

The command triggers an event and therefore has no query form and no *RST value.

Example: MMEM:STOR:STAT 0,'VAR/USER/TEST1.ss'
            'stores the current instrument setting in the file 'test1.ss' in the USER directory on the internal flash card.

*RST value	Resolution	Options	SCPI
-	-		Compliant

OUTPut Subsystem

The OUTPut system contains the commands which set the properties of the RF output connectors and USER connectors. The properties of the LF output connector are set in the SOURce:LFOutput system, see section "*SOURce:LFOutput Subsystem*".

Command	Parameters	Default unit	Remark
OUTPut:ALL[:STATe]	ON | OFF		
OUTPut:AFIXed:RANGe:LOWer?		dBm	Query only
OUTPut:AFIXed:RANGe:UPPer?		dBm	Query only
OUTPut:ALC:SEARch:MODE	NORMal | MINimum		
OUTPut:AMODe	AUTO | FIXed		
OUTPut:BLANk:MODE	OFF | ON | AUTO		
OUTPut:BLANk:POLarity	NORMal | INVerted		
OUTPut:FPRoportional:SCALe	S0V5 | S1V0		
OUTPut[:STATe]	ON | OFF		
OUTPut[:STATe]:PON	OFF | UNCHanged		

OUTPut:ALL[:STATe] ON | OFF

The command switches on or off all RF output signals of the instrument.

Example: OUTP:ALL OFF
            'switches off all RF output signals.

*RST value	Resolution	Options	SCPI
OFF			Device-specific

OUTPut:AFIXed:RANGe:LOWer?

The command queries the minimum level which can be set without the attenuator being adjusted (Attenuator FIXed).

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

Example: OUTP:AFIX:RANG:LOW?
            'queries the minimum level for the FIXed setting'.

            Response:
            '–50'
            'the minimum level is -50 dBm.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

OUTPut:AFIXed:RANGe:UPPer?

The command queries the maximum level which can be set without the attenuator being adjusted (Attenuator FIXed).

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

Example: OUTP:AFIX:RANG:UPP?
'queries the maximum level for the FIXed setting for the RF output'.

Response:–27
'the maximum level is -27 dBm.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

OUTPut:ALC:SEARch:MODE NORMal | MINimum

The command activates/deactivates the RF output during the power search.

Example: POW:ALC:SEARch:MODE NORM
'during the power search, the RF output is active.

*RST value	Resolution	Options	SCPI
OFF			Device-specific

OUTPut:AMODe   AUTO | FIXed

The command switches the mode of the attenuator at the RF output (Attenuator MODe).

Parameters: **AUTO**
The mechanical attenuator switches in steps of 10 dB at fixed points.

FIXed
The level settings are made without switching the attenuator or the relays. When this operating mode is switched on, the attenuator and the relays are fixed in their current positions and the resulting variation range is defined.

Example: POW:ALC ON
'activates automatic level control for RF output.

OUTP:AMOD FIX
'sets the fixed mode with uninterrupted level for the RF output'.

*RST value	Resolution	Options	SCPI
AUTO	-		Device-specific

OUTPut:BLANk:MODE OFF | ON | AUTO

The command selects the RF blanking method for sweeps with step widths less than 10 MHz.

Example: OUTP:BLAN:MODE AUTO
'blanking is performed only when the step synthesizer switches to the next step.

*RST value	Resolution	Options	SCPI
AUTO			Device-specific

OUTPut:BLANk:POLarity NORMal | INVerted

The command selects the polarity of the Blank Marker.

Example: `OUTP:BLAN:POL NORM`
                      'selects normal polarity for the Blank Marker.

*RST value	Resolution	Options	SCPI
NORMal			Device-specific

OUTPut:FPRoportional:SCALe S0V5 | S1V0

The command selects the V/GHz ratio for the output.

Example: `OUTP:FPR:SCAL S0V5`
                      'sets the V/GHz ratio for the output to 0.5.

*RST value	Resolution	Options	SCPI
S1V0			Device-specific

OUTPut[:STATe]   ON | OFF

This command activates and deactivates the RF output.

Example: `OUTP OFF`
                      'deactivates the RF output.

*RST value	Resolution	Options	SCPI
OFF	-		Compliant

OUTPut[:STATe]:PON   OFF | UNCHanged

This command selects the state which the RF output assumes when the instrument is switched on.

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

Parameters: **OFF**
                      The output is deactivated when the instrument is switched on.

                      UNCHanged
                      When the instrument is switched on, the output remains in the same state as it was when the instrument was switched off.

Example: `OUTP:PON OFF`
                      'The RF output is deactivated when the instrument is switched on.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SOURce Subsystem

The SOURce subsystem contains the commands for configuring the generated signals. The keyword SOURce is optional and can be ommitted.

SOURce:AM Subsystem

The AM subsystem contains the commands for checking the amplitude modulation. Characteristics which are valid for all modulations and the LF Output are configured in the SOURce:LFOutput subsystem. The external signal is input at the **EXT 1** and/or **EXT 2** connector.

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]AM<[1]| 2>[:DEPTh]	0...100 PCT	PCT	
[SOURce:]AM:RATio	0...100 PCT	PCT	
[SOURce:]AM:SCAN: STATe	ON | OFF		
[SOURce:]AM<[1]| 2>:SENSitivity	-10dB/V…10dB/V	dB/V	
[SOURce:]AM<[1]| 2>:SOURce	LF1 | LF2 | EXT1 | EXT2 | NOISe		
[SOURce:]AM<[1]| 2>:STATe	ON | OFF		

[SOURce:]AM<[1]\| 2>[:DEPTh]   0 ... 100 PCT

The command sets the overall modulation depth of the amplitude modulation in percent.

Example: `AM1:DEPT 15PCT`
                'sets the AM modulation depth to 15 percent for path 1.

*RST value	Resolution	Options	SCPI
30 PCT	See data sheet	R&S SMF-B20	Compliant

[SOURce:]AM:RATio   0 ... 100 PCT

The command sets the path 1/path 2 ratio in percent.

Example: `AM:RAT 50PCT`
                'sets the path 1/path 2 ratio to 50 percent.

*RST value	Resolution	Options	SCPI
50 PCT	0.01	R&S SMF-B20	Compliant

[SOURce:]AM:SCAN:STATe   ON | OFF

The command activates/deactivates logarithmic amplitude modulation.

Example: AM:SCAN:STAT ON

            'activates the logarithmic amplitude modulation.

*RST value	Resolution	Options	SCPI
OFF	-	R&S SMF-B20	Compliant

[SOURce:]AM<[1]| 2>**:SENSitivity**   -10dB/V…10dB/V

The command sets the input sensitivity of the EXT input in db/V.

The command is available for scan state ON only.

Example: AM1:SENS 5

            'sets the input sensitivity to 5 dB/V for path 1.

*RST value	Resolution	Options	SCPI
1	-	R&S SMF-B20	Compliant

[SOURce:]AM<[1]| 2>:SOURce   LF1 | LF2 | EXT1 | EXT2 | NOISe

The command selects the modulation source for amplitude modulation. The external signal is input at the **EXT 1** and/or **EXT 2** connector. Internal and external modulation source can be selected at the same time.

Example: AM1:SOUR LF1

            'selects the LF generator 1 as internal modulation source for path 1.

*RST value	Resolution	Options	SCPI
EXT 1	-	R&S SMF-B20	Compliant

[SOURce:]AM<[1]| 2>:STATe   ON | OFF

The command activates/deactivates amplitude modulation.

Example: AM1:STAT ON

            'activates AM modulation for path 1.

*RST value	Resolution	Options	SCPI
OFF	-	R&S SMF-B20	Compliant

SOURce:CORRection Subsystem

The output level is corrected in the CORRection subsystem. Correction is performed by user-defined table values being added to the output level for the respective RF frequency. In the R&S Signal Generator, this subsystem is used to select, transfer, and activate user correction tables (see also Chapter 4).

Each list is stored as a file. The name of the user correction file can be freely selected. The file extension *.**uco** is assigned automatically and cannot be changed.

The files can be stored in a freely selectable directory and opened from there. The default directory is set using command `MMEMory:CDIRectory`. In the case of files which are stored in the default directory, only the file name has to be specified in commands. Otherwise, the complete absolute path has to be specified with every command. The extension can be omitted in any case.

Note:
 In the following command examples, the files are stored in the default directory.

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]CORRection:CSET:CATalog?	-		Query only
[SOURce:]CORRection:CSET:DATA:FREQuency	300 kHz...RF_{max} {,300 kHz...RF_{max} }	HZ	
[SOURce:]CORRection:CSET:DATA:FREQuency:POINts?			Query only
[SOURce:]CORRection:CSET:DATA:POWer	-40 dB...6dB {,-40 dB...6 dB}	dB	
[SOURce:]CORRection:CSET:DATA:POWer:POINts?			Query only
[SOURce:]CORRection:CSET:DATA:[SENSor<1...3>][:POWer]:SONCe			
[SOURce:]CORRection:CSET:DELete	<table name>		No query
[SOURce:]CORRection:DEXChange:AFILe:CATalog?			Query only
[SOURce:]CORRection:DEXChange:AFILe:EXTension	TXT | CSV		
[SOURce:]CORRection:DEXChange:AFILe:SELect	<ASCII file name>		
[SOURce:]CORRection:DEXChange:AFILe:SEParator:COLumn	TABulator | SEMicolon | COMMa | SPACe		
[SOURce:]CORRection:DEXChange:AFILe:SEParator:DECimal	DOT | COMMa		
[SOURce:]CORRection:DEXChange:EXECute			No query
[SOURce:]CORRection:DEXChange:MODE	IMPort | EXPort		
[SOURce:]CORRection:DEXChange:SELect	<list name>		
[SOURce:]CORRection:CSET[:SELect]	<table name>		
[SOURce:]CORRection[:STATe]	ON | OFF		
[SOURce:]CORRection:VALue		dBm	Query only

[SOURce:]CORRection:CSET:CATalog?

The command requests a list of user correction tables. The individual lists are separated by commas.

The lists are stored with the fixed file extensions ***.uco** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`. A path can also be specified in command `:SOUR:CORR:CSET:CAT?`, in which case the files in the specified directory are read.

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

Example: `MMEM:CDIR 'ar/lists/ucor'`
         'selects the directory for the user correction files.

         `CORR:CSET:CAT?`
         'queries which correction tables are available.

         Response: `UCOR1,UCOR2,UCOR3`
         'the correction tables `UCOR1`, `UCOR2` and `UCOR3` are available.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DATA:FREQuency   300 kHz...RF_{max} {,300 kHz...RF_{max}}

The command transfers the frequency data to the table selected with `:CORR:CSET:SEL`.

*RST does not affect data lists.

Example: `CORR:CSET 'var/lists/ucor/ucor1'`
         'selects the table `ucor1`.

         `CORR:CSET:DATA:FREQ 100MHz,102MHz,103MHz,...`
         'enters the frequency value in the table UCOR1.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DATA:FREQuency:POINts?

The command queries the number of frequency values in the selected table.

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

Example: `CORR:CSET 'var/lists/ucor/ucor1'`
         'selects the table `ucor1`.

         `CORR:CSET:DATA:FREQ:POIN?`
         'queries the number of frequency values in the table `ucor1`.

         Response: `440`
         'the table `ucor1` contains 440 frequency values.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DATA:POWer -40dB ... 6dB {,-40dB ... 6dB}

The command transfers the level data to the table selected with `:CORRection:CSET:SELect`.

*RST does not affect data lists.

Example: `CORR:CSET 'var/lists/ucor/ucor1'`
                     'selects the table ucor1.

                     `CORR:CSET:DATA:POW 1dB, 0.8dB, 0.75dB,...`
                     'enters the level values in the table ucor1.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DATA:POWer:POINts?

The command queries the number of level values in the selected table.

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

Example: `CORR:CSET 'var/lists/ucor/ucor1'`
                     'selects the table `ucor1`.

                     `CORR:CSET:DATA:POW:POIN?`
                     'queries the number of level values in the table `ucor1`.

                     Response: `440`
                     'the table `ucor1` contains 440 level values.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DATA[:SENSor<1...3>][:POWer]:SONCe

Note:
   Power sensors are not supported in this release.

The command fills the user correction list with the level values of the selected power sensor. The power sensor used is selected by the suffix in key word SENSe of the command header. Suffix 1 denotes the sensor connected to the SENSOR connector, suffix 2 the sensor connected first to one of the USB interfaces and suffix 3 the sensor connected second to one of the USB interfaces.

Example: `CORR:CSET:DATA:SENS1:POW:SONC`
                     'fills the user correction list with the level values of the power sensor
                     connected to the SENSOR connector.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:CSET:DELete <table name>

The command deletes the specified table.

The lists are stored with the fixed file extensions ***.uco** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`. A path can also be specified in command `:SOUR:CORR:CSET:CAT?`, in which case the file in the specified directory is deleted.

The command is an event and therefore has no *RST value. The numerical suffix under SOURce is irrelevant.

Example: MMEM:CDIR 'var/lists/ucor'
                'selects the directory for the user correction files.

                CORR:CSET:DEL 'UCOR1'
                'deletes the table `ucor1`.

*RST value	Resolution	Options	SCPI
-	-	-	Device-specific

[SOURce:]CORRection:DEXChange:AFILe:CATalog?

The command requests a list of available ASCII files for export/import of user correction data. The individual files are separated by commas.

The ASCII files are stored with the fixed file extensions ***.txt** or *.**csv** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`. A path can also be specified in command `SOUR:CORR:DEXC:AFIL:CAT?`, in which case the files in the specified directory are read.

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

Example: MMEM:CDIR 'var/lists/ucor/import'
                'selects the directory for the ASCII files with frequency and level value pairs.

                CORR:DEXC:AFIL:EXT TXT
                'selects that ASCII files with extension *.txt are listed.

                CORR:DEXC:AFIL:CAT?
                'queries the available files with extension *.txt.

                Response: 'ucor1,ucor2'
                'the ASCII files `ucor1`.txt and `ucor2`.txt are available.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection:DEXChange:AFILe:EXTension TXT | CSV

The command selects the file extension of the ASCII file to be imported or exported. Selection TXT (text file) or CSV (Excel file) is available.

Example: MMEM:CDIR 'var/lists/ucor/import'
                    'selects the directory for the ASCII files with frequency and level value pairs.

                    CORR:DEXC:AFIL:EXT TXT
                    'selects that ASCII files with extension *.txt are listed.

                    CORR:DEXC:AFIL:CAT?
                    'queries the available files with extension *.txt.

                    Response: 'list1,list2'
                    'the ASCII files ucor1.txt and ucor2.txt are available.

*RST value	Resolution	Options	SCPI
TXT	-		Device-specific

[SOURce:]CORRection:DEXChange:AFILe:SELect <ascii_file_name>

The command selects the ASCII file to be imported or exported.

The ASCII files are stored with the fixed file extensions ***.txt** or *.**csv** in a directory of the user's choice. The directory applicable to the commands is defined with the command MMEMory:CDIR. A path can also be specified in command SOUR:CORR:DEXC:AFIL:SEL, in which case the files are stored or loaded in the specified directory.

Example: CORR:DEXC:MODE IMP
                    'selects that ASCII files with frequency and level value pairs are imported and
                    transferred into user correction lists.

                    CORR:DEXC:AFIL:SEL 'var/user/ucor/import/ucor.csv'
                    'selects that ASCII file ucor.csv is imported.

                    CORR:DEXC:SEL 'var/user/ucor/import/ucor_imp'
                    'selects that the ASCII file ucor.csv is imported into user correction list
                    ucor_imp.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection:DEXChange:AFILe:SEParator:COLumn TABulator | SEMicolon | COMMa | SPACe

The command selects the separator between the frequency and level column of the ASCII table.

Example: CORR:DEXC:MODE EXP
        'selects that the user correction list is exported into an ASCII file.

        CORR:DEXC:AFIL:SEL 'var/user/ucor/import/ucor.csv'
        'selects ASCII file ucor.csv as destination for the user correction list data.

        CORR:DEXC:AFIL:SEP:COL TAB
        'the pairs of frequency and level values are separated by a tabulator.

        CORR:DEXC:AFIL:SEP:DEC DOT
        'selects the decimal separator dot.

        CORR:DEXC:SEL 'var/user/ucor/import/ucor_imp'
        'selects that the user correction list ucor_imp is imported into ASCII file ucor.csv .

*RST value	Resolution	Options	SCPI
SEMicolon	-		Device-specific

[SOURce:]CORRection:DEXChange:AFILe:SEParator:DECimal DOT | COMMa

The command the decimal separator used in the ASCII data between '.' (decimal point) and ',' (comma) with floating-point numerals.

Example: CORR:DEXC:MODE EXP
        'selects that the user correction list is exported into an ASCII file.

        CORR:DEXC:AFIL:SEL 'var/user/ucor/import/ucor.csv'
        'selects ASCII file ucor.csv as destination for the user correction list data.

        CORR:DEXC:AFIL:SEP:COL TAB
        'the pairs of frequency and level values are separated by a tabulator.

        CORR:DEXC:AFIL:SEP:DEC DOT
        'selects the decimal separator dot.

        CORR:DEXC:SEL 'var/user/ucor/import/ucor_imp'
        'selects that the user correction list ucor_imp is imported into ASCII file ucor.csv .

*RST value	Resolution	Options	SCPI
DOT	-		Device-specific

[SOURce:]CORRection:DEXChange:EXECute

The command starts the export or import of the selected file. When import is selected, the ASCII file is imported as user correction list. When export is selected, the user correction list is exported into the selected ASCII file.

The command triggers an event and therefore has no *RST value.

Example: CORR:DEXC:MODE IMP
'selects that ASCII files with frequency and level value pairs are imported and transferred into user correction lists.

CORR:DEXC:AFIL:SEL 'var/user/ucor/import/ucor.csv'
'selects that ASCII file ucor.csv is imported.

CORR:DEXC:SEL 'var/user/ucor/import/ucor_imp'
'selects that the ASCII file ucor.csv is imported into user correction list ucor_imp.

CORR:DEXC:EXEC
'starts the import of the ASCII file data into the user correction file.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection:DEXChange:MODE IMPort | EXPort

The command selects if user correction lists should be imported or exported. Depending on the selection, the file select command define either the source or the destination for user correction lists and ASCII files.

Example: CORR:DEXC:MODE IMP
'selects that ASCII files with frequency and level value pairs are imported and transferred into user correction lists.

CORR:DEXC:AFIL:SEL 'var/user/ucor/import/ucor.csv'
'selects that ASCII file ucor.csv is imported.

CORR:DEXC:SEL 'var/user/ucor/import/ucor_imp'
'selects that the ASCII file ucor.csv is imported into user correction list ucor_imp.

*RST value	Resolution	Options	SCPI
IMPort	-		Device-specific

[SOURce:]CORRection:DEXChange:SELect <list_name>

The command selects the user correction list to be imported or exported.

The user correction files are stored with the fixed file extensions ***.uco** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`. A path can also be specified in command `SOUR:CORR:DEXC:SEL`, in which case the files are stored or loaded in the specified directory.

Example: `CORR:DEXC:MODE IMP`
                   'selects that ASCII files with frequency and level value pairs are imported and transferred into user correction lists.

                   `CORR:DEXC:AFIL:SEL 'var/user/ucor/import/ucor.csv'`
                   'selects that ASCII file ucor.csv is imported.

                   `CORR:DEXC:SEL 'var/user/ucor/import/ucor_imp'`
                   'selects that the ASCII file ucor.csv is imported into user correction list ucor_imp.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection:CSET[:SELect]   <table name>

The command selects the table for user correction. Level correction must also be activated with the command `SOUR:CORRection:CSET:STATe ON`.

The lists are stored with the fixed file extensions ***.uco** in a directory of the user's choice. The directory applicable to the commands is defined with the command `MMEMory:CDIR`. A path can also be specified in command `:SOUR:CORR:CSET:SEL`, in which case the files in the specified directory are selected.

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

Example: `CORR:CSET 'var/lists/ucor/ucor1'`
                   'selects the table `ucor1`.

                   `CORR ON`
                   'activates level correction. Correction is performed using the table `ucor1`.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]CORRection[:STATe]   ON | OFF

The command activates/deactivates level correction. Level correction is performed using the table which has been selected with the command `CORRection:CSET:SELect`.

Example: `SOUR:CORR:CSET 'ucor1'`
                   'selects the table `ucor1`.

                   `SOUR:CORR ON`
                   'activates user correction.

*RST value	Resolution	Options	SCPI
OFF	-		Device-specific

The command requests the current value for user correction.

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

Example: CORR:VAL?
'queries the value currently used for level correction.

Response: –3
'the correction value is -3dB.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SOURce:DM Subsystem

This section contains the commands for generating the digital modulation signal. Two external inputs (**EXT 1** and **EXT 2**) are available as data source. The settings for the external inputs are independently of the type of modulation selected.

Command	Parameters	Default unit	Remark
[SOURce]:DM:ASK:DEPTh	0...100 PCT		
[SOURce]:DM:ASK:SOURce	EXT1 | EXT2 | PGENerator | RANDom		
[SOURce]:DM:ASK:STATe	ON | OFF		
[SOURce]:DM:EXTernal:POLarity<[1]| 2>	NORMal | INVerted		
[SOURce]:DM:FSK:DEViation	0...50 MHz	Hz	
[SOURce]:DM:FSK:SOURce	EXT1 | EXT2 | PGENerator | RANDom		
[SOURce]:DM:FSK:STATe	ON | OFF		
[SOURce]:DM:PSK:STATe	ON | OFF		
[SOURce]:DM:PSK:SOURce	EXT1 | EXT2 | PGENerator | RANDom		
[SOURce]:DM:PSK:DEViation	0...100 rad	rad	

[SOURce:]DM:ASK:DEPTh   0...100 PCT

The command sets the modulation depth for ASK modulation.

Example: SOUR:DM:ASK 30PCT
'sets the modulation depth for the amplitude modulation to 30%.

*RST value	Resolution	Options	SCPI
30 PCT	0.01 PCT	R&S SMF-B20	Device-specific

[SOURce:]DM:ASK:SOURce   EXT1 | EXT2 | PGENerator | RANDom

The command selects the source for the ASK modulation signal.

Parameters: **EXT 1/EXT 2**
Selects the external inputs (either **EXT 1** or **EXT 2**) as the source for ASK modulation.

PGEN
Selects the internal pulse generator as source for ASK modulation.

RAND
Selects random pulses generated by the noise generator as the source for ASK modulation.

Example: SOUR:DM:ASK:SOUR EXT 1
'selects the external input EXT 1 as source for the amplitude modulation signal.

*RST value	Resolution	Options	SCPI
EXT1	-	R&S SMF-B20	Device-specific

[SOURce:]DM:ASK:STATe   ON | OFF

The command activates/deactivates the ASK modulation.

Example: SOUR:DM:ASK:STAT ON
'activates the amplitude modulation.

*RST value	Resolution	Options	SCPI
OFF	-	R&S SMF-B20	Device-specific

[SOURce:]DM:EXTernal:POLarity<[1]| 2>   NORMal | INVerted

The command sets the polarity of the external modulation signal.

Parameters: **NORMal**
The RF level is ON while the level is HIGH.

INVerted
The RF level is ON while the level is LOW.

Example: SOUR:DM:EXT:POL NORM
'sets the marker output polarity to normal.

*RST value	Resolution	Options	SCPI
NORMal		R&S SMF-B20	Device-specific

SOURce:]DM:FSK:DEViation   0...50 MHz

The command sets the frequency deviation for FSK modulation.

Example: SOUR:DM:FSK:DEV 20 MHz
'sets the deviation to 20 MHz.

*RST value	Resolution	Options	SCPI
40 MHz	0.1 Hz	R&S SMF-B20	Device-specific

[SOURce:]DM:FSK:SOURce   EXT1 | EXT2 | PGENerator | RANDom

The command selects the source for the FSK modulation signal.

Parameters: **EXT 1/EXT 2**
Selects the external inputs (either **EXT 1** or **EXT 2**) as the source for FSK modulation.

PGEN
Selects the internal pulse generator as source for FSK modulation.

RAND
Selects random pulses generated by the noise generator as the source for FSK modulation.

Example: SOUR:DM:FSK:SOUR EXT 1
'selects the external input EXT 1 as source for the frequency modulation signal.

*RST value	Resolution	Options	SCPI
EXT1	-	R&S SMF-B20	Device-specific

[SOURce:]DM:FSK:STATe   ON | OFF

The command activates/deactivates the FSK modulation.

Example: SOUR:DM:FSK:STAT ON
'activates the frequency modulation.

*RST value	Resolution	Options	SCPI
OFF	-	R&S SMF-B20	Device-specific

SOURce:]DM:PSK:DEViation   0...100 RAD

The command sets the phase deviation for PSK modulation.

Example: SOUR:DM:PSK:DEV 30RAD
'sets the deviation to 30 RAD.

*RST value	Resolution	Options	SCPI
30 RAD		R&S SMF-B20	Device-specific

[SOURce:]DM:PSK:SOURce   EXT1 | EXT2 | PGENerator | RANDom

The command selects the source for the PSK modulation signal.

Parameters: **EXT 1/EXT 2**
Selects the external inputs (either **EXT 1** or **EXT 2**) as the source for PSK modulation.

                     PGEN
Selects the internal pulse generator as source for PSK modulation.

                     RAND
Selects random pulses generated by the noise generator as the source for PSK modulation.

Example: SOUR:DM:PSK:SOUR EXT 1
'selects the external input EXT 1 as source for the phase modulation signal.

*RST value	Resolution	Options	SCPI
EXT1	-	R&S SMF-B20	Device-specific

[SOURce:]DM:PSK:STATe   ON | OFF

The command activates/deactivates the PSK modulation.

Example: SOUR:DM:PSK:STAT ON
'activates the phase modulation.

*RST value	Resolution	Options	SCPI
OFF	-	R&S SMF-B20	Device-specific

SOURce:FM Subsystem

The FM subsystem contains the commands for checking the frequency modulation. Characteristics which are valid for all modulations and the LF Output are configured in the SOURce:LFOutput subsystem (e.g. frequency). The external signal is input at the **EXT 1** and/or **EXT 2** connector. Internal and external modulation source can be selected at the same time, thus enabling two-tone FM modulation.

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]FM<[1]| 2>:DEViation	0 Hz...50 MHz	kHz	
[SOURce:]FM:MODE	NORMal | LNOise		
[SOURce:]FM:RATio	0...100 PCT	PCT	
[SOURce:]FM<[1]| 2>:SOURce	LF1 | LF2 | EXT1 | EXT2 | NOISe		
[SOURce:]FM<[1]| 2>:STATe	ON | OFF		

[SOURce:]FM<[1]\| 2>:DEViation   0 … 50 MHz

The command enters the deviation of the FM signal

Example: FM1:DEV 3kHz
                 'sets the modulation depth of 3 kHz for path 1.

*RST value	Resolution	Options	SCPI
10 kHz	-	R&S SMF-B20	Compliant

[SOURce:]FM:MODE   NORMal \| LNOise

The command sets the mode for the frequency modulation.

Parameters: **NORMal**
                    The maximum range for modulation bandwidth and FM deviation is available.

                    LNOise
                    Frequency modulation with phase noise and spurious characteristics close to CW mode. The range for modulation bandwidth and FM deviation is reduced (see data sheet).

Example: FM:MODE NORM
                 'sets the normal mode, e.g. the maximum range for modulation bandwidth and FM deviation is available.

*RST value	Resolution	Options	SCPI
NORMal	-	R&S SMF-B20	Compliant

[SOURce:]FM:RATio   0 ... 100 PCT

The command sets the path 1/path 2 ratio in percent.

Example: FM:RAT 50PCT

               'sets the path 1/path 2 ratio to 50 percent.

*RST value	Resolution	Options	SCPI
50 PCT	0.01	R&S SMF-B20	Compliant

[SOURce:]FM<[1]| 2>**:SOURce**   LF1 | LF2 | EXT1 | EXT2 | NOISe

Selects the source for the FM signal.

Example: FM1:SOUR LF2

               'selects the LF generator 2 as internal modulation source for path 1.

*RST value	Resolution	Options	SCPI
EXT1	-	R&S SMF-B20	Compliant

[SOURce:]FM<[1]| 2>**:STATe**   ON | OFF

The command activates/deactivates frequency modulation.

Activation of frequency modulation deactivates phase modulation.

Example: FM1:STAT ON

               'activates FM modulation for path 1.

*RST value	Resolution	Options	Correlation	SCPI
OFF	-	R&S SMF-B20	FM ON deactivates phase modulation.	Compliant

SOURce:FREQuency Subsystem

This subsystem contains the commands used to define the frequency settings for the RF sources and sweeps.
The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]FREQuency:CENTer	300 kHz...RF$_{max}$	Hz	
[SOURce:]FREQuency[:CW|:FIXed]	100 kHz...RF$_{max}$	Hz	
[SOURce:]FREQuency[:CW	:FIXed]:RCL	INCLude	EXCLude		
[SOURce:]FREQuency:FREQuency	100 kHz...RF$_{max}$	Hz	
[SOURce:]FREQuency:MANual	300 kHz...RF$_{max}$	Hz	
[SOURce:]FREQuency:MODE	CW	FIXed	SWEep		
[SOURce:]FREQuency:MULT	0.001...10000		
[SOURce:]FREQuency:OFFSet	-50 ...+50 GHz	Hz	
[SOURce:]FREQuency:SPAN	0...RF$_{max}$	Hz	
[SOURce:]FREQuency:STARt	100 kHz...RF$_{max}$	Hz	
[SOURce:]FREQuency:STEP[:INCRement]	1 MHz...10 GHz	MHz	
[SOURce:]FREQuency:STEP:MODE	USER	DECimal		
[SOURce:]FREQuency:STOP	300 kHz...RF$_{max}$	Hz	

[SOURce:]FREQuency:CENTer   100 kHz...RF$_{max}$ (RF$_{max}$ depending on model)

The command sets the center frequency of the sweep. This setting in combination with the span setting ([SOURce:]FREQuency:SPAN) defines the sweep range.

This command is linked to the commands [SOURce:]FREQuency:STARt and [SOURce:]FREQuency:STOP, i.e. changing these values causes the CENTer value to change, and vice versa:

CENTer = (STARt + STOP)/2.

As with the **Frequency** value entered in the header, the OFFSet value and the multiplier factor are also taken into consideration with this command. The specified value range is therefore only effective if OFFSet and MULTiplier are set to 0. The value range for other OFFSet values/MULTiplier factors can be calculated using the following formula:

100 kHz + OFFSet + MULTiplier ... RF$_{max}$ + OFFSet + MULTiplier

Example: FREQ:CENT 400 MHz
                'sets the center frequency for the frequency sweep to 400 MHz.

                FREQ:SPAN 200 MHz
                'sets a span of 200 MHz. This sets the sweep range to 300 MHz to 500 MHz.

*RST value	Resolution	Options	Correlation	SCPI
10 GHz	0.01 Hz		CENTer = (STARt + STOP)/2	Compliant

[SOURce:]FREQuency[:CW|:FIXed]   100 kHz ... RF_max

The command sets the frequency of the RF output signal for CW mode
(`SOURce:FREQuency:MODE CW`). In Sweep mode (`SOURce:FREQuency:MODE SWEep`), this
value is linked to the current sweep frequency.

In addition to a numerical value, it is also possible to specify `UP` and `DOWN`. The frequency is then
increased or decreased by the value which is set under `[SOURce:]FREQuency:STEP`.

As with the **FREQ** value entered in the display, the `OFFSet` value and the `MULTiplier` factor are
also taken into consideration with this command. The specified value range is therefore only
effective if `OFFSet` and `MULTiplier` are set to 0. The value range for other `OFFSet`
values/`MULTiplier` factors can be calculated using the following formula:

100 kHz + `OFFSet` + `MULTiplier` ... RF_max + `OFFSet` + `MULTiplier`

Example: `FREQ 500kHz`
'sets the frequency of the RF signal at the output of the downstream
instrument to 500 kHz considering the offset value and multiplier factor.

*RST value	Resolution	Options	Correlation	SCPI
100 MHz	0.01 Hz		`:FREQ` for `FREQ:MODE SWE` linked to sweep frequency.	Compliant

[SOURce:]FREQuency[:CW|:FIXed]:RCL INCLude | EXCLude

The command determines whether the current frequency setting is retained or whether the stored
frequency setting is adopted when an instrument configuration is loaded.

*RST does not affect this setting.

Parameters: **INCLude**
The stored frequency is also loaded when a stored instrument configuration is
loaded.

EXCLude
The RF frequency is not loaded when a stored instrument configuration is
loaded. The current frequency is retained.

Example: `FREQ:RCL INCL`
'the stored frequency is set if the Recall command is called.

*RST value	Resolution	Options	SCPI
-	-		Compliant

[SOURce:]FREQuency:FREQuency   100 kHz ... RF$_{max}$

The command sets the frequency of the RF output signal for CW mode
(`SOURce:FREQuency:MODE CW`). In Sweep mode (`SOURce:FREQuency:MODE SWEep`), this
value is linked to the current sweep frequency.

In addition to a numerical value, it is also possible to specify `UP` and `DOWN`. The frequency is then
increased or decreased by the value which is set under `[SOURce:]FREQuency:STEP`.

The frequency entered and displayed here corresponds to the frequency at the RF connector, that is
any offset entry or multiplier factor is not taken into consideration.

Example: `FREQ:FREQ 500kHz`
                'sets the frequency of the RF output signal to 500 kHz.

*RST value	Resolution	Options	Correlation	SCPI
100 MHz	0.01 Hz		`:FREQ` for `FREQ:MODE SWE` linked to sweep frequency.	Compliant

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[SOURce:]FREQuency:MANual   STARt ... STOP

In Sweep mode (`SOUR:FREQ:MODE SWE`) the command sets the frequency for the next sweep step
in the **Step** sweep mode (`SOUR:SWE:MODE MAN`). Here only frequency values between the settings
`[SOUR]:FREQ:STAR` and `...:STOP` are permitted. Each sweep step is triggered by a separate
`SOUR:FREQ:MAN` command.

As with the **Frequency** value entered in the header, the `OFFSet` value and the multiplier factor are
also taken into consideration with this command. The specified value range is therefore only
effective if `OFFSet` and `MULTiplier` are set to 0. The value range for other `OFFSet`
values/`MULTiplier` factors can be calculated using the following formula:

`STARt + OFFSet + MULTiplier  ... STOP + OFFSet + MULTiplier`

Example: `SWE:MODE MAN`
                'sets the **Step** sweep mode.

                `FREQ:MAN 500MHz`
                'sets an RF frequency of 500 MHz for the next step in the **Step** sweep mode.

                `FREQ:MODE SWE`
                'sets the Frequency Sweep mode. An RF frequency of 500 MHz is output.

                `FREQ:MAN 550MHz`
                'triggers the next sweep step with an RF frequency of 550 MHz.

*RST value	Resolution	Options	SCPI
10 GHz	0.01 Hz		Compliant

[SOURce:]FREQuency:MODE CW |FIXed | SWEep

The command sets the instrument operating mode and therefore also the commands used to set the RF output frequency.

Parameters: **CW|FIXed**
        The instrument operates in fixed-frequency mode. CW and FIXed are synonyms. The output frequency is set with `:SOURce:FREQuency:CW | FIXed`.

        SWEep
        The instrument operates in SWEep mode. The frequency is set using the commands `SOURce:FREQuency:STARt; STOP; CENTer; SPAN; MANual`.

Example: `FREQ:MODE SWE`
        'sets the SWEep mode. The settings under `SOURce:FREQuency:STARt; STOP; CENTer; SPAN; MANual` become effective.

*RST value	Resolution	Option	Correlation	SCPI
CW	-			Compliant

[SOURce:]FREQuency:MULTiplier 0.001...10000

The command sets the value for the multiplication factor of a subsequent downstream instrument.

Example: `FREQ:MULT 1`
        'sets the multiplication factor to 1.

*RST value	Resolution	Option	Correlation	SCPI
1	-			Compliant

[SOURce:]FREQuency:OFFSet -50 GHz ... + 50 GHz

The command sets the frequency offset of a downstream instrument, for example a mixer. If a frequency offset is entered, the frequency entered with `SOURce:FREQuency:...` no longer corresponds to the RF output frequency. The following correlation applies:

`SOURce:FREQuency:...` = RF output frequency + `SOURce:FREQuency:OFFSet`.

Entering an offset does not change the RF output frequency, but rather the query value of `SOURce:FREQuency:.....`.

Example: `SOUR:FREQ:OFFS 500kHz`
        'sets the frequency offset to 500 kHz.

*RST value	Resolution	Options	SCPI
0 Hz	0.01 Hz		Compliant

[SOURce:]FREQuency:SPAN   100 kHz...RF$_{max}$ (RF$_{max}$ depending on model)

This command specifies the span for the sweep. This setting in combination with the center frequency setting (`[SOUR]:FREQ:CENT`) defines the sweep range.

This command is linked to the commands `[SOUR]:FREQ:STAR` and `[SOUR]:FREQ:STOP`, i.e. changing these values causes the `SPAN` value to change, and vice versa:

`SPAN = (STOP - STARt)`

Negative values for SPAN are permitted; STARt > STOP then applies.

Example: `FREQ:CENT 400MHz`
            'sets the center frequency of the frequency sweep to 400 MHz.

        `FREQ:SPAN 200MHz`
            'sets a span of 200 MHz. This sets the sweep range to 300 MHz to 500 MHz.

*RST value	Resolution	Options	Correlation	SCPI
10 GHz	0.01 Hz		SPAN = (STOP - STARt)	Compliant

[SOURce:]FREQuency:STARt   100 kHz...RF$_{max}$ (RF$_{max}$ depending on model)

This command sets the start frequency for the sweep mode. `STARt` can be greater than `STOP`.

This command is linked to the commands `[SOUR]:FREQ:CENT` and `[SOUR]:FREQ:SPAN`, i.e. changing these values causes the `STARt` value to change, and vice versa:

`STARt = (CENTer - SPAN/2).`

As with the **Frequency** value entered in the header, the `OFFSet` value and the multiplier factor are also taken into consideration with this command. The specified value range is therefore only effective if `OFFSet` and `MULTiplier` are set to 0. The value range for other `OFFSet` values/`MULTiplier` factors can be calculated using the following formula:

100 kHz + `OFFSet` + `MULTiplier` ... RF$_{max}$ + `OFFSet` + `MULTiplier`

Example: `FREQ:STAR 1MHz`
            'sets the start frequency for the frequency sweep to 1 MHz.

        `FREQ:STOP 2GHz`
            'sets the stop frequency for the frequency sweep to 2 GHz.

*RST value	Resolution	Options	Correlation	SCPI
10 GHz	0.01 Hz		STARt = (CENTer - SPAN/2)	Compliant

[SOURce:]FREQuency:STEP[:INCRement] 1 MHz ... 10 GHz

The command sets the step width for the frequency setting if the frequency values UP/DOWN are used and variation mode SOUR:FREQ:STEP:MODE USER is selected. The command is linked to **Variation Step** for manual control, i.e. the command also sets the step width of the rotary knob for **Variation Active on**.

Example: FREQ:STEP:MODE USER
'activates the step width mode for frequency variation with the rotary knob (manual control) and with frequency values UP/DOWN (remote control)'

FREQ:STEP 15MHz
'sets the step width for the frequency setting to 15 MHz'.

*RST value	Resolution	Options	SCPI
1 MHz	1 MHz		Device-specific

[SOURce:]FREQuency:STEP:MODE USER | DECimal

This command activates (USER) or deactivates (DECimal) the user-defined step width used when varying the frequency value with the frequency values UP/DOWN. The command is linked to the command **Variation Active** for manual control, i.e. the command also activates/deactivates the user-defined step width used when varying the frequency value with the rotary knob.

Example: FREQ:STEP 15MHz
'sets the step width for the frequency setting to 15 MHz'.

FREQ:STEP:MODE USER
'activates this step width for frequency variation with the rotary knob (manual control) and with frequency values UP/DOWN (remote control).

*RST value	Resolution	Options	SCPI
DECimal	-		Device-specific

[SOURce:]FREQuency:STOP 100 kHz...RF_{max} (RF_{max} depending on model)

This command sets the stop frequency for the sweep mode. STOP can be less than STARt.

This command is linked to the commands [:SOUR]:FREQ:CENt and [:SOUR]:FREQ:SPAN, i.e. changing these values causes the STARt value to change, and vice versa:

STOP = (CENTer + SPAN/2).

As with the **Frequency** value entered in the header, the OFFSet value and the MULTiplier factor are also taken into consideration with this command. The specified value range is therefore only effective if OFFSet and MULTiplier are set to 0. The value range for other OFFSet values and MULTiplier factors can be calculated using the following formula:

100 kHz + OFFSet + MULTiplier ... RF_{max} + OFFSet + MULTiplier

Example: FREQ:STOP 2GHz
'sets the stop frequency for the frequency sweep to 2 GHz.

FREQ:STAR 1MHz
'sets the start frequency for the frequency sweep to 1 MHz.

*RST value	Resolution	Options	Correlation	SCPI
10 GHz	0.01 Hz		STOP = (CENTer + SPAN/2)	Compliant

SOURce-KBOard Subsystem

The KBOard subsystem contains the commands to set the keyboard language and layout.

Command	Parameters	Default unit	Remark
KBOard:LANGuage	DE | US	MHz	
KBOard:LAYout	DE | US		

KBOard:LANGuage   DE \| US

The command selects the keyboard language. The assignment of some keys depends on the selected language.

Example: `KBO:LANG DE`
              'selects the German keyboard language.

*RST value	Resolution	Options	SCPI
US	-		Compliant

KBOard:LAYout   DE \| US

The command selects the keyboard layout. The assignment of some keys depends on the selected layout.

Example: `KBO:LAY DE`
              'selects the German keyboard layout.

*RST value	Resolution	Options	SCPI
US	-		Compliant

SOURce-INPut Subsystem

The SOURce:INPut subsystem contains the commands for configuring the inputs for external
modulation signals and trigger.
The instrument trigger setting influences all sweeps (Instrument Trigger).

Command	Parameters	Default unit	Remark
[SOURce:]INPut:MODext:COUPling<[1]	2>	AC	DC		
[SOURce:]INPut:MODext:IMPedance<[1]|2>	G50	G600	G100k		
[SOURce:]INPut:TRIGger:SLOPe	POSitive	NEGative		

[SOURce:]INPut:MODext:COUPling<[1]|2>   AC | DC

The command selects the coupling mode for external feed via **EXT 1** and/or **EXT 2** input.

Parameters: **AC**
                                The DC voltage component is disconnected from the modulation signal.

                      DC
                                The modulation signal is not changed.

Example: SOUR:INP:MOD:COUP1 AC
                                'selects the coupling mode AC for external modulation input EXT1.

*RST value	Resolution	Options	SCPI
AC	-	Option R&S SMF-B20	Compliant

[SOURce:]INPut:MODext:IMPedance<[1]|2> G50 | G600 | G100k

The commands set the impedance for external feed via the **EXT 1** or **EXT 2** input.

Parameters: **G100k**
                                100 kohm to ground

                      G600
                                600 ohm to ground

                      G50
                                50 ohm to ground

Example: INP:MOD:IMP1 G50
                                'the EXT input is set to 50 ohm to ground.

*RST value	Resolution	Options	SCPI
G100k	-	Option R&S SMF-B20	Device-specific

[SOURce:]INPut:TRIGger:SLOPe   POSitive | NEGative

The command sets the active slope of an externally applied trigger signal at the TRIGGER input (BNC connector at the rear of the instrument).

Example: INP:TRIG:SLOP NEG

'the active slope of the external trigger signal at the **TRIGGER** input is the falling slope.

*RST value	Resolution	Options	SCPI
POSitive	-		Device-specific

SOURce:LFOutput Subsystem

This subsystem contains the commands for setting the LF signal source in CW and Sweep mode as well as for analog modulations. Two internal LF generators and a noise generator are available with option R&S SMF-B20.
The suffix for LFOutput<[1]|2> denotes the selected LF generator.

The source for the LF sweep (LF generator 1 or 2) is selected with command
SOURce:LFOutput:SWEep:LFSource.

An LF sweep is set in several steps which are shown in the following example:

1. Set the sweep range.
   LFOutput:FREQuency:STARt 4kHz
   LFOutput:FREQuency:STOP 10kHz

2. Select linear or logarithmic sweep spacing.
   LFOutput:SWEep[:FREQuency]:SPACing LIN

3. Set the step width and dwell time.
   LFOutput:SWEep[:FREQuency]:STEP[:LINear] 100Hz
   LFOutput:SWEep[:FREQuency]:DWELl 20ms

4. Determine the sweep mode.
   LFOutput:SWEep:MODE AUTO

5. Determine the trigger.
   TRIGger:LFFSWeep:SOURce SINGle

6. Activate the sweep.
   LFOutput:FREQuency:MODE SWEep

7. Trigger the sweep (depending on the mode).
   LFOutput:SWEep:EXECute

The keyword SOURce is optional and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]LFOutput<[1]| 2>:BANDwidth	BW0M2 | BW10m	kHz	
[SOURce:]LFOutput<[1]| 2>:FREQuency	Min … max	Hz	See data sheet
[SOURce:]LFOutput<[1]| 2>:SHAPe	SINE | SQUare | TRIangle | TRAPeze		
[SOURce:]LFOutput<[1]| 2>:SHAPe:PULSe:DCYCle	0...100 PCT	PCT	
[SOURce:]LFOutput<[1]| 2>:SHAPe:PULSe:PERiod	1 µs...100 s	ms	
[SOURce:]LFOutput<[1]| 2>:SHAPe:PULSe:WIDTh	1 µs...100 s	ms	
[SOURce:]LFOutput<[1]| 2>:SHAPe:TRAPeze:FALL	1 µs...100 s	ms	
[SOURce:]LFOutput<[1]| 2>:SHAPe:TRAPeze:HIGH	1 µs...100 s	ms	
[SOURce:]LFOutput<[1]| 2>:SHAPe:TRAPeze:PERiod	1 µs...100s	ms	
[SOURce:]LFOutput<[1]| 2>:SHAPe:TRAPeze:RISE	1 µs...100s	ms	
[SOURce:]LFOutput<[1]| 2>:SHAPe:TRIangle:PERiod	1 µs...100s	ms	
[SOURce:]LFOutput<[1]| 2>:SHAPe:TRIangle:RISE	1 µs...100 s	ms	
[SOURce:]LFOutput<[1]|2>:SOURce	LF1 | LF2 | EXT1 | EXT2 | NOISe		
[SOURce:]LFOutput<[1]|2>:VOLTage	0 V ... 6 V	V	
[SOURce:]LFOutput<[1]|2>[:STATe]	ON | OFF		
[SOURce:]LFOutput:FREQuency:MANual	0.1 Hz ... 1 MHz	Hz	
[SOURce:]LFOutput:FREQuency:MODE	CW | FIXed | SWEep		
[SOURce:]LFOutput:FREQuency:STARt	0.1 Hz ... 10 MHz	Hz	
[SOURce:]LFOutput:FREQuency:STOP	0.1 Hz ... 10 MHz	Hz	
[SOURce:]LFOutput:MONitoring:MODE	OFF | AM | FMPM		
[SOURce:]LFOutput:OFFSet	0 V ... 4 V	V	
[SOURce:]LFOutput:SWEep[:FREQuency]:DWELl	0.1 ms ... 10 s	s	
[SOURce:]LFOutput:SWEep[:FREQuency]:EXECute	-		
[SOURce:]LFOutput:SWEep[:FREQuency]:MODE	AUTO | MANual | STEP		
[SOURce:]LFOutput:SWEep[:FREQuency]:POINts	1...16777215		
[SOURce:]LFOutput:SWEep[:FREQuency]:SPACing	LINear | LOGarithmic		
[SOURce:]LFOutput:SWEep[:FREQuency]:STEP:LOGarithmic	0.01 ... 50 PCT	PCT	
[SOURce:]LFOutput:SWEep[:FREQuency]:STEP[:LINear]	0 ... (STOP - STARt)	Hz	
[SOURce:]LFOutput:SWEep:LFSource	LF1 | LF2		
[SOURce:]LFOutput:SWEep:VOLTage:DWELl	0.1 ms...100s		
[SOURce:]LFOutput:SWEep:VOLTage:EXECute			
[SOURce:]LFOutput:SWEep:VOLTage:LFSource	LF1 | LF2		
[SOURce:]LFOutput:SWEep:VOLTage:MODE	AUTO | MANual | STEP		
SOURce:]LFOutput:SWEep:VOLTage:POINts	1 ...16777215		
[SOURce:]LFOutput:SWEep:VOLTage:STEP[:LINear]	0 V...6 V		
[SOURce:]LFOutput:VOLTage:MANual	Min … max	dBm	
[SOURce:]LFOutput:VOLTage:MODE	CW | SWEep		
[SOURce:]LFOutput:VOLTage:STARt	Min … max	V	
[SOURce:]LFOutput:VOLTage:STOP	0 V...6 V	V	

[SOURce:]LFOutput<[1]|2>:BAND   BW0M2 | BW10M

The command selects the bandwith for the external feed via the **EXT 1** and/or **EXT 2** input. Selection 200 kHZ und 10 MHz are available.

Example: SOUR:LFO1:BAND BW0M2
                 'selects the bandwith 200 kHz for the external feed.

*RST value	Resolution	Options	SCPI
BW10M	-	Option R&S SMF-B20	Compliant

[SOURce:]LFOutput<[1]|2>:FREQuency   0... 10 MHz

The command sets the frequency of the LF signal for CW mode (:SOUR:MODE CW mode). The setting is valid for all analog modulations (AM/FM/PhiM) with internal modulation source and for the LF Output.

In Sweep mode (SOUR:LFO:FREQ:MODE SWE), the frequency is linked to the sweep frequency. "

Example: SOUR:LFO2:FREQ 5kHz
                 'sets the frequency of the LF generator 2 signal to 5 kHz'.

*RST value	Resolution	Options	Correlation	SCPI
1 kHz	0.1 Hz	R&S SMF-B20	LFO:FREQ for LFO:FREQ:MODE SWE linked to sweep frequency	Compliant

[SOURce:]LFOutput<[1]|2>:SHAPe   SINE | SQUare | TRIangle | TRAPeze

The command selects the shape of the LF generator.

Example: SOUR:LFO1:SHAP TRI
                 'selects a triangular shape for the signal of LF generator 1.

*RST value	Resolution	Options	SCPI
SINE		R&S SMF-B20	Compliant

[SOURce:]LFOutput<[1]|2>:SHAPe:PULSe:DCYCle   1 … 100 PCT

The command sets the duty cycle for the shape pulse.

Example: SOUR:LFO2:SHAP:PULS:DCYC 50PCT
                 'sets a duty cycle of 50% for the pulse shape of the signal of LF generator 1.

*RST value	Resolution	Options	SCPI
50 PCT	0.001 PCT	R&S SMF-B20	Compliant

[SOURce:]LFOutput<[1]|2>:SHAPe:PULSe:PERiod 1 us ... 100 s

The command sets the period of the generated pulse. The period determines the repetition frequency of the internal signal.

Example: SOUR:LFO2:SHAP:PULS:PER 10s

'sets a pulse period of 10s for the pulse shape of the signal of LF generator 2.

*RST value	Resolution	Options	SCPI
1 ms	0.01 us	R&S SMF-B20	Compliant

[SOURce:]LFOutput<[1]|2>:SHAPe:PULSe:WIDTh 1 us … 100 s

The command sets the width of the generated pulse. The width determines the pulse length.

Example: SOUR:LFO2:SHAP:PULS:WIDT 10s

'sets a pulse width of 10 s for the pulse shape of the signal of LF generator 2.

*RST value	Resolution	Options	SCPI
1 ms	0.01 us	R&S SMF-B20	Compliant

[SOURce:]LFOutput<[1]|2>:SHAPe:TRAPeze:FALL 1 us … 100 s

The command selects the fall time for the trapezoid shape of the LF generator.

Example: SOUR:LFO2:SHAP:TRAP:FALL 100s

'selects a fall time of 100 s for trapezoid shape of the signal of LF generator 1.

*RST value	Resolution	Options	SCPI
0.25 ms	0.1 ns	Option R&S SMF-B20	Compliant

[SOURce:]LFOutput<[1]|2>:SHAPe:TRAPeze:HIGH 1 us … 100 s

The command selects the high time for the trapeze shape of the LF generator.

Example: SOUR:LFO1:SHAP:TRAP:HIGH 100s

'selects a high time of 100 s for trapeze shape of the signal of LF generator 1.

*RST value	Resolution	Options	SCPI
0.25 ms	0.1 ns	Option R&S SMF-B20	Compliant

[SOURce:]LFOutput<[1]|2>:SHAPe:TRAPeze:PERiod 1 us … 100 s

The command sets the period of the generated trapezoid shape.

Example: SOUR:LFO2:SHAP:TRAP:PER 100s

'sets a pulse period of 100 s for the trapezoid shape of the signal of LF generator 2.

*RST value	Resolution	Options	SCPI
1 ms	0.01 us	R&S SMF-B20	Compliant

SOURce:]LFOutput<[1]|2>:SHAPe:TRAPeze:RISE   1 us … 100 s

The command selects the rise time for the trapeze shape of the LF generator.

Example: SOUR:LFO1:SHAP:TRAP:RISE 100s

                    'selects a rise time of 100 s for trapeze shape of the signal of LF generator 1.

*RST value	Resolution	Options	SCPI
0.25 ms	0.01 ns	R&S SMF-B20	Compliant

[SOURce:]LFOutput<[1]|2>:SHAPe:TRIAngle:PERiod   1 us … 100 s

The command sets the period of the generated pulse. The period determines the repetition frequency of the internal signal.

Example: SOUR:LFO2:SHAP:TRIA:PER 100s

                    'sets a pulse period of 100 s for the pulse shape of the signal of LF generator 2.

*RST value	Resolution	Options	SCPI
1 ms	0.01 us	R&S SMF-B20	Compliant

[SOURce:]LFOutput<[1]|2>:SHAPe:TRIangle:RISE   1 us … 100 s

The command selects the rise time for the triangle shape of the LF generator.

Example: SOUR:LFO1:SHAP:TRI:RISE 13s

                    'selects a rise time of 13 s for triangle shape of the signal of LF generator 1.

*RST value	Resolution	Options	SCPI
0.5 ms	0.01 ns	R&S SMF-B20	Compliant

[SOURce:]LFOutput<[1]|2>:SOURce   LF1 | LF2 | EXT1 | EXT2 | NOISe

The command selects the internal and/or external source to be used for the LF Output signal.

Example: SOUR:LFO1:SOUR NOIS

                    'selects the noise generator as source for the LF output signal.

*RST value	Resolution	Options	SCPI
LF1	-	R&S SMF-B20	Device-specific

[SOURce:]LFOutput<[1]|2>:VOLTage   0 V...6 V

The command sets the output voltage of the LF output.

Example: SOUR:LFO1:VOLT 3V

                    'sets the voltage of the LF output to 3 V.

*RST value	Resolution	Options	SCPI
1 V	0.001 V	R&S SMF-B20	Device-specific

[SOURce:]LFOutput<[1]|2>[:STATe] ON | OFF

The command activates/deactivates the LF output.

Example: SOUR:LFO1 ON

'activates the LF output. The settings under LFO:FREQ and LFO:SWE become effective.

*RST value	Resolution	Options	SCPI
OFF	-	R6S SMF-B20	Device-specific

[SOURce:]LFOutput:FREQuency:MANual STARt ... STOP

In Sweep mode (SOUR:LFO:FREQ:MODE SWE) the command sets the frequency for the next sweep step in the **Step** sweep mode (SOUR:LFO:SWE:MODE MAN). Here only frequency values between the settings SOUR:LFO:FREQ:STAR and ...:STOP are permitted. Each sweep step is triggered by a separate SOUR:LFO:FREQ:MAN command.

Example: SOUR:LFO:SWE:MODE MAN

'sets the **Step** sweep mode.

SOUR:LFO:FREQ:MAN 5kHz

'sets an LF frequency of 5 kHz for the next step in the **Step** sweep mode.

SOUR:LFO:FREQ:MODE SWE

'sets the LF Sweep mode. An LF frequency of 5 kHz is output.

SOUR:LFO:FREQ:MAN 5.1kHz

'triggers the next sweep step with a frequency of 5.1 kHz.

*RST value	Resolution	Options	SCPI
1 kHz	0.1 Hz.	R&S SMF-B20	Compliant

[SOURce:]LFOutput:FREQuency:MODE CW|FIXed | SWEep

The command sets the instrument operating mode and therefore also the commands used to set the LF output frequency.

The source for the LF sweep is selected with command SOUR:LFO:SWE:LFS

Parameters: **CW|FIXed**

The instrument operates in fixed-frequency mode. CW and FIXed are synonyms. The output frequency is set with [SOURce:]LFOutput<[1]|2>:FREQuency.

SWEep

The instrument operates in SWEep mode. The frequency is set using the commands SOURce:LFOutput:FREQuency:STARt; STOP or MANual.

Example: SOUR:LFO:FREQ:MODE SWE

'sets the SWEep mode. The settings under SOURce:LFOutput:FREQuency:STARt; STOP; MANual become effective.

*RST value	Resolution	Options	SCPI
CW	-	R&S SMF-B20	Compliant

[SOURce:]LFOutput:FREQuency:STARt 0.1 Hz... 10 MHz

This command sets the start frequency for the LF Sweep mode.

Example: `RST*`
'activates all presettings.

`SOUR:LFO:SWE:MODE AUTO`
'sets the AUTO sweep mode, i.e. each trigger triggers a complete sweep.

`TRIG:FSW:SOUR SING`
'sets the SINGle trigger mode, i.e. the sweep is triggered by the command `:LFOutput:SWEep:EXECute` or `*TRG`.

`SOUR:LFO:FREQ:STAR 100kHz`
'sets the start frequency for the LF sweep to 100 kHz.

`SOUR:LFO:FREQ:STOP 200kHz`
'sets the stop frequency of the LF sweep to 200 kHz.

`SOUR:LFO:FREQ:MODE SWE`
'sets the LF sweep mode.

`SOUR:LFO:SWE:EXEC`
'a one-off LF sweep from 100 kHz to 200 kHz is performed. The linear step width is 1 kHz with a dwell time of 15 ms (preset values).

*RST value	Resolution	Options	SCPI
1 kHz	0.1 Hz	R&S SMF-B20	Compliant

[SOURce:]LFOutput:FREQuency:STOP 0.1 Hz... 10 MHz

This command sets the stop frequency for the LF sweep.

Example: `SOUR:LFO:FREQ:STOP 200kHz`
'sets the stop frequency for the LF sweep to 200 kHz.

`SOUR:LFO:FREQ:STAR 100kHz`
'sets the start frequency for the LF sweep to 100 kHz.

*RST value	Resolution	Options	SCPI
1 kHz	0.1 Hz	R&S SMF-B20	Compliant

[SOURce:]LFOutput:MONitor:MODE OFF | AM | FMPM

The command selects the LF output monitoring mode. The settings for the LF output are synchronized to amplitude modulation or frequency/phase modulation settings.

Example: `SOUR:LFO:MON:MODE AM`
'sets the LF output settings are synchronized to the amplitude modulation signal.

*RST value	Resolution	Options	SCPI
OFF	-	R&S SMF-B20	Compliant

[SOURce:]LFOutput:OFFSet -4 V... 4 V

The command sets a DC offset at the LF Output.

Example: SOUR:LFO:OFFS 2V
                       'sets a DC OFFSet of 2 V.

*RST value	Resolution	Options	SCPI
0 V	0.001 V	R&S SMF-B20	Compliant

[SOURce:]LFOutput:SWEep[:FREQuency]:DWELl 0.1 ms...10 s

The command sets the dwell time for each frequency step of the sweep.

Example: SOUR:LFO:SWE:DWEL 20ms
                       'sets a dwell time of 20 ms.

*RST value	Resolution	Options	SCPI
15 ms	0.1 ms	R&S SMF-B20	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:EXECute

The command immediately starts an LF sweep. The MODE setting determines which sweep is executed, e.g. SOURce:LFOutput:SWEep:FREQuency:MODE STEP. The command corresponds to the manual-control command EXECUTE SINGLE SWEEP.

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

Example: SOUR:LFO:SWE:MODE STEP
                       'sets the step-by-step processing of the LF sweep.

                   SOUR:LFO:SWE:EXEC
                       'starts a step of the LF sweep.

*RST value	Resolution	Options	SCPI
-	-	R&S SMF-B20	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:MODE   AUTO | MANual | STEP

The command sets the cycle mode of the LF sweep.

The assignment of the IEC/IEEE-bus commands to the sweep modes is given in the description of the sweep menus.

Parameters: **AUTO**
Each trigger triggers exactly one complete sweep.

MANual
The trigger system is not active. Each frequency step of the sweep is triggered individually, either by varying the **Current Frequency** value using the rotary knob under manual control or by means of a `:LFOutput:FREQ:MAN` command under remote control. With manual control, the frequency increases or decreases (depending on the direction of the rotary encoder) by the value specified under `:LFOutput:SWEep:FREQ:STEP`. With remote control, the frequency is set directly with the command `:LFOutput:FREQ:MAN`.

STEP
Each trigger triggers one sweep step only. The frequency increases by the value entered under `[SOURce:]LFOutput:SWEep:STEP`.

Example: `SOUR:LFO:SWE:MODE AUTO`
'selects **Mode Auto**.

*RST value	Resolution	Options	SCPI
AUTO	-	R&S SMF-B20	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:POINts   <numeric_value>

The command sets the number of steps in an LF sweep. The command is linked to the command `:LFOutput:SWEep[:FREQuency]:STEP` as follows:

The following applies for linear sweeps and `STARt < STOP`:
```
POINts = ((STOP-STARt) / STEP:LIN)) + 1
```

The following applies for logarithmic sweeps and `STARt < STOP`:
```
POINts = ((log STOP - log STARt) / log STEP:LOG)) + 1
```

If `POINts` changes, the value of `STEP` is adjusted. The `STARt` and `STOP` value is retained.

Two separate POINts values are used for linear or logarithmic sweep spacing (`LFOutput:SWEep[:FREQuency]:SPACing LIN | LOG`). The command is always effective for the currently set sweep spacing.

Example: SOUR:LFO:FREQ:STAR
             'sets the start frequency to 2 kHz.

                 SOUR:LFO:FREQ:STOP
             'sets the stop frequency to 20 kHz.

                 SOUR:LFO:SWE:SPAC LIN
             'sets linear sweep spacing.

                 SOUR:LFO:SWE:POIN 9
             'sets 9 sweep steps for linear sweep spacing. The sweep step width (`STEP`) is automatically set to 2 kHz.

*RST value	Resolution	Options	Correlation	SCPI
100	1	R&S SMF-B20	The value of `:LFO:SWE:STEP` is adjusted automatically.	Device-specific (adapted to instrument properties)

[SOURce:]LFOutput:SWEep[:FREQuency]:SPACing   LINear | LOGarithmic

The command selects linear or logarithmic sweep spacing.

Example: SOUR:LFO:SWE:SPAC LIN
                 'selects linear sweep spacing.

*RST value	Resolution	Options	SCPI
LINear	-	R&S SMF-B20	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:STEP:LOGarithmic   0.01 ... 100 PCT

The command specifies the step width factor for logarithmic sweeps. The next frequency value of a sweep is calculated (for STARt < STOP) using the following formula:

New frequency = Old frequency + STEP:LOG x Old frequency

STEP:LOG therefore gives the fraction of the old frequency. The frequency is increased by this fraction for the next sweep step. Usually STEP:LOG is given in percent, whereby the suffix PCT must always be used.

The command is linked to the command :LFOutput:SWEep[:FREQuency]:POINts as follows:

The following applies for logarithmic sweeps and STARt < STOP:
POINts = ((log STOP - log STARt) / (log STEP:LOG)) + 1

If STEP:LOG changes, the value of POINts is adjusted. The STARt and STOP value is retained.

Example: SOUR:LFO:FREQ:STAR
                 'sets the start frequency to 1 kHz.

                 SOUR:LFO:FREQ:STOP
                 'sets the stop frequency to 100 kHz.

                 SOUR:LFO:SWE:SPAC LOG
                 'sets logarithmic sweep spacing.

                 SOUR:LFO:SWE:STEP:LOG 10PCT
                 'sets the step width for logarithmic sweep spacing to 10% of the previous frequency in each instance.

*RST value	Resolution	Options	Correlation	SCPI
1 PCT	0.01 PCT	R&S SMF-B20	The value of :LFO:SWE:POIN is adjusted automatically.	Device-specific

[SOURce:]LFOutput:SWEep[:FREQuency]:STEP[:LINear] 0 ... (STOP - STARt)

The command sets the step width for the linear sweep.

This command is linked to the command `:LFOutput:SWEep[:FREQuency]:POINts` as follows:

The following applies for `STARt < STOP`:
`POINts = ((STOP-STARt) / (STEP:LIN)) + 1`

If `STEP:LIN` changes, the value of `POINTS` is adjusted. The `STARt` and `STOP` value is retained.

Example: `SOUR:LFO:FREQ:STAR`
                  'sets the start frequency to 2 kHz.

                  `SOUR:LFO:FREQ:STOP`
                  'sets the stop frequency to 20 kHz.

                  `SOUR:LFO:SWE:SPAC LIN`
                  'sets linear sweep spacing.

                  `SOUR:LFO:SWE:STEP 2kHz`
                  'sets the sweep step width to 2 kHz. The number of sweep steps for linear
                  sweep spacing (`POINts`) is automatically set to 9.

*RST value	Resolution	Options	Correlation	SCPI
1kHz	0.1 Hz	R&S SMF-B20	The value of `:LFO:SWE:POIN` is adjusted automatically.	Device-specific

[SOURce:]LFOutput:SWEep:LFSource LF1 | LF2

The command selects the source for the LFsweep.

Example: `SOUR:LFOSWE:LFS LF2`
                  'selects LF generator 2 as the LF frequency sweep source.

*RST value	Resolution	Options	SCPI
LF1	-	R&S SMF-B20	Device-specific

[SOURce:]LFOutput:SWEep:VOLTage:DWELl 0.1 ms...100 s

The command sets the time taken for each level step of the sweep.

Example: `SOUR:LFO:SWE:VOLT:DWEL 12m`
                  'sets a dwell time of 12 ms for a level sweep.

*RST value	Resolution	Options	SCPI
15 ms	0.1 ms	R&S SMF-B20	Device-specific

[SOURce:]LFOutput:SWEep:VOLTage:EXECute

The command triggers a sweep. The sweep to be executed depends on the set sweep mode (`:SOURce:LFOutput:SWEep:VOLTage:MODE`). The command corresponds to the manual-control command **Execute Trigger**.

The command triggers an event and therefore has no query form and no *RST value.

Example: `SOUR:LFO:SWE:VOLT:MODE STEP`
                'sets the STEP trigger mode, i.e. a trigger starts the sweep initially, and then the sweep is generated continously.

                `SOUR:LFO:SWE:VOLT:EXEC`
                'triggers a level sweep.

*RST value	Resolution	Options	SCPI
-	-	R&S SMF-B20	Device-specific

[SOURce:]LFOutput:SWEep:VOLTage:LFSource LF1 | LF2

The command selects the source for the LF level sweep.

Example: `SOUR:SWE:LFO:VOLT:LFS LF2`
                'selects LF generator 2 as the LF frequency sweep source.

*RST value	Resolution	Options	SCPI
LF1	-	R&S SMF-B20	Device-specific

SOURce:]LFOutput:VOLTage:MODE CW | SWEep

The command sets the instrument operating mode and therefore also the commands used to set the LF output level.

Parameters: **CW**
                The instrument operates at a constant level. The output level is set with `:SOURce:LFOutput:POWer`.

                SWEep
                The instrument operates in SWEep mode. The level is set using the commands `SOURce:LFOutput:POWer:STARt; STOP; MANual`.

Example: `SOUR:LFO:VOLT:MODE SWE`
                'sets the SWEep mode. The settings under `SOURce:LFOutput:POW:STARt; STOP; MANual` become effective.

*RST value	Resolution	Options	Correlation	SCPI
CW	-	R&S SMF-B20		Compliant

[SOURce:]LFOutput:SWEep:VOLTage:POINts 1 ...16777215

The command the number of LF Level sweep steps.

Example: `SOUR:LFO:VOLT:POINts 25`
                'sets the number of sweep steps to 25.

*RST value	Resolution	Options	Correlation	SCPI
501	1	R&S SMF-B20		Device-specific

[SOURce:]LFOutput:SWEep:VOLTage:STEP[:LINear] 0 ... 6 V

The command sets the step width for the level setting if UP and DOWN are used as the level values and variation mode :SOUR:LFO:POW:STEP:MODE USER is selected. The command is linked to setting **Variation Step** for manual control, i.e. the command also sets the step width of the rotary knob for **Variation Active on**.

Example: SOUR:LFO:SWE:VOLT:STEP:LIN 2 or VOLT:STEP 2
                     'sets the step width for entering the LF level to 2 V.

*RST value	Resolution	Options	SCPI
0.1 V		R&S SMF-B20	Device-specific

[SOURce:]LFOutput:VOLTage:MANual   Minimum level ... Maximum level

In Sweep mode (:SOUR:LFO:VOLT:MODE SWE) the command sets the level for the next sweep step in the **Step** sweep mode (:SOUR:LFO:SWE:VOLT:MODE MAN). Here only level values between the settings [:SOUR]:LFO:VOLT:STAR and ...:STOP are permitted. Each sweep step is triggered by a separate :SOUR:LFO:VOLT:MAN command.

As with the **Level** value entered in the **LF Level** menu, the OFFSet value is also taken into consideration with this command.

The specified value range is therefore only effective if :SOURce:POWer:OFFSet is set to 0. The value range for other OFFSet values can be calculated using the following formula:

Minimum level + OFFSet ... Maximum level + OFFSet

Parameters: **Minimum level ... Maximum level**
                        The value range for the level setting varies according to the instrument model.
                        The values are given in the data sheet.

Example: SOUR:LFO:SWE:VOLT:MODE MAN
                     'sets the **Step** sweep mode.

                     SOUR:LFO:VOLT:MAN -5dBm
                        'sets an RF level of -5 dBm for the next setting in the **Step** sweep mode.

                     SOUR:LFO:VOLT:MODE SWE
                        'sets the Level Sweep mode.

                     SOUR:LFO:VOLT:MAN -5.5dBm
                        'triggers the next sweep step with a level of -5.5 dBm.

*RST value	Resolution	Options	SCPI
	0.01 dBm	R&S SMF-B20	Compliant

[SOURce:]LFOutput:SWEep:VOLTage:MODE   AUTO | MANual | STEP

The command sets the cycle mode of the LF level sweep.

Parameters: **AUTO**
Each trigger triggers exactly one complete sweep.

MANual
The trigger system is not active. Each level step of the sweep is triggered individually, either by varying the **Current Level** value using the rotary knob under manual control or by means of a `:VOLT:MAN` command under remote control. With manual control, the level increases or decreases (depending on the direction of the rotary encoder) by the value specified under `VOLT:STEP`. With remote control, the level is set directly with the command `VOLT:MAN`.

STEP
Each trigger triggers one sweep step only. The level increases by the value entered under `:SWEep:VOLTage:STEP:LOGarithmic`.

Example: `LFO:SWE:VOLT:MODE AUTO`
'selects **Mode Auto** for a LF level sweep.

*RST value	Resolution	Options	SCPI
AUTO	-	R&S SMF-B20	Device-specific

[SOURce:]LFOutput:VOLTage:STARt   Minimum level ... Maximum level

The command sets the LF start level in sweep mode.

As with the **Level** value entered in the **LF Level** menu, the `OFFSet` value is also taken into consideration with this command.

The specified value range is therefore only effective if `:SOURce:LFOutput:Sweep:POWer:OFFSet` is set to 0. The value range for other `OFFSet` values can be calculated using the following formula:

Minimum level + `OFFSet` ...Maximum level + `OFFSet`

Parameters: **Minimum level ... Maximum level**
The value range for the level setting varies according to the instrument model. The values are given in the data sheet.

Example: `SOUR:LFO:VOLT:STAR 5V`
'sets the start level for the LF level sweep to 5 V.

*RST value	Resolution	Options	SCPI
1 V	0.1 mV	R&S SMF-B20	Compliant

[SOURce:]LFOutput:VOLTage:STOP 0 V... 6 V

The command sets the stop level in LF sweep mode.

As with the **Level** value entered in the **LF Level** menu, the OFFSet value is also taken into consideration with this command.

The specified value range is therefore only effective if :SOURce:LFOutput:SWEep:POWer:OFFSet is set to 0. The value range for other OFFSet values can be calculated using the following formula:

Minimum level + OFFSet ...Maximum level + OFFSet

Parameters: **Minimum level ... Maximum level**
                         The value range for the level setting varies according to the instrument model. The values are given in the data sheet.

Example: SOUR:LFO:VOLT:STOP 6V
                         'sets the stop level for the LF level sweep to 6 V.

*RST value	Resolution	Options	SCPI
1 V	0.1 mV	R&S SMF-B20	Compliant

SOURce:MODulation Subsystem

This subsystem contains the command for switching on/off all modulations.

Command	Parameters	Default unit	Remark
[SOURce:]MODulation[:ALL]:STATe	ON | OFF		

[SOURce:]MODulation[:ALL]:STATe ON | OFF

The command switches the modulations on and off. A subsequent command :SOUR:MOD:ALL:STAT ON restores the status that was active before the last switch-off. **MOD OFF** is displayed in the info line of the header next to the **Level** field.

Example: MOD:STAT OFF
                         'switches off all active modulations

*RST value	Resolution	Options	SCPI
ON	-	-	Device-specific

SOURce:NOISe Subsystem

The SOURce:NOISe subsystem contains the commands for setting the noise modulation signal. The noise generator is optional
The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]NOISe:BWIDth	100 kHz ... 10 MHz	Hz	
[SOURce:]NOISe:DISTribution	GAUSs	EQUal		
[SOURce:]NOISe:LEVel[:ABSolute]?			Query only
[SOURce:]NOISe:LEVel:RELative?			Query only

[SOURce:]NOISe:BWIDth 100 kHz ... 10 MHz

This command sets the noise level in the system bandwidth. Distinct bandwidth settings between 100 kHz and 10 MHz in 100 kHz steps (range 100 .. 1 MHz), 1 MHz (range 1 MHz .. 5 MHz) and 5 MHz (5 MHz … 10 MHz) are possible.

Example: NOIS:BWID 1MHz
'sets a system bandwidth of 1 MHz.

*RST value	Resolution	Options	SCPI
100 kHz	100 kHz	R&S SMF-B20	Device-specific

[SOURce:]NOISe:DISTribution GAUSs | EQUal

This command selects the noise power densitiy distribution of the noise.

Example: NOIS:DIST GAUS
'selects Gaussian distribution.

*RST value	Resolution	Options	SCPI
GAUSs		Option R&S SMF-B20	Device-specific

[SOURce:]NOISe:LEVel:RELative?

This command queries the level of the noise signal for a bandwith of 1 Hz.

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

Example: NOIS:LEV?
'queries the noise level.

*RST value	Resolution	Options	SCPI
-		R&S SMF-B20	Device-specific

[SOURce:]NOISe:LEVel[:ABSolute]?

This command queries the level of the noise signal in the system bandwidth for enabled bandwidth limitation.

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

Example: NOIS:BWID:STAT ON
                'enables bandwidth limitation.

                        NOIS:BWID 10MHz
                'sets a system bandwidth of 1 MHz.

                        NOIS:LEV:ABS"
                'queries the noise level in the system bandwidth

*RST value	Resolution	Options	SCPI
-		R&S SMF-B20	Device-specific

SOURce:PM Subsystem

The PM subsystem contains the commands for checking the phase modulation. Characteristics which are valid for all modulations and the LF Output are configured in the SOURce:LFOutput subsystem (e.g. frequency). The external signal is input at the **EXT 1** and **EXT 2** connector.

Command	Parameters	Default unit	Remark
[SOURce:]PM<[1]| 2>[:DEViation]	0 ...100 RAD	RAD	
[SOURce:]PM:MODE	HBANdwidth | HDEViation | LNOise		
[SOURce:]PM:RATio	0...100 PCT	PCT	
[SOURce:]PM<[1]| 2>:SOURce	LF1 | LF2 | EXT1 | EXT2 | NOISe		
[SOURce:]PM<[1]| 2>:STATe	ON | OFF		

[SOURce:]PM<[1]\| 2>:DEViation   0... 100 RAD

Sets the modulation deviation in RAD or degrees.

Example: PM1:DEV 20RAD
                'selects a deviation of 10 RAD for the selected modulation source for path 1.

*RST value	Resolution	Options	SCPI
0 RAD	-	R&S SMF-B20	Compliant

[SOURce:]PM:MODE   HBANdwidth | HDEViation | LNOise

The command selects the mode for the phase modulation.

Parameters: **HBANdwith**

The maximum range for modulation bandwidth is available. However, phase noise is increased for low frequencies. The range for PhiM deviation is limited. This mode is recommended for high modulatiuon frequencies.

HDEViation

The maximum range for PhiM deviation is available. Phase noise is improved for low frequencies. The range for modulation frequency is limited (see data sheet). This mode is recommended for low modulation frequencies and high PhiM deviation.

LNOise

Phase modulation with phase noise and spurious characteristics close to CW mode. The range for modulation bandwidth and PhiM deviation is reduced (see data sheet).

Example: `PM:MODE HDEV`
'selects high deviation mode for external phase modulation.

*RST value	Resolution	Options	SCPI
HBANdwidth	-	R&S SMF-B20	Compliant

[SOURce:]PM:RATio   0 ... 100 PCT

The command sets the path 1/path 2 ratio in percent.

Example: `PM:RAT 50PCT`
'sets the path 1/path 2 ratio to 50 percent.

*RST value	Resolution	Options	SCPI
50 PCT	0.01	R&S SMF-B20	Compliant

[SOURce:]PM<[1]| 2>:SOURce   LF1 | LF2 | EXT1 | EXT2 | NOISe

Selects the source for the phase modulation signal.

Example: `PM1:SOUR LF2`
'selects the LF generator 2 as internal modulation source for path 1.

*RST value	Resolution	Options	SCPI
EXT 1	-	Option R&S SMF-B20	Compliant

[SOURce:]PM<[1]| 2>:STATe   ON | OFF

The command activates/deactivates phase modulation.

Activation of phase modulation deactivates frequency modulation.

Example: `PM1:STAT ON`
'activates PM modulation for path 1.

*RST value	Resolution	Options	Correlation	SCPI
OFF	-	R&S SMF-B20	`PM:STATe ON` deactivates frequency modulation.	Compliant

SOURce:POWer Subsystem

This subsystem contains the commands for setting the output level, level control and level correction of the RF signal. Other units can also be used instead of dBm:

by entering the unit directly after the numerical value (example `:POW 0.5V`),
by changing the DEFault unit in the UNIT system (see the command `UNIT:POWER`).

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]POWer:ALC:SONCe			No query
[SOURce:]POWer:ALC[:STATe]	ON | OFF		
[SOURce:]POWer:ATTenuation	0 ... 110 dB	dB	
[SOURce:]POWer:[LEVEL][:IMMediate][:AMPLitude]	-130 ... 30 dBm	dBm	Depending on model
[SOURce:]POWer:[LEVEL][:IMMediate]:OFFSet	-100 ...+100 dBm	dBm	Depending on model
[SOURce:]POWer:[LEVEL][:IMMediate]:RCL	INCLlude | EXCLude		
[SOURce:]POWer:LIMit[:AMPLitude]	<numeric_value>	dBm	Depending on model
[SOURce:]POWer:MANual	<numeric_value>	dBm	Depending on model
[SOURce:]POWer:MODE	FIXed|CW | SWEep		
[SOURce:]POWer:POWer	-130 ... 30 dBm	dBm	
[SOURce:]POWer:RESolution	R01 | R1	dBm	
[SOURce:]POWer:STARt	<numeric_value>	dBm	Depending on model
[SOURce:]POWer:STOP	<numeric_value>	dBm	Depending on model
[SOURce:]POWer:STEP[:INCRement]	0 ...100 dB	dBm	
[SOURce:]POWer:STEP:MODE	USER | DECimal		

[SOURce:]POWer:ALC:SONCe

The command briefly activates level control for correction purposes.

The command triggers an event and therefore has no *RST value and no query form.

Example:　　　`POW:ALC OFF`
　　　　　　　　　'deactivates automatic level control.

　　　　　　　　　`POW:ALC:SONC`
　　　　　　　　　'level control is performed once only.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]POWer:ALC[:STATe] ON | OFF

The command activates/deactivates automatic level control.

Parameters: **ON**
                   internal level control is permanently activated.

                   OFF
                   internal level control is deactivated, Sample & Hold mode is activated.

Example: POW:ALC ON
                   'activates automatic level control.

*RST value	Resolution	Options	SCPI
ON	-		Compliant

[SOURce:]POWer:ATTenuation 0 ... 110 dB

The command sets the attenuation.

Example: SOUR:POW:ATT 20dB
                   'sets the power attenuation to 20 dB.

*RST value	Resolution	Options	SCPI
0	-		Compliant

[SOURce:]POWer[:LEVel][:IMMediate][:AMPLitude] -130 dBm ... 30 dBm

The command sets the RF output level in CW mode. In addition to numerical values, it is also possible to specify UP and DOWN. The level is then increased or decreased by the value specified under [SOURce:]POWer:STEP.

As with the **Level** value entered in the header, the OFFSet value is also taken into consideration with this command.

The specified value range is therefore only effective if :SOURce:POWer:OFFSet is set to 0. The value range for other OFFSet values can be calculated using the following formula:

Minimum level + OFFSet ...Maximum level + OFFSet

The keywords of this command are largely optional. Therefore, both the long and short form of the command are shown in the example.

Example: SOUR:POW:LEV:IMM:AMPL 15 or :POW 15
                   'sets the level of the RF signal at the output of the downstream instrument to
                   to 15 dBm considering the offset value.

*RST value	Resolution	Options	SCPI
-30 dBm	0.01 dB		Compliant

[SOURce:]POWer[:LEVel][:IMMediate]:OFFSet -100 dB ... +100 dB

Caution:
The level offset is also effective for level sweeps!

The command specifies the constant level offset of a downstream attenuator/amplifier. If a level offset is entered, the level entered with `:POWer` no longer corresponds to the RF output level. The following correlation applies:

`:POWer` = RF output level + `POWer:OFFSet`.

Entering a level offset does not change the RF output level, but rather the query value of `:POWer`.

Only dB is permitted as the unit here. The linear units (V, W, etc.) are not permitted.

The keywords of this command are largely optional. Therefore, both the long and short form of the command are shown in the example.

Example: `SOUR:POW:LEV:IMM:OFFS 10`

or

`POW:OFFS 10`
'sets the RF level offset to 10 dB.

*RST value	Resolution	Options	SCPI
0 dB	0.01 dB		Compliant

[SOURce:]POWer[:LEVel][:IMMediate]:RCL INCLude | EXCLude

The command determines whether the current level is retained or whether the stored level setting is adopted when an instrument configuration is loaded.

*RST does not affect this setting.

Parameters: **INCLude**
The stored level is also loaded when a stored instrument configuration is loaded.

EXCLude
The RF level is not loaded when a stored instrument configuration is loaded. The current level is retained.

Example: `POW:RCL INCL`
'the stored level is set if the Recall command is called'.

*RST value	Resolution	Options	SCPI
-	-		Compliant

[SOURce:]POWer:LIMit[:AMPLitude] Minimum level .... Maximum level

The command limits the maximum RF output level in CW and SWEEP mode. It does not influence the LEVEL display or the response to the `POW?` query command.

Parameters: **Minimum level ... Maximum level**
The value range for the level setting varies according to the instrument model. The values are given in the data sheet.

Example: `SOURce:POWer:LIMit:AMPLitude 10 or :POW:LIM 10`
'limits the RF level to maximum +10 dBm.

*RST value	Resolution	Options	SCPI
+30 dBm	0.01 dB		Compliant

[SOURce:]POWer:MANual Minimum level ... Maximum level

In Sweep mode (`:SOUR:POW:MODE SWE`) the command sets the level for the next sweep step in the **Step** sweep mode (`:SOUR:SWE:POW:MODE MAN`). Here only level values between the settings `[:SOUR]:POW:STAR` and `...:STOP` are permitted. Each sweep step is triggered by a separate `:SOUR:POW:MAN` command.

As with the **Level** value entered in the **RF Level** menu, the `OFFSet` value is also taken into consideration with this command.

The specified value range is therefore only effective if `:SOURce:POWer:OFFSet` is set to 0. The value range for other `OFFSet` values can be calculated using the following formula:

Minimum level + `OFFSet` ... Maximum level + `OFFSet`

Parameters: **Minimum level ... Maximum level**
The value range for the level setting varies according to the instrument model. The values are given in the data sheet.

Example: `POW:SWE:MODE MAN`
'sets the **Step** sweep mode.

`POW:MAN -5dBm`
'sets an RF level of -5 dBm for the next setting in the **Step** sweep mode.

`POW:MODE SWE`
'sets the Level Sweep mode.

`POW:MAN -5.5dBm`
'triggers the next sweep step with a level of -5.5 dBm.

*RST value	Resolution	Options	SCPI
-30 dBm	0.01 dBm		Compliant

[SOURce:]POWer:RESolution R01 | R1 dB

The command selects the resolution for the level settings.

Example: POW:RES R01

               'sets the resolution for the level settings to 0.01 dB.

*RST value	Resolution	Options	SCPI
R01	-		Compliant

[SOURce:]POWer:MODE CW|FIXed | SWEep

The command sets the instrument operating mode and therefore also the commands used to set the RF output level.

Parameters: **CW|FIXed**

              The instrument operates at a constant level. CW and FIXed are synonyms. The output level is set with :SOURce:POWer.

              SWEep

              The instrument operates in SWEep mode. The level is set using the commands SOURce:POWer:STARt; STOP; MANual.

Example: SOUR:POW:MODE SWEep

               'sets the SWEep mode. The settings under SOURce:POW:STARt; STOP; MANual become effective.

*RST value	Resolution	Options	Correlation	SCPI
CW	-			Compliant

[SOURce:]POWer:POWer -130 ... 30 dBm

The command sets the RF output level in CW mode. In addition to numerical values, it is also possible to specify UP and DOWN. The level is then increased or decreased by the value specified under [SOURce:]POWer:STEP.

The RF output level entered and displayed here corresponds to the output level at the RF connector, that is any offset entry is not taken into consideration

The keywords of this command are largely optional. Therefore, both the long and short form of the command are shown in the example.

Example: SOUR:POW:POW 15

               'sets the level of the RF signal output to 15 dBm.

*RST value	Resolution	Options	SCPI
-30 dBm	0.01 dB		Compliant

[SOURce:]POWer:STARt   Minimum level ... Maximum level

The command sets the RF start level in Sweep mode.

As with the **Level** value entered in the **RF Level** menu, the OFFSet value is also taken into consideration with this command.

The specified value range is therefore only effective if :SOURce:POWer:OFFSet is set to 0. The value range for other OFFSet values can be calculated using the following formula:

Minimum level + OFFSet ...Maximum level + OFFSet

Parameters: **Minimum level ... Maximum level**
                      The value range for the level setting varies according to the instrument model. The values are given in the data sheet.

Example: POW:STAR –20dBm
                      'sets the start level for the level sweep to -20 dBm.

*RST value	Resolution	Options	SCPI
-30 dBm	0.01 dB		Compliant

[SOURce:]POWer:STEP[:INCRement] 0 dB ... 100 dB

The command sets the step width for the level setting if UP and DOWN are used as the level values and variation mode :SOUR:POW:STEP:MODE USER is selected. The command is linked to setting **Variation Step** for manual control, i.e. the command also sets the step width of the rotary knob for **Variation Active on**.

Example: SOURce:POWer:STEP:INCRement 2dB or POW:STEP 2dB
                      'sets the step width for entering the RF level to 2 dB.

*RST value	Resolution	Options	SCPI
1 dB	0.01 dB		Device-specific

[SOURce:]POWer:STEP:MODE USER | DECimal

This command activates (USER) or deactivates (DECimal) the user-defined step width used when varying the level value with the level values UP/DOWN. The command is linked to setting **Variation Active** for manual control, i.e. the command also activates/deactivates the user-defined step width used when varying the level value with the rotary knob.

Example: POW:STEP 2
                      'sets the step width for the level setting to 2 dB'.

                      POW:STEP:MODE USER
                      'actives this step width for level variation with the rotary knob (manual control) and with level values UP/DOWN (remote control)'.

*RST value	Resolution	Options	SCPI
DECimal	-		Device-specific

[SOURce:]POWer:STOP   Minimum level ... Maximum level

The command sets the stop level in Sweep mode.

As with the **Level** value entered in the **RF Level** menu, the `OFFSet` value is also taken into consideration with this command.

The specified value range is therefore only effective if `:SOURce:POWer:OFFSet` is set to 0. The value range for other `OFFSet` values can be calculated using the following formula:

Minimum level + `OFFSet` ...Maximum level + `OFFSet`

Parameters: **Minimum level ... Maximum level**
                         The value range for the level setting varies according to the instrument model. The values are given in the data sheet.

Example: `POW:STOP 3dBm`
                         'sets the stop level for the level sweep to 3 dBm.

*RST value	Resolution	Options	SCPI
-10 dBm	0.01 dB		Compliant

SOURce:PULM and PGEN Subsystem

The PULM subsystem contains the commands for checking the pulse modulation. The external signal is input at the **PULSE IN** connector. The connector can be used as trigger input for internal pulse modulation. The polarity and input impedance of the connector can be selected.
The pulse modulation signal is output at the **PULSE OUT** connector.

The PGEN Subsystem contains the command for activating the pulse generator.

The keyword SOURce is optional with commands and can be omitted.

Command	Parameters	Default unit	Remark
[SOURce:]PGEN:OUTPut:POLarity	NORMal | INVerted		
[SOURce:]PGEN:OUTPut:STATe	ON | OFF		
[SOURce:]PGEN:STATe	ON | OFF		
[SOURce:]PULM:DELay	10ns .. 100s	s	
[SOURce:]PULM:DOUBle:DELay	20ns .. 1s	s	
[SOURce:]PULM:DOUBle:STATe	ON | OFF		
[SOURce:]PULM:PERiod	100ns .. 85 s		
[SOURce:]PULM:POLarity	NORMal | INVerted		
[SOURce:]PULM:SOURce	EXTernal | INTernal | RANDom		
[SOURce:]PULM:STATe	ON | OFF		
[SOURce:]PULM:TRIGger:EXTern:IMPedance	G50 | G10K	Ohm	
[SOURce:]PULM:TRIGger:EXTern:LEVel	TTL | P0V5 | M2V5	V	
[SOURce:]PULM:TRIGger:EXTern:SLOPe	POSitiv | NEGativ		
[SOURce:]PULM:TRIGger:GATe:POLarity	NORMal | INVerted		
[SOURce:]PULM:TRIGger:MODE	AUTO | EXTernal | EGATe		
[SOURce:]PULM:OUTPut:VIDeo:POLarity	NORMal | INVerted		
[SOURce:]PULM:WIDTh	100ns .. 100s	s	

[SOURce:]PGEN:OUTPut:POLarity NORMal | INVerted

The command sets the polarity between modulating and modulated signal. This command is effective only for an internal modulation signal.

Parameters: **NORMal**
The RF signal is suppressed during the pulse pause.

INVerted
The RF signal is suppressed during the pulse.

Example: PGEN:OUTP:POL INV
'selects inverted polarity.

*RST value	Resolution	Options	SCPI
NORMal	-		Device-specific

[SOURce:]PGEN:OUTPut:STATe   ON | OFF

The command activates/deactivates the pulse generator output.

Example: PGEN:OUTP:STAT ON

               'activates pulse generator output.

*RST value	Resolution	Options	SCPI
OFF	-		Compliant

[SOURce:]PULM:DELay   10ns .. 100s

The command sets the pulse delay. The pulse delay determines the time that elapses after a trigger event before pulse modulation starts. The pulse delay is not effective for double pulse generation.

Example: PULM:DEL 13ms

               '13 ms elapse after a trigger before the first pulse is generated.

*RST value	Resolution	Options	SCPI
20 ns	20 ns	Option R&S SMF-K23	Device-specific

[SOURce:]PULM:DOUBle:DELay   20ns .. 1s

The command sets the delay from the start of the first pulse to the start of the second pulse.

Example: PULM:DOUB:DEL 22 us

               '22 us elapse between the beginning of the first pulse and the beginning of the second pulse in double-pulse mode.

*RST value	Resolution	Options	SCPI
1 ms	20 ns	Option R&S SMF-K23	Device-specific

[SOURce:]PULM:DOUBle:STATe   ON | OFF

The command activates/deactivates double pulse generation. The two pulses are generated in one pulse period.

Example: PULM:DOUB:STAT ON

               'double-pulse mode is enabled.

*RST value	Resolution	Options	SCPI
OFF		R&S SMF-K23	Device-specific

[SOURce:]PULM:PERiod   100ns .. 85 s

The command sets the period of the generated pulse. The period determines the repetition frequency of the internal signal.

Example: PULM:PER 220MS

               'the pulse period is 220 ms.

*RST value	Resolution	Options	SCPI
1 ms	1us	20 ns	Option R&S SMF-K23	Device-specific

[SOURce:]PULM:POLarity NORMal | INVerted

The command sets the polarity between modulating and modulated signal. This command is only effective for an external modulation signal.

Parameters: **NORMal**
The RF signal is suppressed during the pulse pause.

INVerted
The RF signal is suppressed during the pulse.

Example: `PULM:SOUR EXT`
'selects the external modulation source.

`PULM:POL INV`
'selects inverted polarity.

*RST value	Resolution	Options	SCPI
NORMal	-		Device-specific

[SOURce:]PULM:SOURce EXTernal | INTernal | RANDom

The command selects the source for pulse modulation. Pulse"

Parameters: **EXTernal**
The signal applied externally via the **PULS EXT** connector is used for the pulse modulation.

INTernal
The internal pulse generator (option R&S SMF-K23) is used for the pulse modulation. This selection is only available if option R&S SMF-K23 is fitted.

RANDom
Selects random pulses generated by the noise generator as the source for pulse modulation.

Example: `PULM:SOUR EXT`
'selects the external modulation source.

`PULM:STAT ON`
'activates the pulse modulation.

*RST value	Resolution	Options	SCPI
EXTernal	-		Compliant

[SOURce:]PULM:STATe ON | OFF

The command activates/deactivates the pulse modulation.

Example: `PULM:STAT ON`
'activates pulse modulation with the modulation source selected under `SOURce:PULM:SOURce`.

*RST value	Resolution	Options	SCPI
OFF	-	`SOURce:PULM:SOURce` requires option R&S SMF-K23	Compliant

[SOURce:]PULM:TRIGger:EXTern:IMPedance G50 | G10K

The command selects the impedance for external pulse trigger.

Example: SOUR:PULM:TRIG:EXT:IMP G50
                      'selects 50 OHM as the trigger impedance for the external pulse trigger.

*RST value	Resolution	Options	SCPI
G10K	-		Compliant

[SOURce:]PULM:TRIGger:EXTern:LEVel TTL | P0V5 | M2V5

The command selects the external trigger level.

Example: PULM:TRIG:EXT:LEV TTL
                      'selects TTL as external trigger level.

*RST value	Resolution	Options	SCPI
TTL	-		Compliant

[SOURce:]PULM:TRIGger:EXTern:SLOPe   POSitive | NEGative

The command sets the active slope of an externally applied trigger signal at the TRIGGER input (BNC connector at the rear of the instrument).

Example: PULM:TRIG:EXT:SLOP NEG
                      'the active slope of the external trigger signal at the **TRIGGER** input is the falling slope.

*RST value	Resolution	Options	SCPI
POSitive	-		Device-specific

[SOURce:]PULM:TRIGger:GATe:POLarity   NORMal | INVerted

The command selects the active level of the gate signal.

Example: PULM:TRIG:GAT:POL NORM
                      'selects normal polarity.

*RST value	Resolution	Options	SCPI
POSitive	-		Device-specific

[SOURce:]PULM:TRIGger:MODE AUTO | EXTernal | EGATe

The command selects the trigger mode for pulse modulation.

Parameters: **AUTO**
                    The pulse modulation is generated continuously.

                    EXTernal
                    The pulse modulation is triggered by an external trigger event. The trigger
                    signal is supplied via the PULSE IN connector.

                    EGATe
                    The pulse modulation is gated by an external gate signal. The signal is
                    supplied via the PULSE IN connector.

Example: PULM:TRIG:MODE EXT
                    'selects triggering by an external trigger event. The trigger signal is supplied
                    via the PULSE IN connector.

*RST value	Resolution	Options	SCPI
AUTO	-		Compliant

[SOURce:]PULM:OUTPut:VIDeo:POLarity NORMal | INVerted

The command sets the polarity between modulating and modulated signal.

Parameters: **NORMal**
                    The RF signal is suppressed during the pulse pause.

                    INVerted
                    The RF signal is suppressed during the pulse.

Example: PULM:SOUR EXT
                    'selects the external modulation source.

                    PULM:OUTP:VID:POL INV
                    'selects inverted polarity.

*RST value	Resolution	Options	SCPI
NORMal	-		Device-specific

[SOURce:]PULM:WIDTh 100ns .. 100s

The command sets the width of the generated pulse. The width determines the pulse length.

Example: PULM:WIDT 33s
                    'sets a width of 33 s for the pulse.

*RST value	Resolution	Options	SCPI
1ms	20 ns	Option R&S SMF-K23	Device-specific

SOURce:ROSCillator Subsystem

This subsystem contains the commands for setting the external and internal reference frequency.

Command	Parameters	Default unit	Remark
[SOURce:]ROSCillator:EFC: STATe	ON | OFF		
[SOURce:]ROSCillator:EXTernal:FREQuency	5 MHz | 10 MHz | 13 MHz	Hz	
[SOURce:]ROSCillator:EXTernal:SBANdwidth	NARRow | WIDE		
[SOURce:]ROSCillator[:INTernal]:ADJust[:STATe]	ON | OFF		
[SOURce:]ROSCillator[:INTernal]:ADJust:VALue	0 ... 4095		
[SOURce:]ROSCillator:OUTPut:SOURCE	INTernal | EXTernal		
[SOURce:]ROSCillator:SOURce	INTernal | EXTernal		

[SOURce:]ROSCillator:EFC: STATe   On | OFF

The command activates/deactivates the electronic frequency control.

Example: ROSC:EFC:STAT ON
                    'activates the electronic frequency control.

*RST value	Resolution	Options	SCPI
OFF		-	Compliant

[SOURce:]ROSCillator:EXTernal:FREQuency   5 MHz | 10 MHz | 13 MHz

The command informs the instrument of the frequency of the external reference.

Example: ROSC:SOUR EXT
                    'selects the external source. The reference must be input at the REF IN input.

                    ROSC:EXT:FREQ 5 MHz
                    'informs the instrument that the external reference frequency is 5 MHz.

*RST value	Resolution	Options	SCPI
10 MHz	-	-	Compliant

[SOURce:]ROSCillator[:INTernal]:ADJust[:STATe] ON | OFF

The command determines whether the calibrated (OFF) or a user-defined (ON) adjustment value is used for fine adjustment of the frequency. With STATe ON, the instrument is no longer in the calibrated state.

Example: ROSC:SOUR INT
                'selects the internal source.

                ROSC:ADJ ON
                'activates use of a user-defined adjustment value.

                ROSC:ADJ:VAL 1400
                'sets the adjustment value to 1400.

*RST value	Resolution	Options	SCPI
OFF	-	-.	Device-specific

[SOURce:]ROSCillator[:INTernal]:ADJust:VALue 0 ... 4095

The command specifies the frequency correction value (adjustment value).

Example: ROSC:ADJ:VAL 1400
                'sets the adjustment value to 1400.

*RST value	Resolution	Options	SCPI
1400	1		Device-specific

[SOURce:]ROSCillator:EXTernal:SBANdwidth NARRow | WIDe

The command selects the synchronization bandwidth for an external reference signal.

Parameters: **NARRow**
                Synchronization bandwidth is approx. 1 Hz.

                WIDE
                Synchronization bandwidth is approx. 750 Hz. This mode is the standard mode, it is provided for using good reference sources of high spectral purity.

Example: ROSC:SOUR EXT
                'selects the external source.

                ROSC:EXT:FREQ 5 MHz
                'informs the instrument that the external reference has a frequency of 5 MHz.

                ROSC:EXT:SBAN WID
                'selects wideband setting for synchronization bandwidth.

*RST value	Resolution	Options	SCPI
NARRow	-	-	Device-specific

[SOURce:]ROSCillator:OUTPut:SOURce INTernal | EXTernal

The command selects the output for the reference oscillator signal. The external output is only available in case that the external reference frequency is 10 MHz.

Parameters: **INTernal**
                   The reference oscillator signal is used internally.

                   EXTernal
                   The reference oscillator signal is used as output at the REF OUT connector

Example: ROSC:OUTP:SOUR EXT
                   'the reference oscillator signal is output at the REF OUT connector.

*RST value	Resolution	Options	SCPI
INTernal	-	-	Device-specific

[SOURce:]ROSCillator:SOURce INTernal | EXTernal

The command selects between internal and external reference frequency.

Parameters: **INTernal**
                   The internal reference oscillator is used. The reference signal is provided at the REF OUT connector.

                   EXTernal
                   An external reference signal is used. It must be input at the REF IN connector at the rear of the instrument. The instrument is informed of the frequency of the external reference signal by means of the command
                   SOURce:ROSCillator:EXTernal:FREQuency.

Example: ROSC:SOUR EXT
                   'selects the external source.

                   ROSC:EXT:FREQ 5 MHz
                   'informs the instrument that the external reference has a frequency of 5 MHz.

*RST value	Resolution	Options	SCPI
INTernal	-	-	Device-specific

SOURce:SWEep Subsystem

This subsystem contains the commands for checking the RF sweeps, i.e. the sweeps of the RF generators. Sweeps are always triggered, except for the `MANual` sweep mode. The frequency sweep is activated by the command `SOURce:FREQuency:MODE SWEep`, and the level sweep by the command `SOURce:POWer:MODE SWEep`. All sweeps, including the LF sweep, can be set independently of each other.
The keyword SOURce is optional with commands and can be omitted.

A sweep is set in several steps which are shown below taking a frequency sweep as an example:

1. Set the sweep range.
   ```
   [SOURce:]FREQuency:CENTer 200 MHz
   [SOURce:]FREQuency:SPAN 300 MHz
   ```

2. Select linear or logarithmic spacing.
   ```
   [SOURce:]SWEep[:FREQuency]:SPACing LIN
   ```

3. Set the step width and dwell time.
   ```
   [SOURce:]SWEep[:FREQuency]:STEP:LINear 20 MHz
   [SOURce:]SWEep[:FREQuency]:DWELl 12 ms
   ```

4. Select the trigger mode.
   ```
   TRIGger:FSWeep:SOURce SINGle
   ```

5. Select the sweep mode and activate the sweep.
   ```
   [SOURce:]SWEep[:FREQuency]:MODE AUTO
   [SOURce:]FREQuency:MODE  SWEep
   ```

6. Trigger the sweep.
   ```
   [SOURce:]SWEep[:FREQuency]:EXECute
   ```

Command	Parameters	Default unit	Remark
[SOURce:]SWEep[:FREQuency]:DWELl	10 ms ... 100 s	ms	
[SOURce:]SWEep[:FREQuency]:EXECute	-		
[SOURce:]SWEep[:FREQuency]:MODE	AUTO | MANual | STEP		
[SOURce:]SWEep[FREQuency]:POINts	<numeric_value>		
[SOURce:]SWEep[:FREQuency]:SPACing	LINear | LOGarithmic		
[SOURce:]SWEep[:FREQuency]:STEP: COUNt	1...16777215		
[SOURce:]SWEep[:FREQuency]:STEP[:LINear]	0 ... (STOP - STARt)	Hz	
[SOURce:]SWEep[:FREQuency]:STEP:LOGarithmic	0 ... 100 PCT		
[SOURce:]SWEep:POWer:DWELl	10 ms...10 s	ms	
[SOURce:]SWEep:POWer:EXECute	-		
[SOURce:]SWEep:POWer:MARK<[1]...10>:STATe	ON | OFF		
[SOURce:]SWEep:POWer:MODE	AUTO | MANual | STEP		
[SOURce:]SWEep:POWer:POINts	<numeric_value>		
[SOURce:]SWEep:POWer:SPACing:MODE			Query only
[SOURce:]SWEep:POWer:STEP:[:LOGarithmic]	0 ...160 dB	dB	
[SOURce:]SWEep:RESet[:ALL]			No query

[SOURce:]SWEep[:FREQuency]:DWELl   10 ms...100 s

The command sets the time taken for each frequency step of the sweep.

The keyword [:FREQuency] can be omitted (see example). The command is then SCPI-compliant.

Example: SWE:DWEL 12ms
       'sets a dwell time of 12 ms for a frequency sweep.

*RST value	Resolution	Options	SCPI
15 ms	0.1 ms		Device-specific

[SOURce:]SWEep[:FREQuency]:EXECute

The command immediately starts an RF frequency sweep. The sweep to be executed depends on the respective MODE setting (SOURce:SWEep:FREQuency:MODE). The command corresponds to the manual-control command **Execute Trigger**.

The command triggers an event and therefore has no query form and no *RST value.

Example: SWE:FREQ:EXEC
       'triggers a frequency sweep.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]SWEep[:FREQuency]:MODE   AUTO | MANual | STEP

The command sets the sweep mode.

The keyword [:FREQuency] can be omitted (see example). The command is then SCPI-compliant.

Parameters: **AUTO**
       Each trigger triggers exactly one complete sweep.

       MANual
       The trigger system is not active. Each frequency step of the sweep is triggered individually, either by varying the **Current Frequency** value using the rotary knob under manual control or by means of a FREQ:MAN command under remote control. With manual control, the frequency increases or decreases (depending on the direction of the rotary encoder) by the value specified under FREQ:STEP. With remote control, the frequency is set directly with the command :FREQ:MAN.

       STEP
       Each trigger triggers one sweep step only (**Mode Single Step**). The frequency increases by the value entered under SOUR:SWE:FREQ:STEP:LIN (linear spacing) or ...:STEP:LOG (logarithmic spacing).

Example: SOUR:SWE:MODE AUTO
       'selects **Mode Auto** for a frequency sweep.

*RST value	Resolution	Options	SCPI
AUTO	-		Device-specific

[SOURce:]SWEep[:FREQuency]:POINts <numeric_value>

The command sets the number of steps in an RF sweep. The command is linked to the command
`:SWEep[:FREQuency]:STEP` as follows:

The following applies for linear sweeps: `POINts = (SPAN / STEP:LIN) + 1`

The following applies for logarithmic sweeps and `STARt < STOP`:
`POINts = ((log STOP - log STARt) / log STEP:LOG) + 1`

If `POINts` changes, the value of `STEP` is adjusted. The `STARt` and `STOP` value is retained.

Two separate POINts values are used for linear or logarithmic sweep spacing
(`:SWEep[:FREQuency]:SPACing LIN | LOG`). The command is always effective for the
currently set sweep spacing.

Example: `FREQ:STAR`
                'sets the start frequency to 100 MHz.

                `FREQ:STOP`
                'sets the stop frequency to 500 MHz.

                `SWE:SPAC LIN`
                'sets linear sweep spacing.

                `SWE:POIN 401`
                'sets 401 sweep steps for linear sweep spacing. The sweep step width (`STEP`)
                is automatically set to 1 MHz.

*RST value	Resolution	Options	Correlation	SCPI
	-		The value of `:SWE:STEP` is adjusted automatically.	Device-specific (adapted to instrument properties)

[SOURce:]SWEep[:FREQuency]:SPACing LINear | LOGarithmic

The command selects linear or logarithmic sweep spacing.

The keyword `[:FREQuency]` can be omitted (see example). The command is then SCPI-compliant.

Example: `SWE:SPAC LIN`
                'selects linear sweep spacing for a frequency sweep.

*RST value	Resolution	Options	SCPI
LIN	-		Device-specific

[SOURce:]SWEep[:FREQuency]:STEP[:LINear]   0 ... (STOP - STARt)

The command sets the step width for linear sweeps.

This command is linked to the command `:SWEep[:FREQuency]:POINts` as follows:

`POINts = (SPAN / STEP:LIN) + 1`

If `STEP:LIN` changes, the value of `POINTS` is adjusted. The `STARt` and `STOP` value is retained.

The keywords `[:FREQuency]` and `[:LINear]` can be omitted (see example). The command is then SCPI-compliant.

Example: `FREQ:STAR`
           'sets the start frequency to 100 MHz.

                     `FREQ:STOP`
           'sets the stop frequency to 500 MHz.

                     `SWE:SPAC LIN`
           'sets linear sweep spacing.

                     `SWE:STEP 2MHz`
           'sets the step width for linear sweep spacing to 2 MHz (RF sweep). The number of sweep steps for linear sweep spacing (`POINts`) is automatically set to 201.

*RST value	Resolution	Options	Correlation	SCPI
1 MHz	0.1 Hz.		The value of `:SWE:POINts` is adjusted automatically.	Device-specific

[SOURce:]SWEep[:FREQuency]:STEP:LOGarithmic   0 ... 100 PCT

The command specifies the step width factor for logarithmic sweeps. The next frequency value of a sweep is calculated (for `STARt` < `STOP`) using the following formula:

New frequency = Old frequency + `STEP:LOG` x Old frequency

`STEP:LOG` therefore gives the fraction of the old frequency. The frequency is increased by this fraction for the next sweep step. Usually `STEP:LOG` is given in percent, whereby the suffix `PCT` must always be used.

The command is linked to the command `:SWEep[:FREQuency]:POINts` for `STARt` < `STOP` as follows:

`POINts = ((log STOP - log STARt) / log STEP:LOG) + 1`

If `STEP:LOG` changes, the value of `POINts` is adjusted. The `STARt` and `STOP` value is retained.

Example: `FREQ:STAR`
           'sets the start frequency to 100 MHz.

                     `FREQ:STOP`
           'sets the stop frequency to 500 MHz.

                     `SWE:SPAC LOG`
           'sets logarithmic sweep spacing.

                     `SWE:STEP:LOG 10PCT`
           'sets the step width for logarithmic sweep spacing to 10% of the previous frequency in each instance (for a frequency sweep).

*RST value	Resolution	Options	Correlation	SCPI
1 PCT	0.01 PCT		The value of `:SWE:POIN` is adjusted automatically.	Device-specific

[SOURce:]SWEep:POWer:DWELl   10 ms...10 s

The command sets the time taken for each level step of the sweep.

Example: SWE:POW:DWEL 12m
'sets a dwell time of 12 ms for a level sweep.

*RST value	Resolution	Options	SCPI
15 ms	0.1 ms		Device-specific

[SOURce:]SWEep:POWer:EXECute

The command immediately starts an RF level sweep. The sweep to be executed depends on the set sweep mode (:SOURce:SWEep:POWer:MODE). The command corresponds to the manual-control command **Execute Trigger**.

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

Example: SWE:POW:MODE STEP
'sets the STEP trigger mode, i.e. a trigger starts the sweep initially, and then the sweep is generated continuously.

SOUR:SWE:POW:EXEC
'starts the continuous generation of the RF level sweep.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]SWEep:POWer:MODE   AUTO | MANual | STEP

The command sets the cycle mode of the level sweep.

Parameters: **AUTO**
Each trigger triggers exactly one complete sweep.

MANual
The trigger system is not active. Each level step of the sweep is triggered individually, either by varying the **Current Level** value using the rotary knob under manual control or by means of a POW:MAN command under remote control. With manual control, the level increases or decreases (depending on the direction of the rotary encoder) by the value specified under POW:STEP. With remote control, the level is set directly with the command POW:MAN.

STEP
Each trigger triggers one sweep step only. The level increases by the value entered under :SWEep:POWer:STEP:LOGarithmic.

Example: SWE:POW:MODE AUTO
'selects **Mode Auto** for a level sweep.

*RST value	Resolution	Options	SCPI
AUTO	-		Device-specific

[SOURce:]SWEep:POWer:POINts <numeric_value>

The command sets the number of steps in a level sweep. The command is linked to the command `:SWEep:POWer:STEP` as follows:

`POINts = (STOP - STARt) / STEP:LOG) + 1`

If `POINts` changes, the value of `STEP` is adjusted. The `STARt` and `STOP` value is retained.

Example: `POW:STAR - 30dBm`
                  'sets the start frequency to -30 dBm.

                  `POW:STOP - 10dBm`
                  'sets the stop frequency to -10 dBm.

                  `SWE:POW:POIN 20`
                  'sets 20 sweep steps. The sweep step width (`STEP`) is automatically set to 1 dB.

*RST value	Resolution	Options	Correlation	SCPI
20 dB	-		The value of `:SWE:POW:STEP` is adjusted automatically.	Device-specific (adapted to instrument properties)

[SOURce:]SWEep:POWer:SPACing:MODE?

The command queries the sweep spacing. The sweep spacing for level sweeps is always linear.

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

Example: `SWE:POW:SPAC:MODE?`
                  'queries the sweep spacing for a level sweep.

                  Result: `LIN`
                  'linear spacing.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

[SOURce:]SWEep:POWer:STEP[:LOGarithmic] 0 ... 160 dB

The command sets the step width factor for logarithmic sweeps. The next level value of a sweep is calculated (for `STARt` < `STOP`) using the following formula:

New level = Old level + `STEP:LOG` x Old level

`STEP:LOG` therefore gives the fraction of the old level. The level is increased by this fraction for the next sweep step. Usually `STEP:LOG` is given in decibels, whereby the suffix `dB` must always be used.

The command is linked to the command `:SWEep:POWer:POINts` for `STARt` < `STOP` as follows:

`POINts = (STOP - STARt) / (STEP:LOG) + 1`

If `STEP:LOG` changes, the value of `POINts` is adjusted. The `STARt` and `STOP` value is retained.

Example: `SWE:POW:STEP 10dB`
                  'sets the step width for logarithmic sweep spacing to 10 dB of the previous level in each instance (for a level sweep).

*RST value	Resolution	Options	SCPI
0 dB	0.01 dB		Device-specific

[SOURce:]SWEep:RESet[:ALL]

The command resets all active sweeps to the starting point.

The command triggers an event and therefore has no reset value.

Example: SWE:RES

'resets all active sweeps to the starting point.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

STATus Subsystem

This system contains the commands for the status reporting system. *RST has no effect on the status registers.
Queries return the current value of the respective register, which permits a check of the device status. A decimal value between 0 and 32767 (=2^{15}-1) is returned.
The configuration commands set the respective register thus determining which status changes of the R&S Signal Generator causes the status registers to be changed. A decimal value between 0 and 32767 (= 2^{15}-1) is set.

Command	Parameters	Default unit	Remark
STATus:OPERation:CONDition?			Query only
STATus:OPERation:ENABle	0...32767		
STATus:OPERation[:EVENt]?			Query only
STATus:OPERation:NTRansition	0...32767		
STATus:OPERation:PTRansition	0...32767		
STATus:PRESet			No query
STATus:QUEStionable:CONDition?			Query only
STATus:QUEStionable:ENABle	0...32767		
STATus:QUEStionable[:EVENt]?			Query only
STATus:QUEStionable:NTRansition	0...32767		
STATus:QUEStionable:PTRansition	0...32767		
STATus:QUEue[:NEXT]?			Query only

STATus:OPERation:EVENt?

The command queries the content of the EVENt part of the STATus:OPERation register. This part contains information on the actions performed in the instrument since the last readout. The content of the EVENt part is deleted after being read out.

Example: STAT:OPER:EVEN?

'queries the STATus:OPERation:EVENt register.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:OPERation:CONDition?

The command queries the content of the CONDition part of the STATus:OPERation register. This part contains information on the action currently being performed in the instrument. The content is not deleted after being read out since it indicates the current hardware status.

Example: STAT:OPER:COND?
                    'queries the Status:Operation:Condition register.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:OPERation:PTRansition

The command sets the bits of the PTRansition part of the STATus:OPERation register. If a bit is set, a transition from 0 to 1 in the condition part causes an entry to be made in the EVENt part of the register. A new event in the hardware is thus registered, e.g. the start of an adjustment.

Example: STAT:OPER:PTR 32767
                    'all transitions from 0 to 1 in the condition part of the Status:Operation register cause an entry to be made in the EVENt part.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:OPERation:NTRansition

The command sets the bits of the NTRansition part of the STATus:OPERation register. If a bit is set, a transition from 1 to 0 in the condition part causes an entry to be made in the EVENt part of the register. The disappearance of an event in the hardware is thus registered, e.g. the end of an adjustment.

Example: STAT:OPER:NTR 0
                    'a transition from 1 to 0 in the condition part of the Status:Operation register does not cause an entry to be made in the EVENt part.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:OPERation:ENABle

The command sets the bits of the ENABle part of the STATus:OPERation register. This setting determines which events of the Status-Event part are forwarded to the sum bit in the status byte. These events can be used for a service request.

Example: STAT:OPER:ENAB 32767
                    'all events are forwarded to the sum bit of the status byte.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:PRESet

The command resets the status registers. All PTRansition parts are set to FFFFh (32767), 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 parts of STATus:OPERation and STATus:QUEStionable are set to 0, i.e. all events in these registers are not passed on.

The command triggers an event and therefore has no query form and no *RST value.

Example: `STAT:PRES`
'resets the status registers.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEStionable:EVENt?

The command queries the content of the EVENt part of the STATus:QUEStionable register. This part contains information on the actions performed in the instrument since the last readout. The content of the EVENt part is deleted after being read out.

Example: `STAT:OPER:EVEN?`
'queries the Status:Questionable:Event register.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEStionable:CONDition?

The command queries the content of the CONDition part of the STATus:QUEStionable register. This part contains information on the action currently being performed in the instrument. The content is not deleted after being read out since it indicates the current hardware status.

Example: `STAT:OPER:COND?`
'queries the Status:Questionable:Condition register.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEStionable:PTRansition

The command sets the bits of the PTRansition part of the STATus:QUEStionable register. If a bit is set, a transition from 0 to 1 in the condition part causes an entry to be made in the EVENt part of the register.

Example: `STAT:OPER:PTR 32767`
'all transitions from 0 to 1 in the condition part of the Status:Questionable register cause an entry to be made in the EVENt part.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEStionable:NTRansition

The command sets the bits of the NTRansition part of the STATus:QUEStionable register. If a bit is set, a transition from 1 to 0 in the condition part causes an entry to be made in the EVENt part of the register.

Example: STAT:OPER:NTR 0
'a transition from 1 to 0 in the condition part of the Status:Questionable register does not cause an entry to be made in the EVENt part.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEStionable:ENABle

The command sets the bits of the ENABle part of the STATus:QUEStionable register. This setting determines which events of the Status-Event part are enabled for the sum bit in the status byte. These events can be used for a service request.

Example: STAT:OPER:ENAB 1
'problems when performing an adjustment cause an entry to be made in the sum bit.

*RST value	Resolution	Options	SCPI
-	-		Compliant

STATus:QUEue[:NEXT]?

The command queries the oldest entry in the error queue and then deletes it. Positive error numbers denote device-specific errors, and negative error numbers denote error messages defined by SCPI (see Chapter 9). If the error queue is empty, 0 ("No error") is returned. The command is identical to SYSTem:ERRor?.

Example: STAT:QUE?
'queries the oldest entry in the error queue.

Response: "0, 'no error'"
'no errors have occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem Subsystem

The SYSTem subsystem contains a series of commands for general functions which do not directly affect signal generation.

Command	Parameters	Default unit	Remark
SYSTem:BEEPer:STATe	ON | OFF		
SYSTem:COMMunicate:GPIB:LTERminator	EOI | STANdard		
SYSTem:COMMunicate:GPIB[:SELF]:ADDRess	0...30		
SYSTem:COMMunicate:NET:DHCP	ON | OFF		
SYSTem:COMMunicate:NETWork:DNS:ALTernate	0.0.0.0 .. ff.ff.ff.ff		
SYSTem:COMMunicate:NETWork:DNS:MODE	AUTO | STATic		
SYSTem:COMMunicate:NETWork:DNS:PREFerred	0.0.0.0 .. ff.ff.ff.ff		
SYSTem:COMMunicate:NETWork:DNS:SET			
SYSTem:COMMunicate:NETWork:COMMon:SET			
SYSTem:COMMunicate:NETWork:IPADdress:SET			
SYSTem:COMMunicate:NETWork[:COMMon]:DOMain	'string'		
SYSTem:COMMunicate:NETWork[:IPADdress]:GATeway	'string'		
SYSTem:COMMunicate:NETWork[:COMMon]:HOSTname	'string'		
SYSTem:COMMunicate:NETWork:IPADdress	0.0.0.0 .. ff.ff.ff.ff		
SYSTem:COMMunicate:NETWork:IPADdress:MODE	AUTO | STATIC | P2P		
SYSTem:COMMunicate:NETWork:MACAdress			Query only
SYSTem:COMMunicate:NET:PTOP	ON | OFF		
SYSTem:COMMunicate:NETWork:RESource	'string'		
SYSTem:COMMunicate:NETWork[:IPADdress]:SUBNet:MASK	0.0.0.0 .. ff.ff.ff.ff		
SYSTem:COMMunicate:NETWork:COMMon:WORKgroup	'string'		
SYSTem:COMMunicate:NETWork:GET			
SYSTem:COMMunicate:USB:RESource			
SYSTem:DATE	<year>,<month>,<day>		
SYSTem:DISPlay:UPDate	ON | OFF		
SYSTem:ERRor:ALL			Query only
SYSTem:ERRor:CODE:ALL			Query only
SYSTem:ERRor:CODE[:NEXT]?			Query only
SYSTem:ERRor:COUNt?			Query only
SYSTem:ERRor[:NEXT]?			Query only
SYSTem:KLOCk	ON | OFF		
SYSTem:PRESet			No query
SYSTem:PROTect<n>[:STATe]	ON | OFF , password		
SYSTem:TIME	<hour>,<minute>,<second>		
SYSTem:VERSion?			Query only

SYSTem:BEEPer:STATe ON | OFF

The command switches the key beep on or off.

Example:　　　　SYST:BEEP:STAT OFF

　　　　　　　　　　'no acoustic signal is output when a key on the front panel is pressed.

*RST value	Resolution	Options	SCPI
OFF	-		Compliant

SYSTem:COMMunicate:GPIB:LTERminator EOI | STANdard

The command sets the terminator recognition for remote control via the IEC/IEEE bus.

Parameters:　　　**EOI**

　　　　　　　　　　The terminator must be sent together with the line message EOI (End of Line). This setting is recommended for binary block transmissions where a character could coincidentally have the value LF (Line Feed) but is not intended as the terminator. This setting must be selected for block data with undefined length.

　　　　　　　　　　STANdard

　　　　　　　　　　An LF (Line Feed) is recognized as the terminator regardless of whether it is sent with or without EOI.

Example:　　　　SYST:COMM:GPIB:LTER EOI

　　　　　　　　　　'only a character which is sent simultaneously with the line message EOI is accepted as the terminator.

*RST value	Resolution	Options	SCPI
STANdard	-		Compliant

SYSTem:COMMunicate:GPIB[:SELF]:ADDRess 1 ... 30

The command sets the IEC/IEEE-bus address.

Example:　　　　SYST:COMM:GPIB:SELF:ADDR 14

　　　　　　　　　　'sets IEC/IEEE-bus address 14.

*RST value	Resolution	Options	SCPI
28	-		Compliant

SYSTem:COMMunicate:NETWork:DNS:ALTernate 0.0.0.0 .. ff.ff.ff.ff

The command sets the alternate DNS server address manually.

Example:　　　　SYST:COMM:NETW:DNS:ALT 7.8.9.10

　　　　　　　　　　'sets the IP address of the alternate DNS server.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:DNS:MODE AUTO | STATic

The command selects if the DNS server address is assigned automatically or manually.

Example: SYST:COMM:NETW:DNS:MODE:AUTO

' the DNS server address is assigned automatically.

*RST value	Resolution	Options	SCPI
AUTO	-		Device-specific

SYSTem:COMMunicate:NETWork:DNS:PREFerred 0.0.0.0 .. ff.ff.ff.ff

The command sets the preferred DNS server address manually.

Example: SYST:COMM:NETW:DNS:PREF 7.8.9.10

'sets the IP address of the preferred DNS server.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:DNS:SET

The command activates the DNS settings (Commands SYST:COMM:NETW:DNS:...).

The commands triggers an event and therefore has no *RST value and no query form.

Example: SYST:COMM:NETW:DNS:SET

'activates all changes of the DNS settings.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:COMMon:SET

The command activates the hostname setting (Commands SYST:COMM:NETW:COMM:HOST).

The commands triggers an event and therefore has no *RST value and no query form.

Example: SYST:COMM:NETW:COMM:SET

'activates the change of the hostname.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:IPADdress:SET

The command activates the IP setting (Commands SYST:COMM:NETW:IPAD...).

The commands triggers an event and therefore has no *RST value and no query form.

Example: SYST:COMM:NETW:IPAD:SET

'activates all changes of the IP address settings.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork[:COMMon]:DOMain 'string'

The command enters the domain of the network.

Example: SYST:COMM:NETW:COMM:DOM ABC.DE
'enters the domain of the network.

*RST value	Resolution	Options	SCPI
28	-		Device-specific

SYSTem:COMMunicate:NETWork[:IPADdress]:GATeway 0.0.0.0 .. ff.ff.ff.ff

The command enters the IP address of the default gateway.

Example: SYST:COMM:NETW:IPAD:GAT 1.2.3.4
'enters the IP address of the default gateway.

*RST value	Resolution	Options	SCPI
28	-		Device-specific

SYSTem:COMMunicate:NETWork[:COMMon]:HOSTname 'string'

The command enters the individual computer name of the R&S SMF.

Example: SYST:COMM:NETW:COMM:HOST 'SMF123456'
'enters the individual computer name of the R&S SMF.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:IPADdress 0.0.0.0 .. ff.ff.ff.ff

The command enters the IP address.

Example: SYST:COMM:NETW:IPAD 7.8.9.10
'enters the IP address of the R&S SMF.

*RST value	Resolution	Options	SCPI
	-		Device-specific

SYSTem:COMMunicate:NETWork:IPADdress:MODE AUTO | STATic | P2P

The command selects the IP address assignment.

Parameters: **AUTO**
The IP address is assigned automatically.

The network used must support automatic assignment of IP address (DHCP) in order to use this function

STATic
The IP address is assigned manually.

P2P
A Peer to Peer connection is used.

Example: `SYST:COMM:NETW:IPAD:MODE  AUTO`
'the IP adress is assigned automatically via DHCP.

*RST value	Resolution	Options	SCPI
AUTO	-		Device-specific

SYSTem:COMMunicate:NETWork:MACAddress ?

The command queries the MAC address.

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

Example: `SYST:COMM:NETW:MAC?`
'queries the MAC address.

Response:
`55 44 77 3B 99 1D`

*RST value	Resolution	Options	SCPI
	-		Device-specific

SYSTem:COMMunicate:NETWork:RESource ?

The command queries the visa resource string for remote control via the ethernet interface.

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

Example: `SYST:COMM:NET:RES?`
'queries the visa resource string.

Response:
`TCPIP::192.1.2.3::INSTR`

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork[:IPADdress]:SUBNet:MASK 0.0.0.0 .. ff.ff.ff.ff

The command enters the Subnet mask.

Example: SYST:COMM:NETW:IPAD:SUBN:MASK 255.255.255.0
'enters the Subnet mask.

*RST value	Resolution	Options	SCPI
	-		Device-specific

SYSTem:COMMunicate:NETWork[:COMMon]:WORKgroup 'string'

The command enters the individual workgroup name of the R&S SMF.

Example: SYST:COMM:NETW:COMM:WORK 'TEST_09'
'enters the workgroup name 'TEST_09'.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:NETWork:GET

The command retrieves the current system settings of the instrument.

Example: SYST:COMM:NETW:GET
'retrieves the current system settings of the instrument.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:COMMunicate:USB:RESource ?

The command queries the visa resource string for remote control via the USB interface.

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

Example: SYST:COMM:USB:RES?
'queries the visa resource string.

Response:
USB::72::000000::INSTR

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:DATE <year>,<month>,<day>

The command sets the date for the instrument-internal calendar. "

Example: SYST:DATE 2003,05,01
'sets May 1, 2003.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:DISPlay:UPDate ON | OFF

The command switches the update of the display on/off. A switchover from remote control to manual control always sets the status of the update of the display to ON.

Example: `SYST:DISP:UPD OFF`

'switches update of displayed parameter values off.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

SYSTem:ERRor:ALL?

The command queries all entries in the error queue and then deletes them. Positive error numbers denote device-specific errors, and negative error numbers denote error messages defined by SCPI (see section "*Error Messages*"). If the error queue is empty, 0 ("No error") is returned.

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

Example: `SYST:ERR:ALL?`

'queries all entries in the error queue.

Response: "0, 'no error'"

'no errors have occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:ERRor:CODE:ALL?

The command queries all entries in the error queue and then deletes them. Only the error numbers are returned and not the entire error text. Positive error numbers denote device-specific errors, and negative error numbers denote error messages defined by SCPI (see section "*Error Messages*"). If the error queue is empty, 0 ("No error") is returned.

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

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

'queries all entries in the error queue.

Response: "0"

'no errors have occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:ERRor:CODE[:NEXT]?

The command queries the oldest entry in the error queue and then deletes it. Only the error number is returned and not the entire error text. Positive error numbers denote device-specific errors, and negative error numbers denote error messages defined by SCPI (see section "*Error Messages*"). If the error queue is empty, 0 is returned.

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

Example: SYST:ERR:CODE?
                'queries the oldest entry in the error queue.

                Response: "0"
                'no errors have occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:ERRor:COUNt?

The command queries the number of entries in the error queue . If the error queue is empty, '0' is returned.

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

Example: SYST:ERR:CODE?
                'queries the oldest entry in the error queue.

                Response: "1"
                'one error has occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:ERRor[:NEXT]?

The command queries the oldest entry in the error queue and then deletes it. Positive error numbers denote device-specific errors, and negative error numbers denote error messages defined by SCPI (see Chapter 9). If the error queue is empty, 0 ("No error") is returned. The command is identical to the command STATus:QUEue:NEXT?.

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

Example: SYST:ERR?
                'queries the oldest entry in the error queue.

                Response: "0, 'no error'"
                'no errors have occurred since the error queue was last read out.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:KLOCk ON | OFF

The command (Keyboard LOCk) disables the front panel keyboard of the R&S Signal Generator including the ⎡LOCAL⎤ key, or enables it again (OFF).

Example: SYST:KLOC ON

'activates the keyboard lock. The keyboard cannot be operated again until it has been enabled with SYST:KLOC OFF.

*RST value	Resolution	Options	SCPI
OFF	-		Compliant

SYSTem:PRESet

The command triggers an instrument reset. It has the same effect as the ⎡PRESET⎤ key on the front panel and the *RST command.

The command triggers an event and therefore has no *RST value and no query form.

Example: SYST:PRES

'all instrument settings (also those that are not currently active) are reset to their default values.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:PROTect<n>[:STATe] ON | OFF, password

The command activates and deactivates the specified protection level. There are several protection levels which disable specific service functions (authorized personnel of R&S Service Departments only). These levels are identified by the suffix under PROTect.

The respective functions are disabled when the protection level is activated. No password is required for activation. A password must be entered to deactivate the protection level. The password for the first level is 123456. This protection level can be used to lock-out internal adjustments.

The command triggers an event and therefore has no *RST value and no query form.

Example: SYST:PROT1 ON

'activates protection level 1. Internal adjustments are only possible after deactivating the lock-out.

SYST:PROT1 OFF, 123456

'deactivates protection level 1. Internal adjustments are enabled again.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:TIME 0...23,0...59,0...59

The command sets the time for the instrument-internal clock.

Example: SYST:TIME 12,0,0

'sets the time to precisely 12 pm.

*RST value	Resolution	Options	SCPI
-	-		Compliant

SYSTem:VERSion?

The command queries the SCPI version with which the instrument complies.

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

Example: `SYST:VERS?`
          'queries the SCPI version.

          Response: 1996
          'the instrument complies with the version from 1996.

*RST value	Resolution	Options	SCPI
-	-		Compliant

TEST Subsystem

The TEST system contains the commands for performing the routines as well as for direct manipulation of the hardware assemblies (`:TEST:DIRect`). The self tests return a "0" if the test is performed successfully, otherwise a value other than "0" is returned. None of the commands of this system have an *RST value.

> **Caution!**
> *The respective hardware assembly responds directly to the `:TEST:DIRect` command; any safety mechanisms are bypassed. The command is used for servicing purposes and should not be applied by the user. Improper use could destroy the assembly.*

Command	Parameters	Default unit	Remark
TEST:DIRect	**'assembly**, subaddress, hex data string		

TEST:DIRect 'assembly', subaddress, hex data string

The respective hardware assembly responds directly to the command; any safety mechanisms are bypassed. This function is only available via remote control.

Example: `TEST:DIR 'SSYN',0,#H12345678`

          `TEST:DIR? 'SSYN',0`
          `Response:      '#H12345678`

*RST value	Resolution	Options	SCPI
-	-		Device-specific

TRIGger Subsystem

The TRIGger system contains the commands for selecting the trigger source for the RF and LF sweep. The trigger input connector is configured in the SOURce:INPut subsystem.

The trigger system of the R&S Signal Generator is a simplified implementation of the SCPI trigger system. The TRIGger system differs from the SCPI system as follows:
- No INITiate command; the instrument behaves as if `INITiate:CONTinuous ON` were set.

- Under TRIGger several sweep subsystems exist.

Other commands associated with the trigger system of the R&S Signal Generator can be found in the modulation and RF signal subsystems.

Command	Parameters	Default unit	Remark
TRIGger:FSWeep[:IMMediate]			No query
TRIGger:FSWeep:SOURce	AUTO|IMMediate | SINGle|BUS | EXTernal		
TRIGger:LFFSweep:SOURce	AUTO|IMMediate | SINGle|BUS | EXTernal		
TRIGger:LFVSweep:SOURce	AUTO|IMMediate | SINGle|BUS | EXTernal		
TRIGger:PSWeep[:IMMediate]			No query
TRIGger:PSWeep:SOURce	AUTO|IMMediate | SINGle|BUS | EXTernal		
TRIGger[:SWEep][:IMMediate]			No query
TRIGger[:SWEep]:SOURce	AUTO|IMMediate | SINGle|BUS | EXTernal		

TRIGger:FSWeep[:IMMediate]

The command immediately starts an RF frequency sweep. The sweep to be executed depends on the respective MODE setting (SOURce:SWEep:FREQuency:MODE SING). The command corresponds to the manual-control command **Execute Trigger**.

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

Example: SWE:FREQ:MODE SING
               'sets the **Single** trigger mode, i.e. a trigger starts a single sweep.

               TRIG:FSW
               'starts a single RF frequency sweep.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

TRIGger:FSWeep:SOURce   AUTO|IMMediate | SINGle|BUS | EXTernal

The command sets the trigger source for the RF frequency sweep.

The names of the parameters correspond directly to the various settings under manual control. SCPI uses other names for the parameters; these names are also accepted by the instrument. The SCPI names should be used if compatibility is an important consideration. An overview of the various names is given in the following table:

R&S name	SCPI name	Command under manual control
AUTO	IMMediate	**Auto** mode
SINGle	BUS	**Single** and **Step** mode. The command :SWEep:FREQ:MODE is used to select between the two sweep modes.
EXTernal	EXTernal	**Ext Single** and **Ext Step** mode. The command :SWEep:FREQ:MODE is used to select between the two sweep modes.

Parameters: **AUTO | IMMediate**
The trigger is free-running, i.e. the trigger condition is fulfilled continuously. As soon as one sweep is finished, the next sweep is started.

SINGle
The sweep is triggered by the IEC/IEEE-bus commands ...:SWEep:EXEC or *TRG or TRIG:FSW:IMM. If :SOURce:SWEep:MODE is set to STEP, one step is executed. If :SOURce:SWEep:MODE is set to AUTO, one complete sweep is executed.

EXTernal
The sweep is triggered externally via the TRIGGER connector or the AUX connector at the rear of the instrument.

Example: TRIG:FSW:SOUR EXT
'selects triggering with an external trigger. The trigger is input via the TRIGGER connector or the AUX connector at the rear of the instrument.

*RST value	Resolution	Options	SCPI
SINGle	-		Device-specific

TRIGger:LFFSWeep:SOURce   AUTO|IMMediate | SINGle|BUS | EXTernal

The command sets the trigger source for the LF frequency sweep.

The names of the parameters correspond directly to the various settings under manual control. SCPI uses other names for the parameters; these names are also accepted by the instrument. The SCPI names should be used if compatibility is an important consideration. An overview of the various names is given in the following table:

R&S name	SCPI name	Command under manual control
AUTO	IMMediate	**Auto** mode
SINGle	BUS	**Single** and **Step** mode. The command :SWEep:FREQ:MODE is used to select between the two sweep modes.
EXTernal	EXTernal	**Ext Single** and **Ext Step** mode. The command :SWEep:FREQ:MODE is used to select between the two sweep modes.

Parameters: **AUTO | IMMediate**
The trigger is free-running, i.e. the trigger condition is fulfilled continuously. As soon as one sweep is finished, the next sweep is started.

SINGle
The sweep is triggered by the IEC/IEEE-bus command
...:LFOutput:SWEep:EXEC. If :SOURce:LFOutput:SWEep:MODE is set to STEP, one step is executed. If :SOURce:LFOutput:SWEep:MODE is set to AUTO, one complete sweep is executed.

EXTernal
The sweep is triggered externally via the TRIGGER connector or the AUX connector at the rear of the instrument.

Example: TRIG:LFFS:SOUR EXT
'selects triggering with an external trigger. The trigger is input via the TRIGGER connector or the AUX connector at the rear of the instrument.

*RST value	Resolution	Options	SCPI
SINGle	-		Device-specific

TRIGger:LFVSWeep:SOURce   AUTO|IMMediate | SINGle|BUS | EXTernal

The command sets the trigger source for the LF level sweep.

The names of the parameters correspond directly to the various settings under manual control. SCPI uses other names for the parameters; these names are also accepted by the instrument. The SCPI names should be used if compatibility is an important consideration. An overview of the various names is given in the following table:

R&S name	SCPI name	Command under manual control
AUTO	IMMediate	**Auto** mode
SINGle	BUS	**Single** and **Step** mode. The command :SWEep:VOLT:MODE is used to select between the two sweep modes.
EXTernal	EXTernal	**Ext Single** and **Ext Step** mode. The command :SWEep:VOLT:MODE is used to select between the two sweep modes.

Parameters: **AUTO | IMMediate**
The trigger is free-running, i.e. the trigger condition is fulfilled continuously. As soon as one sweep is finished, the next sweep is started.

                             SINGle
The sweep is triggered by the IEC/IEEE-bus command
...:LFO:SWE:VOLT:EXEC. If :SOUR:LFO:SWE:VOLT:MODE is set to STEP, one step is executed. If :SOURce:LFO:SWE:VOLT:MODE is set to AUTO, one complete sweep is executed.

                             EXTernal
The sweep is triggered externally via the TRIGGER connector or the AUX connector at the rear of the instrument.

Example: TRIG:LFVS:SOUR EXT
'selects triggering with an external trigger. The trigger is input via the TRIGGER connector or the AUX connector at the rear of the instrument.

*RST value	Resolution	Options	SCPI
SINGle	-		Device-specific

TRIGger[:PSWeep][:IMMediate]

The command immediately starts an RF level sweep. The sweep to be executed depends on the set sweep mode (:SOURce:SWEep:POWer:MODE). The command corresponds to the manual-control command **Execute Trigger**.

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

Example: SWE:POW:MODE STEP
'sets the STEP trigger mode, i.e. a trigger starts the sweep initially, and then the sweep is generated continuously.

                    TRIG:PSW
'starts the continuous generation of the RF level sweep.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

TRIGger:PSWeep:SOURce   AUTO|IMMediate | SINGle|BUS | EXTernal

The command sets the trigger source for the RF level sweep.

The names of the parameters correspond directly to the various settings under manual control. SCPI uses other names for the parameters; these names are also accepted by the instrument. The SCPI names should be used if compatibility is an important consideration. An overview of the various names is given in the following table:

R&S name	SCPI name	Command under manual control
AUTO	IMMediate	**Auto** mode
SINGle	BUS	**Single** and **Step** mode. The command :SWEep:POW:MODE is used to select between the two sweep modes.
EXTernal	EXTernal	**Ext Single** and **Ext Step** mode. The command :SWEep:POW:MODE is used to select between the two sweep modes.

Parameters: **AUTO | IMMediate**
The trigger is free-running, i.e. the trigger condition is fulfilled continuously. As soon as one sweep is finished, the next sweep is started.

SINGle
The sweep is triggered by the IEC/IEEE-bus commands
:SOURce:SWEep:POWer:EXEC or *TRG or TRIGger:PSWeep:IMMediate.
If :SOURce:SWEep:POWer:MODE is set to STEP, one step is executed. If
:SOURce:SWEep:POWer:MODE is set to AUTO, one complete sweep is executed.

EXTernal
The sweep is triggered externally via the TRIGGER connector or the AUX connector.

Example: TRIG:PSW:SOUR EXT
'selects triggering with an external trigger. The trigger is input via the TRIGGER connector or the AUX connector.

*RST value	Resolution	Options	SCPI
SINGle	-		Device-specific

TRIGger[:SWEep][:IMMediate]

The command starts the sweeps which is activated. The sweep to be executed depends on the respective MODE setting (:SOUR:SWEep:POW|FREQ:MODE and
:SOUR:LFO:SWEep[:FREQ]:MODE). The command corresponds to the manual-control command
Execute Trigger.

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

Example: TRIG
'starts all active sweeps.

*RST value	Resolution	Options	SCPI
-	-		Device-specific

TRIGger:SWEep:SOURce   AUTO|IMMediate | SINGle | EXTernal|BUS

The command sets the trigger source for all sweeps.

The names of the parameters correspond directly to the various settings under manual control. SCPI uses other names for the parameters; these names are also accepted by the instrument. The SCPI names should be used if compatibility is an important consideration.

An overview of the various names is given in the following table:

R&S name	SCPI name	Command under manual control
AUTO	IMMediate	MODE AUTO
SINGle	BUS	MODE SINGLE or STEP
EXTernal	EXTernal	MODE EXT TRIG SINGLE or EXT TRIG STEP

Parameters: **AUTO | IMMediate**
The trigger is free-running, i.e. the trigger condition is fulfilled continuously. As soon as one sweep is finished, the next sweep is started.

SINGle
The sweep is triggered by the IEC/IEEE-bus commands
`:SOURce:SWEep:POWer|FREQuency:EXEC` or `*TRG` or
`TRIGger:PSWeep|FSWeep:IMMediate`. If `:SOURce:SWEep:POWer:MODE` is set to `STEP`, one step is executed. If `:SOURce:SWEep:POWer:MODE` is set to `AUTO`, one complete sweep is executed.

EXTernal
The sweep is triggered externally via the TRIGGER connectors.

Example: `TRIG:SWE:SOUR EXT`
'selects triggering with an external trigger. The trigger is input via the INST TRIG connector.

*RST value	Resolution	Options	SCPI
SINGle	-		Device-specific

UNIT Subsystem

The UNIT subsystem contains the commands specifying which units are valid if no unit is indicated in a command. These settings are valid for the entire instrument.

Command	Parameters	Default unit	Remark
UNIT:ANGLe	DEG | RAD		
UNIT:POWer	V | DBM		

UNIT:ANGle DEG | RAD

The command defines the default unit for angles. It is valid for all commands which determine angle values. It does not influence the manual control parameter unit and the display.

Example: UNIT:ANGL DEG
                    'sets default unit DEG for all commands which determine angle values.

*RST value	Resolution	Options	SCPI
RAD	-		Compliant

UNIT:POWer V | DBM

The command defines the default unit for power. It is valid for all commands which determine power values. It does not influence the manual control parameter unit and the display.

Example: UNIT:POW V
                    'sets default unit V for all commands which determine power values.

*RST value	Resolution	Options	SCPI
DBM	-		Compliant

Contents Chapter 8 - Maintenance and Remote Control Interfaces

8 Maintenance and Remote Control Interfaces

Introduction - Maintenance and Interfaces

The following chapter contains information on the maintenance of the signal generator and a description of the remote control interfaces.

Please follow the instructions in the service manual when exchanging modules or ordering spares. The order no. for spare parts can be found in the service manual.

The address of our support center and a list of all Rohde & Schwarz service centers can be found at the beginning of the printed manual.

The service manual includes further information particularly on troubleshooting, repair and exchange of modules.

Maintenance

The instrument does not need a periodic maintenance. What is necessary is essentially the cleaning of the instrument. However, it is recommended to check the rated data from time to time.

Cleaning the Outside and Storing

The outside of the instrument is suitably cleaned using a soft, line-free dust cloth. Make sure that vents are not obstructed.

> ⚠️ **Caution!**
>
> *Never use solvents such as thinners, acetone and similar things, as they may damage the front panel labeling or plastic parts.*

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

The original packing should be used, particularly the protective covers at the front and rear, when the instrument is to be transported or dispatched. If the original packing is no longer available, use a sturdy cardboard box of suitable size and carefully wrap the instrument to protect it against mechanical damage.

Hardware Interfaces

The following section describes the remote-control interfaces of the signal generator. All other interfaces are described in Chapter 1, sections *"Legend for Front Panel View"* and *"Legend for Rear Panel View"*. For specifications refer to the data sheet.

IEC/IEEE Bus Interface

The standard instrument is equipped with an IEC/IEEE bus connector. An IEEE 488 interface connector is located on the rear panel. An external controller for remote control of the instrument can be connected via the IEEE 488 interface connector using a shielded cable.

Note:
>   *The IEC/IEEE bus interface is available only with option R&S SMF-B83.*

Interface Characteristics

- 8-bit parallel data transfer
- bi-directional data transfer
- three-line handshake
- high data transfer rate
- up to 15 instruments can be connected
- maximal length of the interconnecting cables 15 m (single connection, 2m)
- wired-OR connection if several instruments are connected in parallel.

Figure 8-1   Pin assignment of IEC/IEEE-Bus interface

Bus Lines

1. **Data bus with 8 lines D0 to D7.**
   The transmission is bit-parallel and byte-serial in the ASCII/ISO code. D0 is the least significant bit, D7 the most significant bit.

2. **Control bus with 5 lines**

IFC (Interface Clear)	active LOW resets the interfaces of the instruments connected to the default setting.
ATN (Attention)	active LOW signals the transmission of interface messages.
	inactive HIGH signals the transmission of device messages.
SRQ (Service Request)	active LOW enables the connected device to send a service request to the controller.
REN (Remote Enable)	active LOW permits switchover to remote control.
EOI (End or Identify)	has two functions in connection with ATN:
	ATN = HIGH active LOW marks the end of data transmission.
	ATN = LOW active LOW triggers a parallel poll.

3. **Handshake bus with three lines**

DAV (Data Valid)	active LOW signals a valid data byte on the data bus.
NRFD (Not Ready For Data)	active LOW signals that one of the connected devices is not ready for data transfer.
NDAC (Not Data Accepted)	active LOW signals that the instrument connected is accepting the data on the data bus.

IEC/IEEE-Bus Interface Functions

Instruments which can be remote controlled via the IEC/IEEE bus can be equipped with different interface functions. The following table lists the interface functions appropriate for the instrument.

Table 8-1   IEC/IEEE Bus Interface functions

Control character	Interface function
SH1	Handshake source function (source handshake), full capability
AH1	Handshake sink function (acceptor handshake), full capability
L4	Listener function, full capability, unaddress if MTA.
T6	Talker function, full capability, ability to respond to serial poll, unaddress if MLA
SR1	Service request function (Service Request), full capability
PP1	Parallel poll function, full capability
RL1	Remote/Local switch over function, full capability
DC1	Reset function (Device Clear), full capability
DT1	*Trigger function (Device Trigger), full capability*
C0	*No controller function*

IEC/IEEE Bus Messages

Interface messages are transferred on the data lines of the IEC/IEEE bus when the "ATN" control line is active (LOW). They are used for communication between controller and instruments and can only be sent by the controller which currently has control of the IEC/IEEE bus.

Universal Commands

The universal commands are encoded 10 - 1F hex. They affect all instruments connected to the bus without addressing.

Table 8-2   Universal Commands

Command	VISUAL BASIC command	Effect on the instrument
DCL (Device Clear)	IBCMD (controller%, CHR$(20))	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument settings..
IFC (Interface Clear)	IBSIC (controller%)	Resets the interfaces to the default setting.
LLO (Local Lockout)	IBCMD (controller%, CHR$(17))	Locks switchover from remote control to manual control by means of the front panel keys
SPE (Serial Poll Enable)	IBCMD (controller%, CHR$(24))	Ready for serial poll.
SPD (Serial Poll Disable)	IBCMD (controller%, CHR$(25))	End of serial poll.
PPU (Parallel Poll Unconfigure)	IBCMD (controller%, CHR$(21))	End of the parallel-poll state.

Addressed Commands

The addressed commands are encoded 00 - 0F hex. They are only effective for instruments addressed as listeners.

Table 8-3   Addressed Commands

Command	VISUAL BASIC Command	Effect on the instrument
SDC (Selected Device Clear)	IBCLR (device%)	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument setting.
GET (Group Execute Trigger)	IBTRG (device%)	Triggers a previously active device function (e.g. a sweep). The effect of the command is the same as with that of a pulse at the external trigger signal input.
GTL (Go to Local)	IBLOC (device%)	Transition to the "Local" state (manual control).
PPC (Parallel Poll Configure)	IBPPC (device%, data%)	Configures instrument for parallel poll. Additionally, the VISUAL BASIC command executes PPE/PPD.

LAN Connector

The unit is equipped with an LAN interface as standard. The LAN connector is at the rear of the instrument. Provided the appropriate rights have been assigned by the network administrator, files can be transmitted via the network, and network resources, e.g. a network folders, can be used. The instrument can also be remote-controlled and manually operated in the network. It is connected by means of a commercial RJ45 cable.

The network card functions with 100 MHz Ethernet IEEE 802.3u. 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.

Connection of the Vector Signal Generator is described in Chapter 1, section "*Connection to the Network*", remote control via Ethernet in chapter 5, section "*Remote control via Ethernet* ". The architecture of a LAN remote-control connection is described in detail in the following.

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

Application	SCPI	SCPI [3]
Presentation	XDR (VXI-11)	RFC 1014 [1,2]
Session	ONC-RPC	RFC 1057
Transport	TCP / UDP	RFC 793
Network	IP	RFC 791
Data Link	Ethernet/802.3	8802-3
Physical	802.3/10BASE-T	8802-3

Fig. 8-2   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, 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) and low-level control messages (interface messages).

A VXI-11 link between a controller and an instrument uses three channels: a 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 ("TCP/IP Instrument Protocol Specification VXI-11, Revision 1.0 VMEbus Extensions for Instrumentation, VXIbus", and "TCP/IP-IEEE 488.2 Instrument Interface Specification VXI-11.3, Draft 0.3 VMEbus Extensions for Instrumentation, VXIbus").

Fig. 8-3   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 PC are identified by the instrument as two different controllers.

Fig. 8-4   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.

In the **'Measurement & Automation Control'** program, this setting is made on the **Template** tab.

VXI-11 Interface Messages

On the Ethernet link, the interface messages are called low-level control messages. These messages can be used to emulate interface messages of the IEC/IEEE bus.

Table 8-4   VXI-11 Interface Messages

Command		Effect on the instrument
&ABO	(Abort)	Aborts the processing of the commands just received.
&DCL	(Device Clear)	Aborts the processing of the commands just received and sets the command processing software to a defined initial state. Does not change the instrument setting.
&GTL	(Go to Local)	Transition to the "Local" state (manual control)
&GTR	(Go to Remote)	Transition to the "Remote" state (remote control)
&GET	(Group Execute Trigger)	Triggers a previously active device function (e.g. a sweep). The effect of the command is the same as with that of a pulse at the external trigger signal input.
&LLO	(Local Lockout)	Disables switchover from remote control to manual control by means of the front panel keys
&POL	(Serial Poll)	Starts a serial poll
&NREN	(Not Remote Enable)	Enables switchover from remote control to manual control by means of the front panel keys

USB Connection

The instrument is equipped as standard with two USB (universal serial bus) interfaces of type A (host USB). The host USB interfaces establish a connection to the controller. They can be used for connecting peripherals such as mouse and keyboard or a memory stick for data transmission. The host USBs are located at the front of the instrument.

Optionally, another USB interface type A (host) and a USB interface type B (device, for remote control) are available on the rear panel (option R&S SMF-B84).

Contents - Chapter 9 - "Error Messages"

9 Error Messages

Introduction - Status Information and Messages

This chapter describes the error messages of the signal generator. The error messages are output in the **Info** line on the screen and entered in the error error/event queue of the status reporting system.
A great variety of different messages such as status messages, error messages, warnings or information are displayed in the header field of the screen. Some error messages require that the error must be eliminated before correct instrument operation can be ensured. The info window with a list of current messages and a detailed description of each message can be opened with the INFO key

In the remote control mode, error messages are entered in the error/event queue of the status reporting system and can be queried with the command `SYSTem:ERRor?`. If the error queue is empty, 0 ("No error") is returned.

Status Information

The status messages are displayed in the header section of the screen. The status information gives the user an overview of the main operating states and settings of the signal generator. The states are indicated for information only and do not necessitate any action by the user. Status information is displayed between the frequency and level fields, at the left of the info line or in the info line itself.

Status information displayed between the frequency and level fields:

RF OFF   The RF output is switched off

MOD OFF   All modulations are switched off.

FREQ OFFSET   A frequency offset is set.

                  The frequency entered and displayed in the frequency field takes any set frequency offset into consideration, e.g. an offset set for a downstream instrument. This means that with a frequency offset the frequency displayed in the header does not correspond to the frequency at the RF output, but rather to the frequency at the output of the downstream instrument.

                  This allows the desired frequency at the output of a downstream instrument to be entered in the frequency field. The signal generator changes the RF output frequency according to the entered offset.

                  However, the frequency entered and displayed in the Frequency/Phase menu of the RF/Ana Mod function block always corresponds to the RF output frequency. Any frequency offset is not taken into consideration.

                  The correlation is as follows:

<p align="center">Freq in header = RF output frequency (= Freq in menu) + Freq offset (= Offset in menu)</p>

LEVEL OFFSET   A level offset is set.

The level entered and displayed in the Level field takes the offset of any downstream attenuators/amplifiers into consideration by way of calculation. This means that with a level offset the level displayed in the header does not correspond to the level at the RF output, but rather to the level at the output of the downstream instrument.
This allows the desired level at the output of downstream instruments to be entered. The signal generator changes the RF output level according to the set offset.

However, the level entered and displayed in the **Level** menu of the **RF/Ana Mod** function block always corresponds to the RF output level. Any level offset is not taken into consideration.

The correlation is as follows:

Level in header = RF output level (= Level in menu) + Level offset

EXT REF   An external reference is used.

The external signal with selectable frequency and defined level must be input at the REF IN connector. It is output at the REF OUT connector.

Status information displayed to the left of the Info line:

REMOTE   The instrument is remote controlled.

The LOCAL key switches the instrument from remote control to manual control. The current command must be fully processed before the mode is switched, otherwise the instrument switches immediately back to remote control.

REM LLO   The instrument is remote controlled.

The instrument can be switched from remote control to manual control by means of remote control only (e.g. with the Visual Basic command `CALL IBLOC (generator%)`); the LOCAL key is disabled. The key is disabled by remote control with the command LLO.

Status information displayed in the Info line:

RFSweep   The indicated sweep is enabled.
LevelSweep
LFSweep

ALC On/Auto/S&H   The status of the automatic level control is indicated:

- ON = automatic level control permanently on

- Auto = automatic level control is automatically adapted to the operating states

- S&H = automatic level control off, recalibration of the level whenever the level or frequency is set (sample and hold mode).

ListMode	List mode is active.
	The values of the frequency/level pairs in the selected list are set for the chosen dwell time.
AttFixed	Attenuator fixed mode is active.
	The uninterrupted level settings are made in a fixed range without attenuator switching. The variation range is set automatically when this mode is activated. The range is displayed under **Attenuator Fixed Range** in the **Level** menu.
UCorr	User Correction is active.
	The level is corrected by the given values in the selected user correction list. Correction is performed by the user-defined list values being added to the output level for the respective RF frequency. With frequencies which are not contained in the list, the level correction is determined by interpolation of the closest correction values.
OvenCold	The reference oscillator has not yet reached its nominal frequency.
	When switching on from the STANDBY mode, the specified frequency accuracy is reached immediately. If the power switch was switched off, the reference oscillator needs some warm-up time to reach its nominal frequency. During this period of time, the output frequency does not yet reach its final value either.

Error Messages

Messages indicate errors in the instrument. They are displayed in the info line in different colors depending on their importance and display duration. Errors (e.g. no calibration data) are displayed in red, information (e.g. file not found) and warnings in black. Warnings indicate less significant errors (e.g. the instrument operates outside specified data).

Brief messages
Brief messages report automatic settings in the instrument (e.g. switching off of incompatible types of modulation) or on illegal entries that are not accepted by the instrument (e.g. range violations). They are displayed in the info line on a yellow background. They are displayed on top of status information or permanent messages.
Brief messages do not normally demand user actions and disappear automatically after a brief period of time. They are stored in the history, however.

Permanent messages
Permanent messages are displayed if an error occurs that impairs further instrument operation, e.g. a hardware fault. The error signaled by a permanent message must be eliminated before correct instrument operation can be ensured.
The message is displayed until the error is eliminated. It covers the status display in the info line. After error elimination, the message automatically disappears and is also recorded in the history.

Alphabetical List of SCPI-Error Messages

The following list contains all error messages defined in SCPI in alphabetical order. SCPI error messages are the same in all SCPI instruments. The errors are assigned negative numbers.

The error text being entered into the error/event queue or being displayed is printed in bold face on the left together with the error code. Below the error text, there is an explanation as to the respective error.

Note:
    The index provides a list of the error messages sorted according to their error codes.

Block data not allowed (-168)

>   The command contains legal block data which are not allowed at this point.

>   **Example:**   The command `SOUR:FREQ` requires a numeric parameter - `FREQ #13a`

>   **SCPI:**   Command error - sets bit 5 in the ESR register

Character data not allowed (-148)

>   The character data is prohibited for this command or at this point of the command.

>   **Example:**   Command `SOURce:FREQuency` requires a numeric parameter.

>   **SCPI:**   Command error - sets bit 5 in the ESR register

Character data too long (-144)

>   The character data element contains more than 12 characters.

>   **SCPI:**   Command error - sets bit 5 in the ESR register

Command Error (-100)

>   Generic error message that cannot detect a more specific error.

>   **SCPI:**   Command error - sets bit 5 in the ESR register

Command protected (-203)

>   The desired command could not be executed as it was protected with a password.

>   **Example:**   The command `CAL:FREQ?` might be protected with a password.

>   **Remedy**   Use command `:SYST:PROT1 OFF,123456` to enable the command.

>   **SCPI:**   Execution error - sets bit 4 in the ESR register

Data out of range (-222)

A value of the transmitted command was outside the legal range.

Example:	Command `SOUR:FREQ` only permits entries in the range of min to max frequency.
SCPI:	Execution error - sets bit 4 in the ESR register

Data type error (-104)

The command contains an invalid value indication.

Example:	ON is indicated instead of a numeric value for frequency setting - `:FREQ ON`
SCPI:	Command error - sets bit 5 in the ESR register

Device-specific error (-300)

Device-specific error not defined in greater detail.

SCPI:	Device-specific error - sets bit 3 in the ESR register

Exponent too large (-123)

The magnitude of the exponent is too large.

SCPI:	Command error - sets bit 5 in the ESR register

Expression data not allowed (-178)

The command contains a mathematical expression at an impermissible position.

SCPI:	Command error - sets bit 5 in the ESR register

GET not allowed (-105)

A Group Execute Trigger (GET) is within a command line.

Note:	A Group Execute Trigger (`GET`) is only allowed at the end of a command line or in a separate command line.
SCPI:	Command error - sets bit 5 in the ESR register

Hardware error (-240)

A legal program command or a query could not be executed because of a hardware problem in the device.

SCPI:	Execution error - sets bit 4 in the ESR register

Hardware missing (-241)

A legal program command or a query could not be executed because of a missing device hardware.

Example:	An option is not fitted.
SCPI:	Execution error - sets bit 4 in the ESR register

Header suffix out of range (-114)

The command contains an illegal numeric suffix.

Example:	`:SOURce22` is not defined for the signal generator.
SCPI:	Command error - sets bit 5 in the ESR register

Illegal parameter value (-224)

The parameter value is invalid.

Example:	An invalid text parameter is indicated : `TRIG:SWEep:SOUR TASTe`
SCPI:	Execution error - sets bit 4 in the ESR register

Invalid block data (-161)

The command contains illegal block data.

Example:	An END message was received before the expected number of data had been received or no numeric data element is sent after the introductory #
SCPI:	Command error - sets bit 5 in the ESR register

Invalid Character (-101)

The command contains an invalid sign.

Example:	A header contains an ampersand, `"SOURCE&"`.
SCPI:	Command error - sets bit 5 in the ESR register

Invalid separator (-103)

The command contains an impermissible sign instead of a separator.

Example:	A semicolon is missing after the first command in a command line with several commands - `":FREQ 2MHz POW -25"`.
SCPI:	Command error - sets bit 5 in the ESR register

Invalid suffix (-131)

> The suffix is not appropriate for this command.

> | **Example:** | nHz is not defined. |
> |---|---|
> | **SCPI:** | Command error - sets bit 5 in the ESR register |

Lists not same length (-226)

> The parts of a list have different lengths. This error message is also displayed if only part of a list has been transmitted via IEC bus. All parts of the list have to be transmitted always before it is executed.

> | **Example:** | The POWer list content is longer than the FREQuency list content, or only the POWer content is transmitted. |
> |---|---|
> | **SCPI:** | Execution error - sets bit 4 in the ESR register |

Missing parameter (-109)

> The command does not contain the required parameters.

> | **Example:** | Command `:SOUR:FREQ` requires the indication of a parameter - `":FREQ; POW -35"` |
> |---|---|
> | **SCPI:** | Command error - sets bit 5 in the ESR register |

No error (0)

> This message is output if the error queue does not contain entries.

Numeric data not allowed (-128)

> The command contains a numeric data element the device does not accept in this position.

> | **Example:** | The command `:SOUR:BB:MCCW:SEQ` requires the indication of a text parameter - `SOUR:BB:MCCW:SEQ AUTO`. |
> |---|---|
> | **SCPI:** | Command error - sets bit 5 in the ESR register |

Out of memory (-225)

> The storage space available in the instrument is exhausted.

> | **SCPI:** | Execution error - sets bit 4 in the ESR register |
> |---|---|

Parameter not allowed (-108)

> The command contains too many parameters.

> | **Example:** | Command `SOURce:FM:INTernal:FREQuency` permits only one frequency indication - `":FREQ:CENT 30 kHz, 40 kHz"`. |
> |---|---|
> | **SCPI:** | Command error - sets bit 5 in the ESR register |

Program mnemonic too long (-112)

> The header contains more than 12 characters.
>
> **SCPI:**   Command error - sets bit 5 in the ESR register

Queue overflow (-350)

> This error code is entered into the queue instead of the actual error code if the queue is full. It indicates that an error has occurred but not been recorded in the queue. The original error message is lost.
>
> **Remedy:**   Reading out the error messages e.g. with command `SYSTem:ERRor:ALL?` clears the error queue.
>
> **SCPI:**   Device specific error- sets bit 3 in the ESR register

Query interrupted (-410)

> This query has been interrupted.
>
> **Example**   After a query, the instrument receives new data before the response has been sent completely.
>
> **SCPI:**   Query error - error in data request - sets bit 2 in the ESR register.

Query unterminated (-420)

> This query is missing or incomplete.
>
> **Example**   The instrument is addressed as a talker and receives incomplete data.
>
> **SCPI:**   Query error - error in data request - sets bit 2 in the ESR register.

Query deadlocked (-430)

> This query cannot be processed.
>
> **Example**   The input and output buffers are full, the instrument cannot be operated.
>
> **SCPI:**   Query error - error in data request - sets bit 2 in the ESR register.

Self test failed ... (-330)

> An error was detected in the selftest named after the semicolon. An error-free operation of the module concerned is no longer guaranteed.
>
> **SCPI:**   Device specific error- sets bit 3 in the ESR register

Settings conflict ... (-221)

There is a setting conflict between the two parameters indicated after the semicolon.

Example:	The set FM deviation is too large for the selected RF frequency.
Remedy	One of the given values has to be corrected to obtain a valid output signal.
SCPI:	Execution error - sets bit 4 in the ESR register

String data not allowed (-158)

The command contains a legal string data element which is not allowed at this point.

Example:	A text parameter is set in quotation marks - `SOURce:FREQuency:MODE "FIXed"`.
SCPI:	Command error - sets bit 5 in the ESR register

Suffix not allowed (-138)

A suffix is not allowed for this command or at this point of the command.

Example:	Command *RCL does not permit indicating a suffix.
SCPI:	Command error - sets bit 5 in the ESR register

Suffix too long (-134)

The suffix contains more than 12 characters.

SCPI:	Command error - sets bit 5 in the ESR register

Syntax error (-102)

The command is invalid.

Example:	The command contains block data the instrument does not accept.
SCPI:	Command error - sets bit 5 in the ESR register

System error (-310)

This error message suggests an error within the instrument. Please inform the R&S Service.

SCPI:	Device specific error- sets bit 3 in the ESR register

Too many digits (-124)

The decimal numeric data element contains too many digits.

SCPI:	Command error - sets bit 5 in the ESR register

Too much data (-223)

> More data were sent by the host than the signal generator can handle.

> **SCPI:**   Execution error - sets bit 4 in the ESR register

Undefined header (-113)

> The sent command header has not been defined.

> **Example:**   Header `:*XYZ` is undefined for every instrument.

> **SCPI:**   Command error - sets bit 5 in the ESR register

Alphabetical List of Device-Specific Error Messages

The following list contains all error messages specific of the instrument in alphabetical order. The positive error codes mark the errors specific of the instrument.

The error text being entered into the error/event queue or being displayed is printed in bold face on the left together with the error code. Below the error text, there is an explanation as to the respective error.

Note:
> *The index provides a list of the error messages sorted according to their error codes.*

Adjustment data invalid (183)

Adjustment data are invalid and must be restored.

Remedy:	The adjustment data have to be generated again by an internal or external adjustment or to be loaded into the instrument.
SCPI:	Device-specific error - sets bit 3 in the ESR register

Adjustment data missing (182)

Adjustment data are missing.

Remedy:	The adjustment data have to be generated first by an internal or external adjustment or to be loaded into the instrument.
SCPI:	Device-specific error - sets bit 3 in the ESR register

Adjustment failed (180)

Adjustment could not be executed

Remedy:	The adjustment data have to be generated first by an internal or external adjustment or to be loaded into the device (see section Adjustment).
SCPI:	Device-specific error - sets bit 3 in the ESR register

Cannot access the EEPROM (202)

A error occurs when writing or reading a EEPROM.

Example:	The EEPROM is defect.
SCPI:	Device-specific error - sets bit 3 in the ESR register

Cannot access hardware (200)

The data transmission to a module was unsuccessful.

Example: The module is not installed, not properly installed or missing.

SCPI: Device-specific error - sets bit 3 in the ESR register

Cannot open file (460)

The selected file can not be opened.

Remedy: Check the path and file name.

SCPI: Device-specific error - sets bit 3 in the ESR register

Cannot read file (462)

The file can not be read.

Example: The file contents are not compatible with the file type.

SCPI: Device-specific error - sets bit 3 in the ESR register

Cannot write file (461)

The file can not be written.

Example: The file is read-only.

SCPI: Device-specific error - sets bit 3 in the ESR register

Driver initialization failed (204)

Initialization of a driver fails when booting the instrument firmware

Example: The driver is not compatible with the hardware or software configuration of the instrument.

SCPI: Device-specific error - sets bit 3 in the ESR register

File contains invalid data (465)

The selected file contains data that is not valid for the file type. The file extension determines the data that is valid for this file type. If the file extension is changed the lists are no longer recognized and the data are therefore invalid.

Example: The extension of a waveform file (= *.wv) was changed to *.txt.

SCPI: Device-specific error - sets bit 3 in the ESR register

Filename missing (463)

> The desired operation cannot be execute because the file name is not specified.
>
> **Example:**   A file name has to be entered when creating a new list.
>
> **SCPI:**   Device-specific error - sets bit 3 in the ESR register

Hardware revision out of date (201)

> A later version of certain parts of the instrument is necessary to execute the function selected.
>
> **Example:**   The driver does not support the installed version of a module.
>
> **SCPI:**   Device-specific error - sets bit 3 in the ESR register

Invalid EEPROM data (203)

> Reading a EEPROM is possible, however the data are inconsistent.
>
> **SCPI:**   Device-specific error - sets bit 3 in the ESR register

Invalid filename extension (464)

> The file extension is not valid for the desired operation.
>
> **Example:**   The file extension for list mode files is ***.lsw**. It is not possible to enter another file extension when storing a list.
>
> **SCPI:**   Device-specific error - sets bit 3 in the ESR register

No current list (241)

> There is no list selected. To execute the desired operation a list has to be selected in the related menu. If no list is available, a new list must be created.
>
> **Example:**   The list mode is enable without a list being selected.
>
> **SCPI:**   Device-specific error - sets bit 3 in the ESR register

This modulation forces other modulations off (140)

> A modulation has been switched on which cannot be used at the same time as an already active modulation. The previous modulation has been switched off.
>
> **Example:**   Enabling modulation GSM/EDGE switches any active digital modulation off.
>
> **SCPI:**   Device-specific error - sets bit 3 in the ESR register

Unknown list type specified (242)

The list type selected is not valid for the desired operation

Example: The file extension for list mode files is ***.lsw**. It is not possible to enter another file extension when selecting a list.

SCPI: Device-specific error - sets bit 3 in the ESR register

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