Broadcasting

Quick Start Guide

R&S® SFE100
TEST TRANSMITTER

ROHDE&SCHWARZ

The Quick Start Guide describes the following models of the TEST TRANSMITTER:

- R&S SFE100 2112.4100.02
- R&S SFE100 2112.4100.03
- R&S SFE100 2112.4100.12
- R&S SFE100 2112.4100.13

The firmware of the instrument makes use of several valuable open source software packages. The most important of them are listed below, together with their corresponding open source license. The verbatimlicense texts are provided in the release notes.

Package	**Link**	**License**
OpenSSL	http://www.openssl.org	OpenSSL/SSLeavy
zlib	http://www.zlib.net	zlib, v.1.2.3
Xalan Xerces	http://xalan.apache.org/ http://xerces.apache.org/	Apache Software License, Version 2.0
ONC/RPC	http://www.plt.rwth-aachen.de	SUN
VNC	http://www.realvnc.com/	GPL V3

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

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The following abbreviations are used throughout this manual:
R&S®SFE100 is abbreviated as R&S SFE100.

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Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

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

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

Symbols and safety labels

						
Notice, general danger location Observe product documentation	Caution when handling heavy equipment	Danger of electric shock	Warning! Hot surface	PE terminal	Ground	Ground terminal

						
Be careful when handling electrostatic sensitive devices	ON/OFF supply voltage	Standby indication	Direct current (DC)	Alternating current (AC)	Direct/alternating current (DC/AC)	Device fully protected by double (reinforced) insulation

Tags and their meaning

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

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

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

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

NOTICE indicates the possibility of incorrect operation which can result in damage to the product.
In the product documentation, the word ATTENTION is used synonymously.

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

Operating states and operating positions

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

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

Electrical safety

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

1. Prior to switching on the product, always ensure that the nominal voltage setting on the product matches the nominal voltage of the AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with an earthing contact and protective earth connection.

3. 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.
4. If the product does not have a power switch for disconnection from the AC supply network, the plug of the connecting cable is regarded as the disconnecting device. In such cases, always ensure that the power plug is easily reachable and accessible at all times (corresponding to the length of connecting cable, approx. 2 m). Functional or electronic switches are not suitable for providing disconnection from the AC supply network. If products without power switches are integrated into racks or systems, a disconnecting device must be provided at the system level.
5. Never use the product if the power cable is damaged. Check the power cable on a regular basis to ensure that it is in proper operating condition. By taking appropriate safety measures and carefully laying the power cable, you can ensure that the cable will not be damaged and that no one can be hurt by, for example, tripping over the cable or suffering an electric shock.
6. 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).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages V_{rms} > 30 V, suitable measures (e.g. appropriate measuring equipment, fusing, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.

12. If a product is to be permanently installed, the connection between the 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 licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fused in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1. Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

1. Operating the products requires special training and intense concentration. Make sure that persons who use the products are physically, mentally and emotionally fit enough to do so; otherwise, injuries or material damage may occur. It is the responsibility of the employer/operator to select suitable personnel for operating the products.
2. Before you move or transport the product, read and observe the section titled "Transport".

3. As with all industrially manufactured goods, the use of substances that induce an allergic reaction (allergens) such as nickel cannot be generally excluded. If you develop an allergic reaction (such as a skin rash, frequent sneezing, red eyes or respiratory difficulties) when using a Rohde & Schwarz product, consult a physician immediately to determine the cause and to prevent health problems or stress.
4. Before you start processing the product mechanically and/or thermally, or before you take it apart, be sure to read and pay special attention to the section titled "Waste disposal", item 1.
5. Depending on the function, certain products such as RF radio equipment can produce an elevated level of electromagnetic radiation. Considering that unborn babies require increased protection, pregnant women must be protected by appropriate measures. Persons with pacemakers may also be exposed to risks from electromagnetic radiation. The employer/operator must evaluate workplaces where there is a special risk of exposure to radiation and, if necessary, take measures to avert the potential danger.
6. Should a fire occur, the product may release hazardous substances (gases, fluids, etc.) that can cause health problems. Therefore, suitable measures must be taken, e.g. protective masks and protective clothing must be worn.
7. If a laser product (e.g. a CD/DVD drive) is integrated into a Rohde & Schwarz product, absolutely no other settings or functions may be used as described in the product documentation. The objective is to prevent personal injury (e.g. due to laser beams).

Repair and service

1. The product may be opened only by authorized, specially trained personnel. Before any work is performed on the product or before the product is opened, it must be disconnected from the AC supply network. Otherwise, personnel will be exposed to the risk of an electric shock.
2. Adjustments, replacement of parts, maintenance and repair may be performed only by electrical experts authorized by Rohde & Schwarz. Only original parts may be used for replacing parts relevant to safety (e.g. power switches, power transformers, fuses). A safety test must always be performed after parts relevant to safety have been replaced (visual inspection, PE conductor test, insulation resistance measurement, leakage current measurement, functional test). This helps ensure the continued safety of the product.

Batteries and rechargeable batteries/cells

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

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

Transport

1. The product may be very heavy. Therefore, the product must be handled with care. In some cases, the user may require a suitable means of lifting or moving the product (e.g. with a lift-truck) to avoid back or other physical injuries.

2. Handles on the products are designed exclusively to enable personnel to transport the product. It is therefore not permissible to use handles to fasten the product to or on transport equipment such as cranes, fork lifts, wagons, etc. The user is responsible for securely fastening the products to or on the means of transport or lifting. Observe the safety regulations of the manufacturer of the means of transport or lifting. Noncompliance can result in personal injury or material damage.
3. If you use the product in a vehicle, it is the sole responsibility of the driver to drive the vehicle safely and properly. The manufacturer assumes no responsibility for accidents or collisions. Never use the product in a moving vehicle if doing so could distract the driver of the vehicle. Adequately secure the product in the vehicle to prevent injuries or other damage in the event of an accident.

Waste disposal

1. If products or their components are mechanically and/or thermally processed in a manner that goes beyond their intended use, hazardous substances (heavy-metal dust such as lead, beryllium, nickel) may be released. For this reason, the product may only be disassembled by specially trained personnel. Improper disassembly may be hazardous to your health. National waste disposal regulations must be observed.
2. If handling the product releases hazardous substances or fuels that must be disposed of in a special way, e.g. coolants or engine oils that must be replenished regularly, the safety instructions of the manufacturer of the hazardous substances or fuels and the applicable regional waste disposal regulations must be observed. Also observe the relevant safety instructions in the product documentation. The improper disposal of hazardous substances or fuels can cause health problems and lead to environmental damage.

Informaciones elementales de seguridad

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

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

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

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

Informaciones elementales de seguridad

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

Símbolos y definiciones de seguridad

						
Aviso: punto de peligro general Observar la documentación del producto	Atención en el manejo de dispositivos de peso elevado	Peligro de choque eléctrico	Adver-tencia: superficie caliente	Conexión a conductor de protección	Conexión a tierra	Conexión a masa

						
Aviso: Cuidado en el manejo de dispositivos sensibles a la electrostática (ESD)	Tensión de alimentación de PUESTA EN MARCHA / PARADA	Indicación de estado de espera (Standby)	Corriente continua (DC)	Corriente alterna (AC)	Corriente continua / Corriente alterna (DC/AC)	El aparato está protegido en su totalidad por un aislamiento doble (reforzado)

Palabras de señal y su significado

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

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

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

Estados operativos y posiciones de funcionamiento

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

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

Seguridad eléctrica

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

1. Antes de la puesta en marcha del producto se deberá comprobar siempre que la tensión preseleccionada en el producto coincida con la de la red de alimentación eléctrica. Si es necesario modificar el ajuste de tensión, también se deberán cambiar en caso dado los fusibles correspondientes del producto.
2. Los productos de la clase de protección I con alimentación móvil y enchufe individual solamente podrán enchufarse a tomas de corriente con contacto de seguridad y con conductor de protección conectado.
3. Queda prohibida la interrupción intencionada del conductor de protección, tanto en la toma de corriente como en el mismo producto. La interrupción puede tener como consecuencia el riesgo de que el producto sea fuente de choques eléctricos. Si se utilizan cables alargadores o regletas de enchufe, deberá garantizarse la realización de un examen regular de los mismos en cuanto a su estado técnico de seguridad.

4. Si el producto no está equipado con un interruptor para desconectarlo de la red, se deberá considerar el enchufe del cable de conexión como interruptor. En estos casos se deberá asegurar que el enchufe siempre sea de fácil acceso (de acuerdo con la longitud del cable de conexión, aproximadamente 2 m). Los interruptores de función o electrónicos no son aptos para el corte de la red eléctrica. Si los productos sin interruptor están integrados en bastidores o instalaciones, se deberá colocar el interruptor en el nivel de la instalación.
5. No utilice nunca el producto si está dañado el cable de conexión a red. Compruebe regularmente el correcto estado de los cables de conexión a red. Asegúrese, mediante las medidas de protección y de instalación adecuadas, de que el cable de conexión a red no pueda ser dañado o de que nadie pueda ser dañado por él, p. ej. al tropezar o por un choque eléctrico.
6. Solamente está permitido el funcionamiento en redes de alimentación TN/TT aseguradas con fusibles de 16 A como máximo (utilización de fusibles de mayor amperaje solo previa consulta con el grupo de empresas Rohde & Schwarz).
7. Nunca conecte el enchufe en tomas de corriente sucias o llenas de polvo. Introduzca el enchufe por completo y fuertemente en la toma de corriente. La no observación de estas medidas puede provocar chispas, fuego y/o lesiones.
8. No sobrecargue las tomas de corriente, los cables alargadores o las regletas de enchufe ya que esto podría causar fuego o choques eléctricos.
9. En las mediciones en circuitos de corriente con una tensión U_{eff} > 30 V se deberán tomar las medidas apropiadas para impedir cualquier peligro (p. ej. medios de medición adecuados, seguros, limitación de tensión, corte protector, aislamiento etc.).
10. Para la conexión con dispositivos informáticos como un PC o un ordenador industrial, debe comprobarse que éstos cumplan los estándares IEC60950-1/EN60950-1 o IEC61010-1/EN 61010-1 válidos en cada caso.
11. A menos que esté permitido expresamente, no retire nunca la tapa ni componentes de la carcasa mientras el producto esté en servicio. Esto pone a descubierto los cables y componentes eléctricos y puede causar lesiones, fuego o daños en el producto.
12. Si un producto se instala en un lugar fijo, se deberá primero conectar el conductor de protección fijo con el conductor de protección del producto antes de hacer cualquier otra conexión. La instalación y la conexión deberán ser efectuadas por un electricista especializado.

13. En el caso de dispositivos fijos que no estén provistos de fusibles, interruptor automático ni otros mecanismos de seguridad similares, el circuito de alimentación debe estar protegido de modo que todas las personas que puedan acceder al producto, así como el producto mismo, estén a salvo de posibles daños.
14. Todo producto debe estar protegido contra sobretensión (debida p. ej. a una caída del rayo) mediante los correspondientes sistemas de protección. Si no, el personal que lo utilice quedará expuesto al peligro de choque eléctrico.
15. No debe introducirse en los orificios de la caja del aparato ningún objeto que no esté destinado a ello. Esto puede producir cortocircuitos en el producto y/o puede causar choques eléctricos, fuego o lesiones.
16. Salvo indicación contraria, los productos no están impermeabilizados (ver también el capítulo "Estados operativos y posiciones de funcionamiento", punto 1). Por eso es necesario tomar las medidas necesarias para evitar la entrada de líquidos. En caso contrario, existe peligro de choque eléctrico para el usuario o de daños en el producto, que también pueden redundar en peligro para las personas.
17. No utilice el producto en condiciones en las que pueda producirse o ya se hayan producido condensaciones sobre el producto o en el interior de éste, como p. ej. al desplazarlo de un lugar frío a otro caliente. La entrada de agua aumenta el riesgo de choque eléctrico.
18. Antes de la limpieza, desconecte por completo el producto de la alimentación de tensión (p. ej. red de alimentación o batería). Realice la limpieza de los aparatos con un paño suave, que no se deshilache. No utilice bajo ningún concepto productos de limpieza químicos como alcohol, acetona o diluyentes para lacas nitrocelulósicas.

Funcionamiento

1. El uso del producto requiere instrucciones especiales y una alta concentración durante el manejo. Debe asegurarse que las personas que manejen el producto estén a la altura de los requerimientos necesarios en cuanto a aptitudes físicas, psíquicas y emocionales, ya que de otra manera no se pueden excluir lesiones o daños de objetos. El empresario u operador es responsable de seleccionar el personal usuario apto para el manejo del producto.
2. Antes de desplazar o transportar el producto, lea y tenga en cuenta el capítulo "Transporte".

3. Como con todo producto de fabricación industrial no puede quedar excluida en general la posibilidad de que se produzcan alergias provocadas por algunos materiales empleados, los llamados alérgenos (p. ej. el níquel). Si durante el manejo de productos Rohde & Schwarz se producen reacciones alérgicas, como p. ej. irritaciones cutáneas, estornudos continuos, enrojecimiento de la conjuntiva o dificultades respiratorias, debe avisarse inmediatamente a un médico para investigar las causas y evitar cualquier molestia o daño a la salud.
4. Antes de la manipulación mecánica y/o térmica o el desmontaje del producto, debe tenerse en cuenta imprescindiblemente el capítulo "Eliminación", punto 1.
5. Ciertos productos, como p. ej. las instalaciones de radiocomunicación RF, pueden a causa de su función natural, emitir una radiación electromagnética aumentada. Deben tomarse todas las medidas necesarias para la protección de las mujeres embarazadas. También las personas con marcapasos pueden correr peligro a causa de la radiación electromagnética. El empresario/operador tiene la obligación de evaluar y señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. En caso de que un producto Rohde & Schwarz contenga un producto láser (p. ej. un lector de CD/DVD), no debe usarse ninguna otra configuración o función aparte de las descritas en la documentación del producto, a fin de evitar lesiones (p. ej. debidas a irradiación láser).

Reparación y mantenimiento

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

control del conductor de protección, medición de resistencia de aislamiento, medición de la corriente de fuga, control de funcionamiento). Con esto queda garantizada la seguridad del producto.

Baterías y acumuladores o celdas

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

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

Transporte

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

Eliminación

1. Si se trabaja de manera mecánica y/o térmica cualquier producto o componente más allá del funcionamiento previsto, pueden liberarse sustancias peligrosas (polvos con contenido de metales pesados como p. ej. plomo, berilio o níquel). Por eso el producto solo debe ser desmontado por personal especializado con formación adecuada. Un desmontaje inadecuado puede ocasionar daños para la salud. Se deben tener en cuenta las directivas nacionales referentes a la eliminación de residuos.
2. En caso de que durante el trato del producto se formen sustancias peligrosas o combustibles que deban tratarse como residuos especiales (p. ej. refrigerantes o aceites de motor con intervalos de cambio definidos), deben tenerse en cuenta las indicaciones de seguridad del fabricante de dichas sustancias y las normas regionales de eliminación de residuos. Tenga en cuenta también en caso necesario las indicaciones de seguridad especiales contenidas en la documentación del producto. La eliminación incorrecta de sustancias peligrosas o combustibles puede causar daños a la salud o daños al medio ambiente.

Safety Instructions for Instruments with Fold-Out Feet

⚠ WARNING

Danger of injury

The feet may fold in if they are not folded out completely or if the instrument is shifted. The feet may break if they are overloaded.

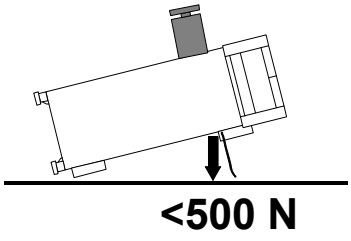
Fold the feet completely in or completely out to ensure stability of the instrument and personal safety.

To avoid injuries, never shift the instrument when its feet are folded out.

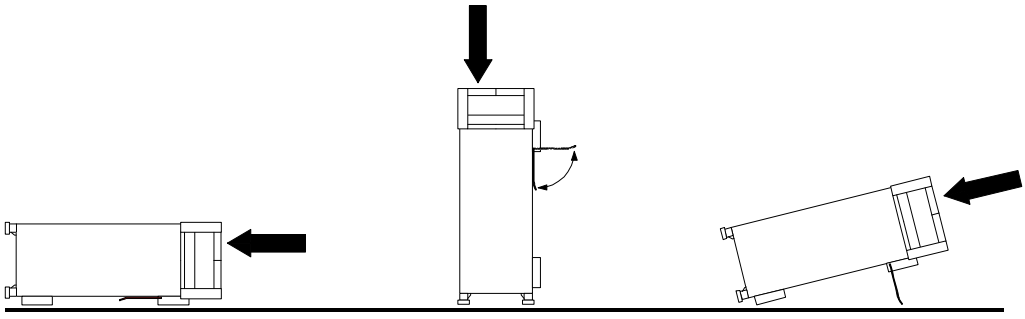
The overall load (the instrument's own weight plus that of the instruments stacked on top of it) on the folded-out feet must not exceed 500 N.

Place the instrument on a stable surface. Secure the instruments stacked on top of it against slipping (e.g. by locking their feet on the top front frame).

When the instrument is standing on its folded-out feet, do not work under the instrument and do not put anything under it, otherwise injuries or material damage could occur.



The instrument can be used in each of the positions shown here.



Informaciones de seguridad para aparatos con telepiés

⚠ ADVERTENCIA

Peligro de heridas

Los telepiés pueden doblarse hacia adentro si no han sido desdoblados por completo o si el aparato es movido. Los telepiés pueden romperse si son sobrecargados.

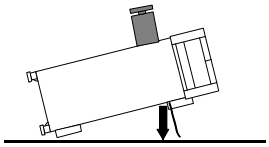
Doblar los telepiés por completo hacia afuera o hacia adentro. De esta manera se puede asegurar la estabilidad del aparato y a la vez la seguridad de las personas.

No mover nunca el aparato con los telepiés desdoblados, para evitar heridas.

El peso total equilibrado (peso própio más el de los aparatos posicionados sobre este) ejercido sobre los telepiés no deberá exceder a los 500 N.

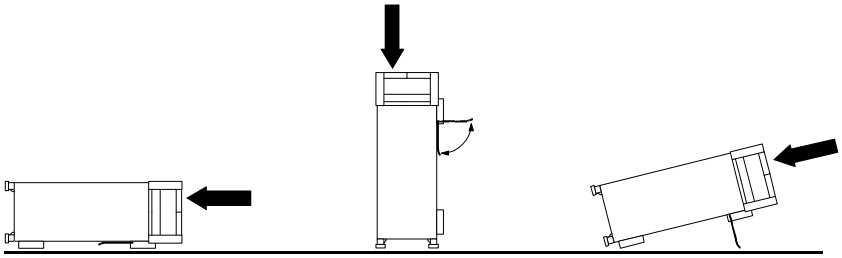
Posicionar el aparato sobre una superficie estable. Los aparatos puestos encima de esté deben estar asegurados para que no resbalen (por ejemplo fijando los piés del aparato en el listón del marco de delante arriba).

Por favor no manipulen debajo del aparato y no pongan nada debajo de este cuando esté posicionado sobre los telepiés desdoblados, ya que si no pueden originarse heridas o daños en objetos.



<500 N

El aparato puede ser puesto en funcionamiento en cualquiera de las posiciones aquí descritas.



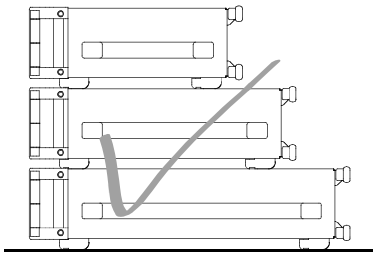
Safety Instructions for Stacking Instruments

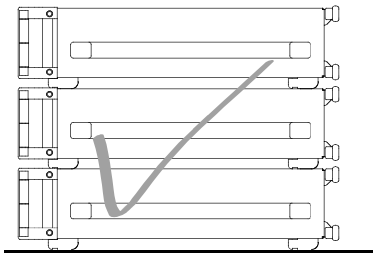
⚠ WARNING

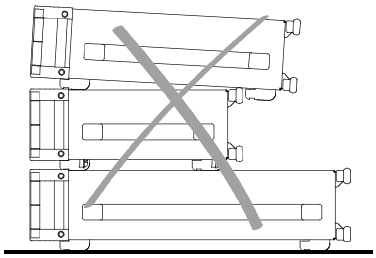
Danger of injury

Instruments may slip if they are stacked on top of each other.

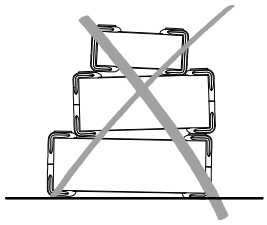
Place the instrument on a stable, even surface. Stack the instruments according to their size, with the largest instrument on the bottom. Do not stack more than three in-struments directly on top of each other. Instruments may only be stacked if their feet and housing allow horizontal stacking. If these conditions are not met, the instru-ments must be installed in a rack in order to avoid the risk of personal injury and material damage.



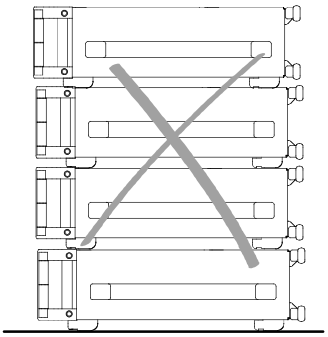




Incorrect order



Incompatible feet



Too many instruments stacked

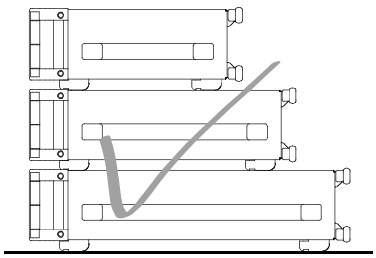
Informaciones de seguridad para el amontonamiento de aparatos

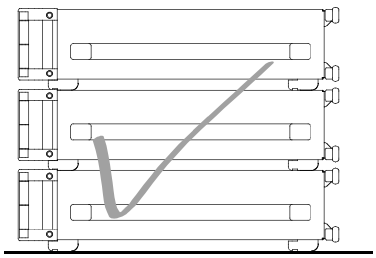
⚠ ADVERTENCIA

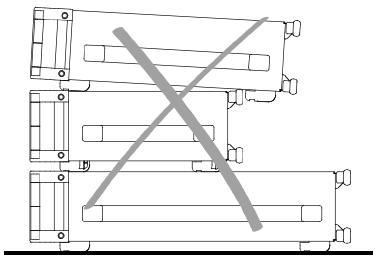
Peligro de heridas

Los aparatos pueden desplazarse al ser amontonados.

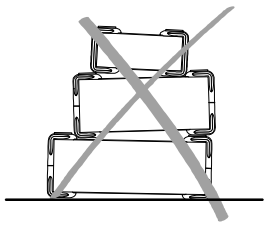
Posicionar los aparatos sobre una superficie estable y lisa. Amontonar los aparatos por orden de su tamaño. No amontonar nunca más de tres aparatos uno sobre el otro. Los aparatos solamente deberán ser amontonados, si los piés y la caja del aparato correspondiente hacen posible amontonarlos de forma horizontal. Si no se cumplen estas condiciones, deberán ser montados los aparatos en una caja apta para este propósito. De esta manera evitarán el riesgo de daños en personas y daños en el aparato.



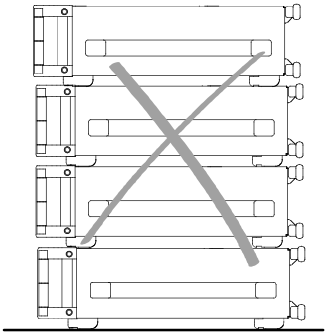




orden no permitido



piés incompatibles

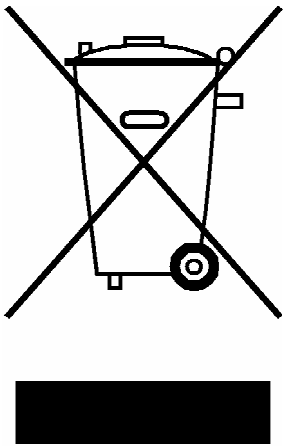


demasiados aparatos amontonados

Customer Information Regarding Product Disposal

The German Electrical and Electronic Equipment (ElektroG) Act is an implementation of the following EC directives:

- 2002/96/EC on waste electrical and electronic equipment (WEEE) and
- 2002/95/EC on the restriction of the use of certain hazardous substances in electrical and electronic equipment (RoHS).



Product labeling in accordance with EN 50419

Once the lifetime of a product has ended, this product must not be disposed of in the standard domestic refuse. Even disposal via the municipal collection points for waste electrical and electronic equipment is not permitted.

Rohde & Schwarz GmbH & Co. KG has developed a disposal concept for the environmental-friendly disposal or recycling of waste material and fully assumes its obligation as a producer to take back and dispose of electrical and electronic waste in accordance with the ElektroG Act.

Please contact your local service representative to dispose of the product.

ROHDE&SCHWARZ

Customer Support

Technical support – where and when you need it

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

Up-to-date information and upgrades

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

USA & Canada	Monday to Friday 8:00 AM – 8:00 PM	(except US public holidays) Eastern Standard Time (EST)
	Tel. from USA From outside USA Fax	888-test-rsa (888-837-8772) (opt 2) +1 410 910 7800 (opt 2) +1 410 910 7801
	E-mail	CustomerSupport@rohde-schwarz.com
East Asia	Monday to Friday 8:30 AM – 6:00 PM	(except Singaporean public holidays) Singapore Time (SGT)
	Tel. Fax	+65 6 513 0488 +65 6 846 1090
	E-mail	CustomerSupport@rohde-schwarz.com
Rest of the World	Monday to Friday 08:00 – 17:00	(except German public holidays) Central European Time (CET)
	Tel. Fax	+49 89 4129 13774 +49 (0) 89 41 29 637 78
	E-mail	CustomerSupport@rohde-schwarz.com

ROHDE&SCHWARZ

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Qualitätszertifikat
Certificate of quality
Certificat de qualité

Certified Quality System
ISO 9001

Certified Environmental System
ISO 14001

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

Der Umwelt verpflichtet
- Energie-effiziente, RoHS-konforme Produkte
- Kontinuierliche Weiterentwicklung nachhaltiger Umweltkonzepte
- ISO 14001-zertifiziertes Umweltmanagementsystem

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

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

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

Engagement écologique
- Produits à efficience énergétique
- Amélioration continue de la durabilité environnementale
- Système de gestion de l'environnement certifié selon ISO 14001

75 Years of Driving Innovation

ROHDE&SCHWARZ

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ROHDE&SCHWARZ

CE Declaration of Conformity

CE

Certificate No.: 2007-75

This is to certify that:

Gerätetyp	Materialnummer	Benennung
SFE100	2112.4100.02/.03/.12/.13	Test Transmitter DTV
SFE100-B3	2112.4400.02	Memory Extension
SFE100-B6	2112.4539.02	Second Hard Disk
SFE100-B90	2112.4900.02	High Power Amplifier

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 (2006/95/EC)
- relating to electromagnetic compatibility (2004/108/EC)

Conformity is proven by compliance with the following standards:

EN 61010-1: 2001
EN 61326-1: 2006
EN 61326-2-1:2006
EN 55011:2007 + A2:2007
EN 61000-3-2:2006
EN 61000-3-3:1995 + A1:2001 + A2:2005

For the assessment of electromagnetic compatibility, the limits of radio interference for Class B (A) equipment as well as the immunity to interference for operation in industry (outside industry) have been used as a basis.

The product complies with the requirements of the Directive relating to the radio interference of vehicles (72/245/EEC adapted by 2004/104/EC, 2005/49/EC, 2005/83/EC, 2006/28/EC, after-market equipment in accordance with Annex I, paragraph 3.2.9 of the Directive); proof of compliance provided by the measurements as described in Annex I, paragraphs 6.5, 6.6, 6.8, 6.9.

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

Munich, 2010-01-12 Central Quality Management MF-QZ / Radde

0 Documentation Overview

Quick Start Guide

The printed Quick Start Guide is delivered with the R&S SFE. On CD-ROM, the Quick Start Guide is provided in the PDF format. It contains the following information:

- Chapter 1
  This chapter describes the instrument's controls and the connectors using front- and rear-panel views. How to prepare the instrument for operation is also described. The procedure for connecting external devices such as a printer, keyboard, mouse, and monitor is also explained. Specifications for the interfaces are contained in the data sheet.
- Chapter 2
  Provides an overview of the instrument's functions and operating concept.
- Chapter 3
  Provides a much more detailed description of how to operate the instrument and includes an overview of the menus.

Operating Manual

The Operating Manual is provided on the CD-ROM in PDF format. It contains the following information:

- Chapter 4
  Explains the instrument's individual menus and functions.
- Chapter 5
  Describes the basic principles of remote control.
- Chapter 6
  Describes how to use the remote control commands.
- Chapter 7
  Describes the instrument's interfaces.
- Chapter 8
  Describes how to maintain the instrument.
- Chapter 9
  Contains an overview of the error messages that the instrument may produce.

Online Help

The Online Help is available on the R&S SFE and on the CD-ROM. It includes all information provided by the Quick Start Guide and the Operating Manual.

On the R&S SFE, the Online Help is context-sensitive and is called by means of the HELP hardkey. For detailed information refer to the Quick Start Guide or the Online Help.

CD-ROM

The CD-ROM is delivered with the instrument. It provides safety information, the manuals in PDF format and the Online Help in CHM format.

1 Putting the Instrument into Operation

1.1 Explanation of the Front Panel

This section provides an overview of the controls and connectors on the instrument's front panel. Each control or connector is briefly described along with a reference to the chapter(s) containing detailed information about its usage.

Figure 1-1 Explanation of the front panel

Keys (models 02 and 03 only)

OK

- Calls up the next menu level
- Activates editing mode for the marked numeric and alphanumeric parameters
- Data entry is completed and the new value is accepted. For numeric parameters, the unit is displayed in the menu next to the value.
- Switches the marked status parameters on/off (State On/Off)
- Confirms (OK) and closes message windows (see Chapter 3)

Cursor keys

- Change the input value or mark the selection in a list in editing mode.
- Mark the parameters in the menus and in the tables (up/down).

- Move the cursor in the input fields in editing mode.
- Mark the parameters in the menus and in the tables (left/right).

(see Chapter 3)

BACK

- Deletes the character to the left of the cursor.
- Used to navigate back in the TREE.

RF ON/OFF

Switches the RF output ON and OFF.

LOCAL

Switches from remote control or remote operation (e.g. using Remote Desktop) to manual operation (using the pront panel).

Interfaces and Connectors on the Front Panel

For information on the pin assignment of interfaces and connectors refer to the Operating Manual, Chapter 7.

USB

USB interfaces (USB = universal serial bus) type A (host USB).

- Connection of external devices such as a mouse, keyboard, printer
- Connection of the memory stick for transferring files
- Firmware update

Another USB interface type A (host USB) is available on the rear panel. (see Chapter 7)

RF OUT

50 Ω BNC output for the RF signal.

NOTICE

Do not overload the RF outputs.

See the data sheet for the maximum permissible reverse power.

1.2 Explanation of the Rear Panel

This section provides an overview of the connectors on the instrument's rear panel. Each connector is briefly described along with a reference to the chapter(s) containing detailed information about its usage. Specifications for the connectors are contained in the data sheet. Information on the pin assignment of interfaces and connectors is provided in the Operating Manual, Chapter 7.

Figure 1-2 Rear-panel view

AC power connector

The instrument is equipped with AC voltage detection. The instrument will automatically set itself to the AC voltage it detects (range: see the type label). No external switching or modification of the fuses is necessary.

AC power switch

The AC power switch is located on the right of the AC power connector.

AC power fuse

See Section "AC Power Fuses" and the data sheet.

TS1 IN / TS2 IN

TS1 IN and TS2 IN are used to feed in a serial MPEG-2 transport stream.

With T-DMB / DAB model, TS2 IN is used as an external ETI input (ETI: ensemble transport interface).

VIDEO IN

Video input for the ATV transmission standards

Multipurpose input

- Audio IN
- BTSC IN
- NICAM IN
- REF FREQ OUT / Trigger OUT

MONITOR

HDMI interface to connect an external monitor. For further details refer to "Displaying the Screen on an External Monitor".

100 BASE-T

LAN interface

DIG I/Q IN

Input for the digital I/Q signal (R&S SFE100-K80 option)

USB

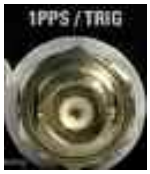
USB interfaces (USB = Universal Serial Bus) type A (host USB).

- Connection of external devices such as a mouse, keyboard, printer
- Connection of the memory stick for transferring files

Further USB interfaces type A (host USB) are located on the front panel of the instrument.

REF FREQ IN

Input for external reference signal



1PPS / TRIG

Input for the 1 pulse per second signal used in SFN modes.

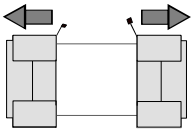
Input for external triggering of digital modulations standards and ARB.

1.3 Preparing for Operation

The following section describes how to prepare the instrument for operation and how to connect external devices. Please observe the general safety instructions for operating the instrument.

For information on installing options and updating the software, refer to the operating manual.

1.3.1 Unpacking the Instrument



Remove protective covers

- After unpacking the instrument, check the supplied equipment against the delivery note and the lists of accessories to make sure that all items are present.
- Remove the two protective covers at the front and the rear of the test transmitter and carefully check the instrument for possible damage.
- Should there be any damage, please inform the carrier immediately. Keep the packaging material to support your claim.
- The original packaging is also useful for transporting or shipping the test transmitter later on. Keep at least the two protective covers for the front and rear panel to prevent the controls and connectors from being damaged if the instrument is transported at a later date.

1.3.2 Standalone Operation or Installation in a 19" Rack

The instrument is designed for interior use only. You can set it up as a standalone device or install it in a 19" rack.

To install it in a 19" rack, you must use a rack mounting adapter (see data sheet for order number). Instructions are included with the adapter.

1.3.3 Safety Instructions

1.3.3.1 General Safety Instructions

NOTICE

Any noncompliance with these instructions can damage the instrument.

Prior to putting the instrument into operation, check the following:

- The instrument cover is in place and screwed on.
- Vent holes are not obstructed, and air flow is not blocked on the rear panel and the lateral vent. The spacing from the wall should 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.
  In particular, please heed the maximum permissible reverse power allowed on the RF outputs (see data sheet).
- The instrument may be operated only in a horizontal position, and the surface on which it is placed must be level.
- The ambient temperature must be in the range specified in the data sheet.

1.3.3.2 Protective Measures against Electrostatic Discharge

NOTICE

Damage to the equipment under test due to electrostatic discharge

In order to avoid damage to the electronic components of the equipment under test (EUT) due to electrostatic discharge when touched, we recommend that you use the appropriate protective equipment.

1.3.3.3 Positioning the Instrument

WARNING

Risk of injuries

Before positioning the instrument, read the safety instructions for instruments with fold-out feet at the beginning of this manual and respectively on the CD-ROM carefully.

1.3.3.4 EMC Safety Precautions

NOTICE

Prevent electromagnetic interference.

To prevent electromagnetic interference, the instrument must be operated only when closed and with all shielding covers fitted. Only suitable and shielded signal and control cables may be used.

- This applies particularly to cables which are connected to the RF/ASI/TRIGGER inputs and outputs. Regardless of the data rate and the packet timing of the transport stream, high signal levels can occur at individual points in the signal spectrum. To avoid EMC problems, the cables should have at least 80 dB shielding protection up to 1 GHz. This generally requires the use of cables with double shielding.
- When connecting the USB interfaces, use only peripheral equipment that does not exceed the specified limits.
- When wiring the LAN interface (100 BASE-T), make sure that a suitable cable (e.g. Category 6) is used.

1.3.4 Connecting the Instrument to AC Power

The instrument is equipped with AC voltage detection. The instrument will automatically set itself to the AC voltage it detects (see rear). No external switching or modification of the fuses is necessary. The AC power connector is at the rear of the instrument.

1.3.5 Switching On the Instrument

- Use the supplied AC power cable to connect the instrument to the AC power supply.

  Since the instrument complies with safety class EN61010-1, it should only be connected to a socket with a ground contact.
- Set the AC switch on the rear of the instrument to the **I** position.

1.3.6 AC Power Fuses

Before changing the fuses, switch off the instrument and disconnect it from the power supply.

The instrument is equipped with two fuses of type F1/F2: IEC127-T2.0H/250 V. The fuses are located under the AC power switch on the rear panel of the instrument.

Changing the fuses:

- Open the cover on the fuse box and remove the fuse holder.
- Replace defective fuses and put the fuse holder back into place.
- Close the fuse box cover.

1.3.7 Startup Screen and Booting the Instrument

Once the instrument has powered up, the installed BIOS will boot.

Then, the Windows XP Embedded operating system will be booted, followed by the instrument firmware. During the boot-up procedure, the instrument firmware is subjected to a self-test. Once the boot-up procedure is complete, the main screen of the test transmitter will appear and the instrument can be operated. The settings that were active before the instrument was last switched off are used unless another instrument setting has been selected in the FILE menu.

1.3.8 Switching Off the Instrument

♦ Set the AC switch on the rear of the instrument to the **O** position. None of the LEDs on the front panel should be lit.

Note:

If you set the power switch to the O position before the instrument settings have been saved, the current settings will be lost.

1.3.9 Functional Check

The test transmitter automatically monitors the main instrument functions during power-up and continuously during operation.

If an error is detected, an “ERROR” indication will appear in the error/warnings line of the display along with a brief description of the error.

To obtain more information about the error, press the ERROR/WARNING DETAILS softkey. A description of the error(s) will be shown in the display (see Chapter 9, Error Messages).

Besides automatic monitoring of instrument functions, the instrument also offers other ways of ensuring proper operation of the test transmitter:

System error correction (“internal adjustment”)
Internal adjustment can be carried out in the Setup Adjustments menu. This is used to obtain the best possible modulator performance, for example.

Self checks
Self checks can be configured if necessary.

Test points
You can also query certain internal measurement points and display the results. See Chapter 4

1.3.10 Presets

Press the **PRESET button** to set the instrument to a defined state.

RF frequency	1 GHz
RF level	−10 dBm
Reference frequency	Internal, adjustment off
Modulation	First available real-time modulation starting with K1, K2,…
Attenuator mode	AUTO
IP address	Unchanged

PRESET sets all parameters and switching states to specific values (even for operating modes that are not currently enabled).

The presettings for the remote command ***RST** are as follows:

RF frequency	1 GHz
RF level	−99 dBm
Reference frequency	Internal, adjustment off
Modulation	OFF
Attenuator mode	AUTO
IP address	Unchanged

1.3.11 Connecting an External Keyboard

The instrument allows you to connect a standard external keyboard with a USB interface. A keyboard will make it easier to enter numbers, file names, etc.

The keyboard is connected to one of the USB interfaces (type A) on the instrument's front or rear panel.

The keyboard should be automatically detected once you connect it. The default language setting is for a UK keyboard. You can change the language and modify other settings such as the repetition rate in Windows XP under **Start → Control Panel → Keyboard** or **Regional and Language Options**. Access this menu by pressing the Windows key on an external keyboard.

1.3.12 Connecting a Mouse

The instrument allows you to connect a standard mouse with a USB interface.

The mouse is connected to one of the USB interfaces on the instrument's front or rear panel.

The mouse should be automatically detected once you connect it. Certain settings such as the speed of the mouse cursor can be modified in the Windows XP menu **Start → Control Panel → Mouse**. Access this menu by pressing the Windows key on an external keyboard.

1.3.13 Displaying the Screen on an External Monitor

Instruments with the following serial numbers have a HDMI interface to connect an external monitor with a DVI-D interface:

- R&S SFE100 model 02 from serial number 120600
- R&S SFE100 model 03 from serial number 130600
- R&S SFE100 model 12 from serial number 140000

To connect the monitor, use a HDMI to DVI adapter or a HDMI to DVI cable.

If you have used the R&S SFE100 without monitor before, activate the HDMI interface by pressing the CTRL+ALT+F4 key combination, several times if necessary.

For instruments without HDMI interface, it is possible to display the screen on external monitors by launching remote operation on an external computer (using the "Remote Desktop Connection" Windows program).

1.4 Notes on the Operating System and Firmware Update

1.4.1 Installing the Software

NOTICE

- Only software authorized by Rohde & Schwarz for use in the instrument may be installed. In case of doubt, please contact your local Rohde & Schwarz representative.
- Changes to the system are only permissible in agreement with Rohde & Schwarz.
- Updating the operating system, e.g. installing a service pack, is not allowed without permission.

Otherwise, the stability and performance of the system may be impaired. Rohde & Schwarz shall not assume any liability for faults caused by impermissible manipulations of the system.

1.4.2 Windows XP Embedded

NOTICE

The drivers and programs that are used with Windows XP have been modified to suit the broadcast tester. To avoid disrupting the operation of the instrument, do not change any settings unless they are mentioned in the following section. The existing software may be modified only by using update software approved by Rohde & Schwarz. Likewise, only run programs on the instrument that have been approved by Rohde & Schwarz for such purposes.

The broadcast tester is equipped with the Windows XP Embedded operating system. When the instrument is delivered, the configuration of this operating system has been set to permit the optimum operation of the broadcast tester and test transmitter. Changes to the system settings are required only if you install peripherals such as a keyboard

and printer or if you configure the network and the settings do not conform to the default settings (see the following sections).
When you power on the broadcast tester or the test transmitter, the operating system will boot up and then automatically start the instrument firmware without asking for a password (“autologin”).

Note:

Auto login uses the user name and the password “Instrument”. This standard user has administrator rights so that it is possible to install printers and networks.

Access to the operating system requires the connection of an external keyboard. Use the Windows key on the external keyboard (next to the CTRL key) to open the Windows XP start menu so that you can run Windows XP programs. You should connect a mouse if you want more convenient access to Windows XP.
The instrument screen will be brought to the foreground if you double-click the Windows button **SFE [xxx]** in the taskbar.
You can modify the system settings under Windows XP in the **Start - Control Panel** menu (see the documentation for Windows XP and for the hardware for the required settings).
The instrument does not have a disk drive. Data can be exchanged using a memory stick which you plug into one of the USB interfaces. The memory stick is automatically assigned a free drive letter and you can use Windows Explorer to transfer data.

1.4.3 Firmware Update

Information on the firmware and instructions how to perform a firmware update are provided in the release notes. The release notes are supplied together with the new firmware or you can download the current version from the Rohde & Schwarz Home Page (http://www.rohde-schwarz.com/downloads/firmware/sfe.html).

1.5 Connecting the Instrument to a Network (LAN)

The instrument is equipped with a network connection and can be connected to an Ethernet LAN (local area network).
Provided the appropriate rights have been granted by the network administrator, files can be transferred via the network, and network resources, e.g. network directories, can be used. The instrument can also be remote-controlled and manually operated in the network.
Remote operation allows someone to operate the instrument from an external computer situated anywhere in the world. For example, a user working in one part of a building can operate one or more instrument units that are part of a test setup situated in another part of the building.
Remote control of the instrument via the LAN interface is described in Chapter 5 of the operating manual (on the supplied CD-ROM).

1.5.1 Connecting to the Network

NOTICE

Always coordinate the connection of the instrument to the network with the network administrator. Any errors that occur during the connection process can affect the entire network.

Make sure that the instrument is switched off (standby mode) when you connect and disconnect the network cable. This is the only way to ensure that the network connection is reliably detected and any disruptions during the operation of the instrument are avoided.

The instrument is connected to the LAN using a standard RJ-45 cable via the LAN interface on the rear of the instrument.

Chapter 7 contains a description of the connector.

Configuring the instrument for network operation

The network interface functions with 100 MHz Ethernet IEEE 802.3u. The TCP/IP network protocol and the associated network services are preconfigured.
To exchange data within a LAN, every computer or instrument that is connected must have a unique IP address or a unique computer name. Access between different users is managed with access authorizations. These access authorizations determine which of the available network resources such as file storage systems are available for the instrument, for example.

Networks with DHCP
The instrument is preconfigured for networks using the dynamic host configuration protocol (DHCP). In such networks, the instrument is automatically assigned a free IP address. In this case, identification in the network is based on the use of a unique computer name.
Every instrument is assigned an individual computer name at the factory. You can view and modify this name in the Windows XP **Start - My Computer** menu (see under "Querying the Computer Name").
Networks that assign fixed IP addresses
In networks that assign fixed IP addresses, the network administrator usually handles this process. The fixed IP address must be entered under Windows XP **Start - Control Panel** (see below “Entering the IP address”).

Point-to-point connections
To set up a single network (a LAN connection between an instrument and a single computer without integration into a larger network), an IP address needs to be assigned to the instrument and the computer. The IP addresses 192.168.xxx.yyy are available for use here, where xxx and yyy can assume values of 1 to 254, and the value for the subnet mask is 255.255.255.0.
In this case, a standard RJ-45 crossover cable is required for the connection.

User parameters
For the instrument, the standard user name is **Instrument**. The user name is used for auto login when the instrument is started up and for remote operation. The password is also **Instrument**. The network administrator must grant authorization to this user to determine what network directories and resources can be accessed by the instrument.

Preparations

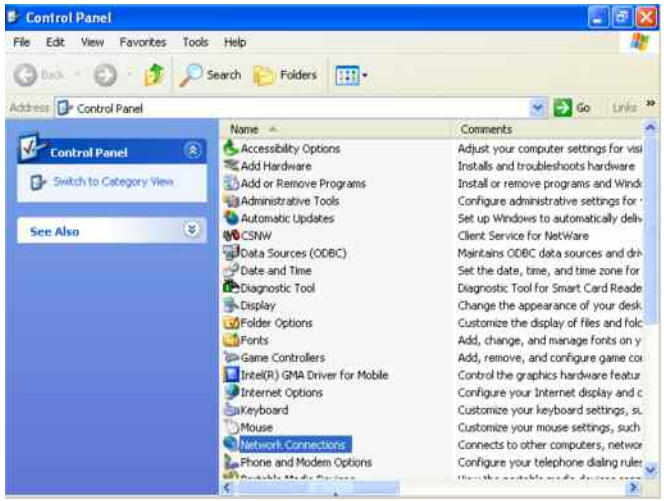
The instrument is configured for network operation in the menus of the Windows XP Embedded operating system. The operating system can be accessed only when an external keyboard is connected. The use of a mouse makes operation more convenient. Power down the instrument prior to connecting the keyboard and mouse so that the operating system will properly recognize them.

1. Switch off the instrument.
2. Connect the external keyboard and mouse to the USB interface.
3. Switch on the instrument.

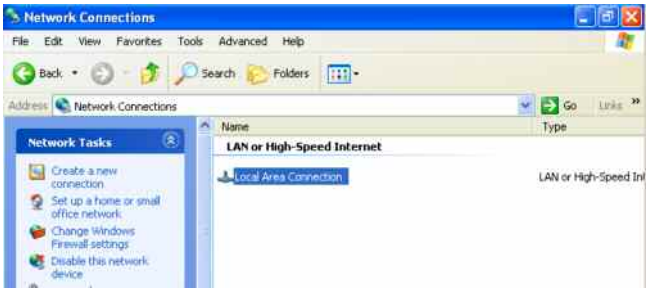
Entering the IP address

1. Press the Windows key on the external keyboard (next to the CTRL key) to call up the start menu.

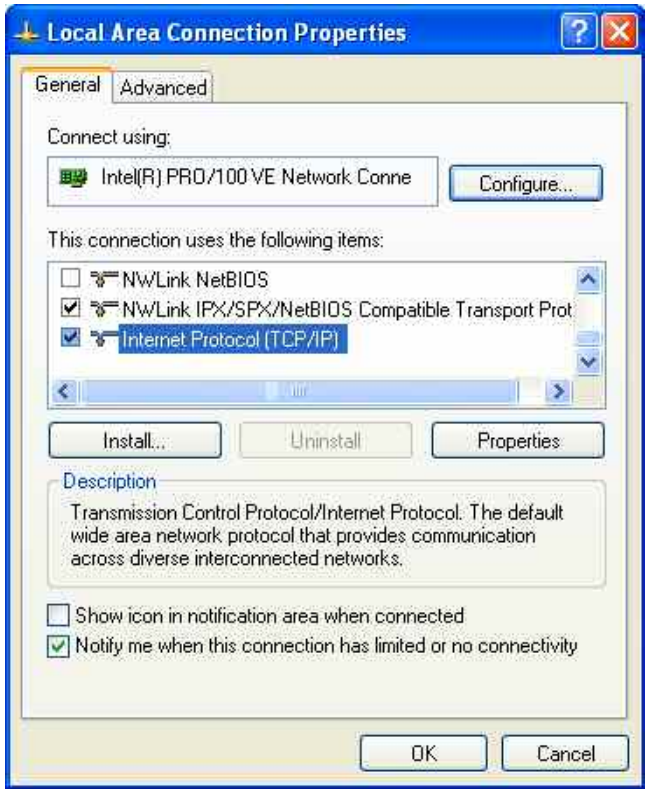
2. Click **Control Panel** and then **Network**



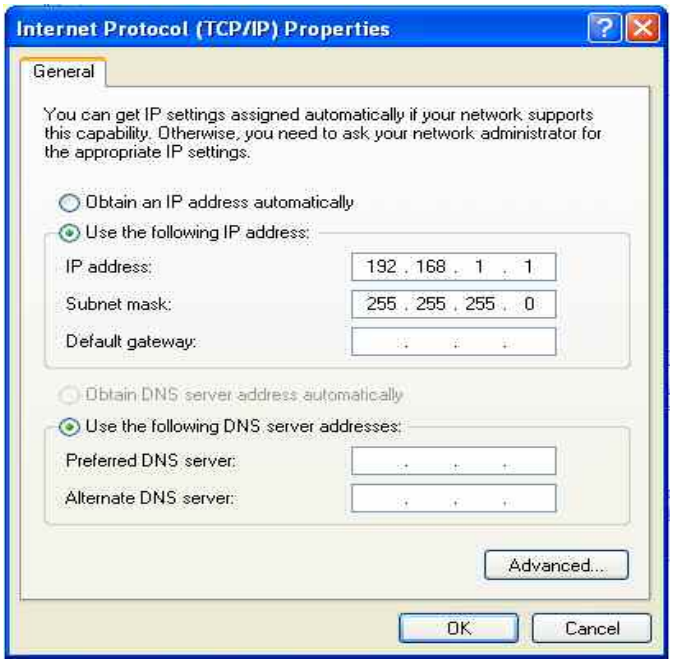
3. In the Network **Connections** menu, click **Local Area Connection** on the right.



4. In the **General** tab, activate Properties. In the field that reads **This connection uses the following items:**, mark the **Internet Protocol (TCP/IP)** item and then click the **Properties** button.



5. In the **Internet Protocol (TCP/IP) Properties** menu, enter the IP address in the field **Use the following IP address** (ask your network administrator if you need more information). Finish by clicking OK in all of the menus.
The default setting will be **Obtain an IP address automatically** (DHCP = Dynamic Host Configuration Protocol).



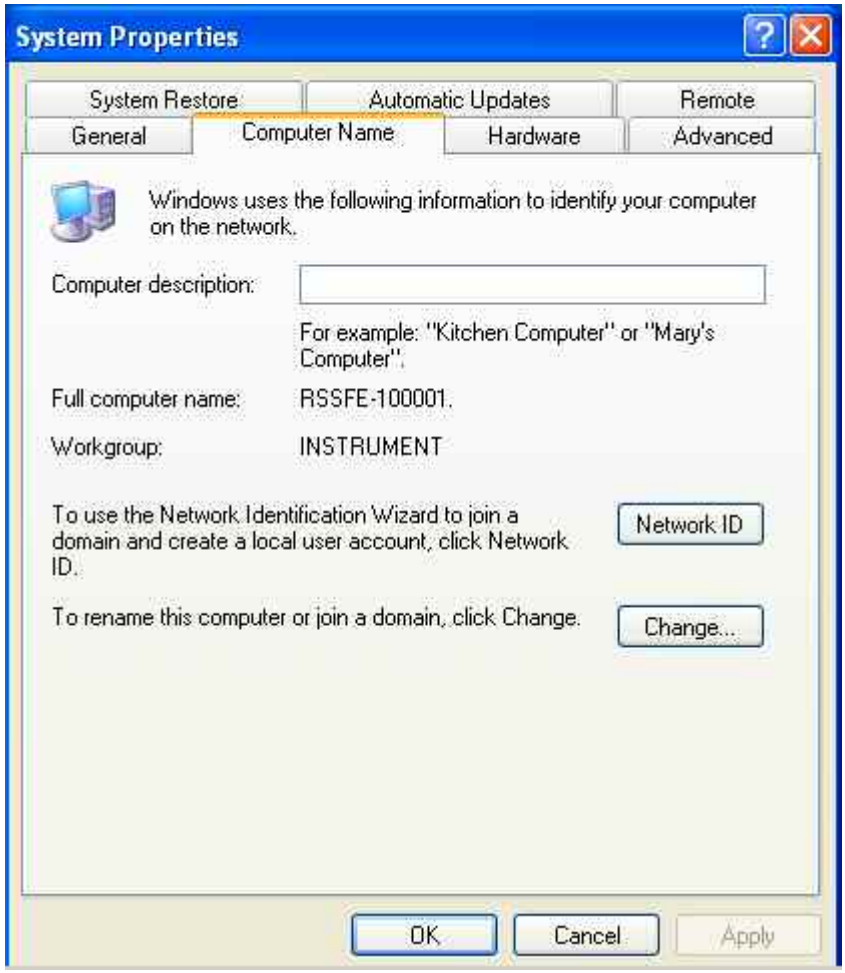
Querying the Computer Name

1. If the instrument has its DEFAULT COMPUTER NAME the computer name is displayed as part of the window title of the application:

Otherwise follow the next steps:

2. Press the Windows key on the external keyboard (next to the CTRL key) to call up the start menu. Select **instrument on RSSFE-xxxxxx** and call up the context-sensitive menu with the right mouse button

3. Click **Properties** and select the **Computer Name** tab in the menu.
The computer name is shown under **Full Computer Name**.

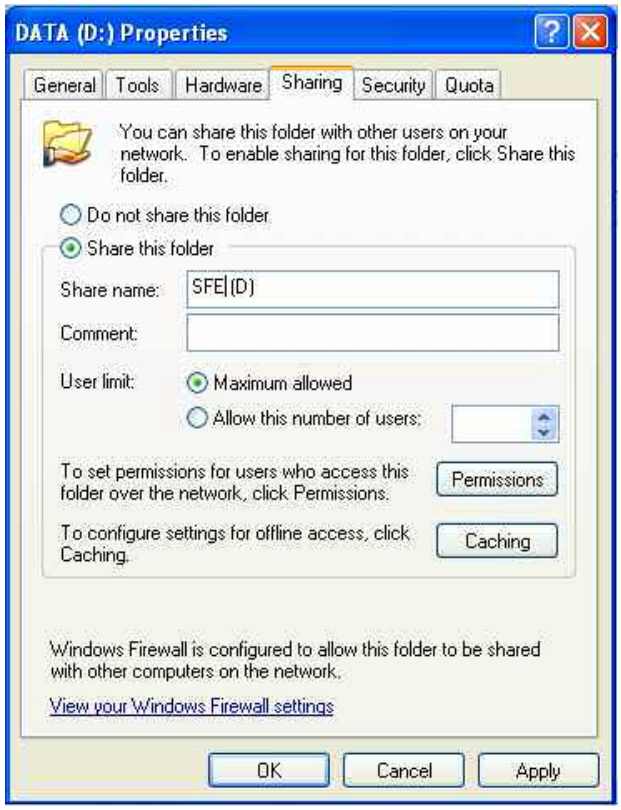


1.5.2 Sharing and Accessing Instrument Drives

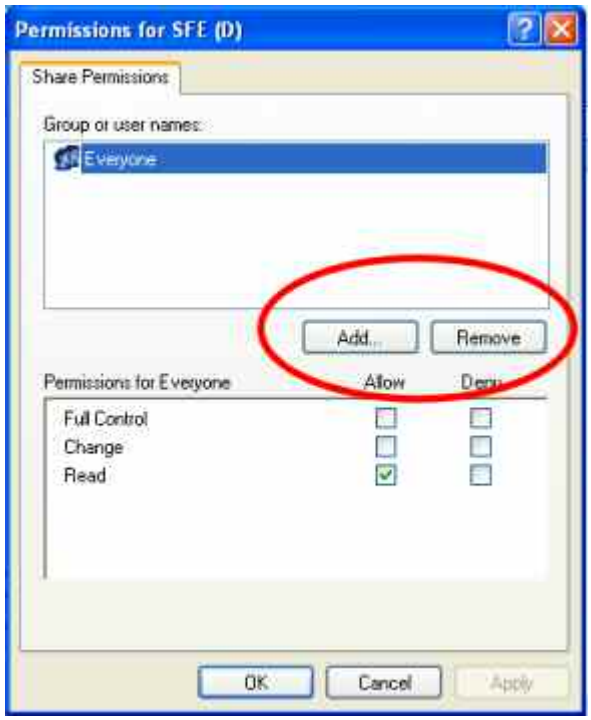
Access to Instrument drives is managed using a system of access authorizations. Complete integration of the instrument into a larger network is complex due to the access authorizations involved and is normally performed by a network administrator.
However, access to the instrument hard drives is relatively simple.

1. Select drive D: on the instrument using Windows Explorer and use the right mouse button to call up the **Sharing and Security** menu.

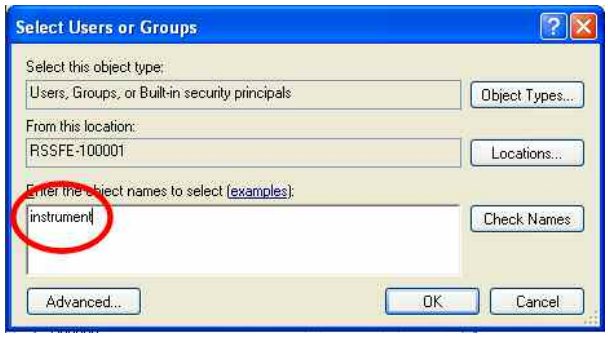
2. On the **Sharing** tab, activate the **Share this folder** option.



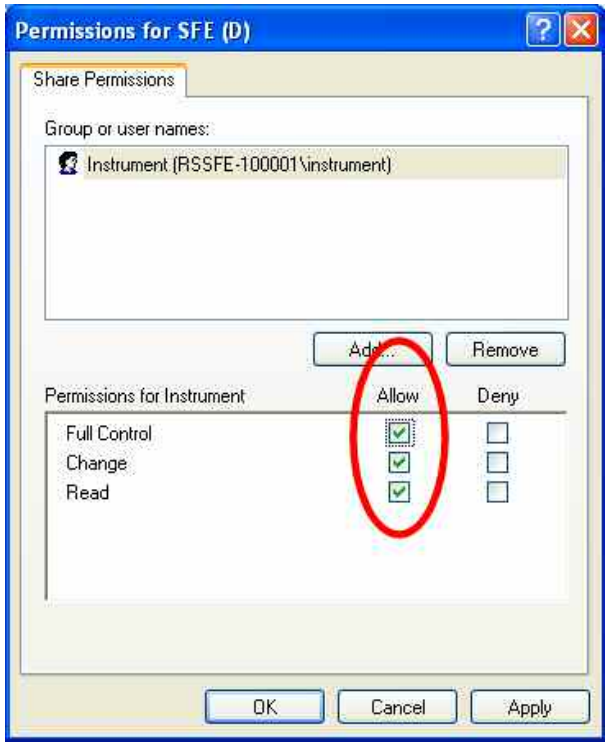
3. Click **Permissions** and remove user "Everyone".



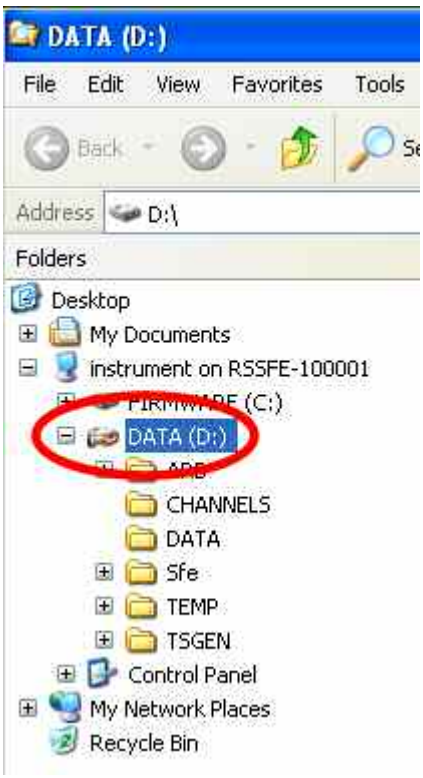
4. Click **Add…**.
5. Enter the object name "instrument".



6. Under **Allow**, activate **Full Control**, **Change** and **Read**.

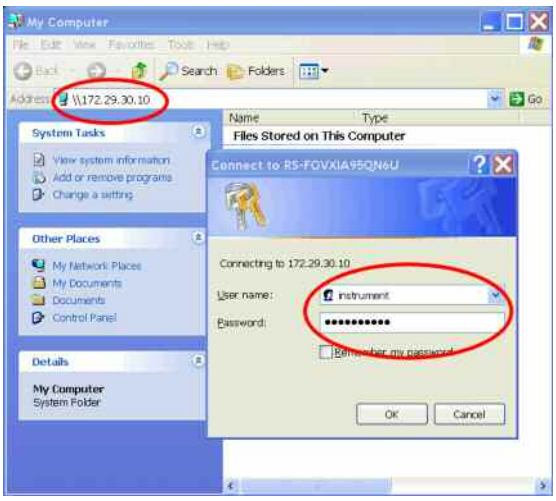


7. Shared drives are marked now.



8. On your PC, open Windows Explorer and enter the IP address of the instrument in the form \\xx.xx.xx.xx.

9. Enter user name "instrument" and password "instrument".



The shared directories should appear, and you can access the files.

1.5.3 Accessing Network Directories from Instrument

Access to network drives is managed using a system of access authorizations. Complete integration of the instrument into a larger network is complex due to the access authorizations involved and is normally performed by a network administrator.
However, access by the instrument to the hard drive of another computer in the network is relatively simple. The desired directory that the instrument will access just needs to be enabled on the other computer. The instrument can then use the Windows XP search function to access this directory.
This procedure is also relevant to a point-to-point connection, e.g. for starting a firmware update for which the files are stored on the hard drive of another computer.

Note:

The computer and the broadcast tester or test transmitter must both have a computer name and an IP address (see section "Configuring the instrument for network operation").

Enable the desired directory on the other computer.

Note:

Depending on the operating system and language used on the other computer, the names of the menus can vary from those shown below.

1. Select the directory in question on the computer using Windows Explorer and use the right mouse button to call up the **Properties** menu.
2. In the **Sharing** panel, activate the **Share this folder** checkbox.
3. Note the computer name (see section "Querying the Computer Name").

On the instrument , now access the shared directory.

1. Use the Windows key to call up the **Start** menu.
2. In the **Search Computers or People** menu, select **A Computer on the Network**.
3. In the input window for the query **Which Computer you are looking for?**, enter the computer name in question and press Enter to start the search.
   The computer should be listed along with its name in the search results.
4. Click the computer name. The shared directory should appear, and you can access the files stored there from the instrument.

Note:

If you are prompted for a user name and password when accessing the computer, you will have the enter the login name and password for that computer.

1.5.4 Configuration for Remote Operation ("Remote Desktop")

It is possible to manually operate the instrument via a network connection from a remote computer. Such operation is based on the Windows program **Remote Desktop Connection**. Remote operation is described in Chapter 3, section "Remote Operation".
The following requirements must be met for remote operation of the broadcast tester or the test transmitter:

- On the external computer, Windows 95 or later must be installed along with the **Remote Desktop Connection** program and a LAN interface must be configured for the network.
- The broadcast tester or the test transmitter and the computer must be connected via the LAN (see "Configuring the instrument for network operation").
- On the broadcast tester or test transmitter, the **Remote Desktop Connection** program must be activated (see "Activation of the Remote Desktop Connection Program on the Instrument").

- The instrument data must be entered on the external computer in the program **Remote Desktop Connection** (IP address or computer name of the instrument in the network; see "Querying the Computer Name").
- Login must have been computed on the external computer for the instrument with the proper user name (**Instrument**) and password (also **Instrument**) (see "Starting Remote Desktop on the External Computer").

1.5.5 Activation of the Remote Desktop Connection Program on the Instrument

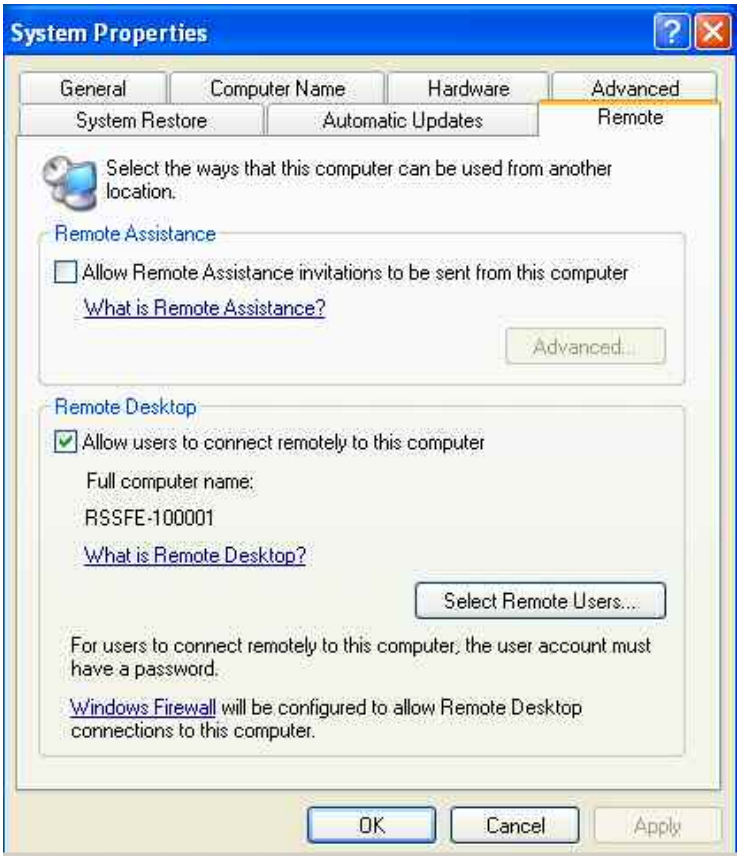
NOTICE

Following activation of Remote Desktop, any user in the network can access this instrument if they know the computer name and login data for the broadcast tester or test transmitter.

1. Press the Windows key on the external keyboard (next to the CTRL key) to call up the **Start** menu. Select **My Computer** and call up the context-sensitive menu with the right mouse button.

2. Click **Properties** and select the **Remote** tab in the menu.

3. Enable the checkbox that reads **Allow users to connect remotely to this computer**.



Starting Remote Desktop on the External Computer

The **Remote Desktop Connection** program is already installed in the Windows XP operating system. For all other Windows operating systems starting with Windows 95™, the program is available as a free download at (http://www.microsoft.com). It can be loaded onto any external computer as described in the instructions (also available on the Internet).

1. If necessary, install the **Remote Desktop Connection** program on the external computer.
2. Start the program from the Windows menu **Start - All Programs - Accessories - Communications**.

Prior to the initial use, you will need to enter the instrument and user data for the instrument on the external computer. The instrument data (the computer name of the instrument) identifies the instrument in the network. Every instrument is delivered with a computer name that is suitable for use with manual remote desktop. For information on querying the computer name, see the section “Querying the Computer Name”.

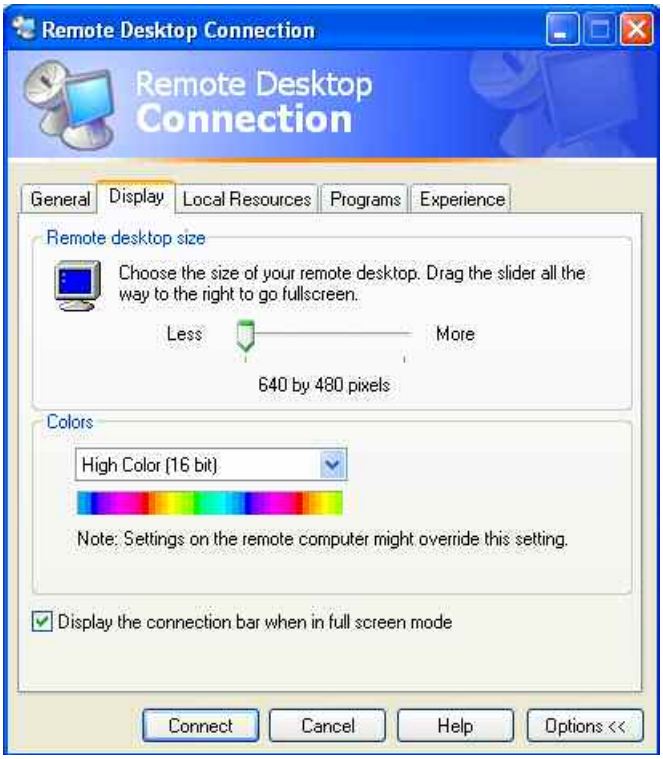
In this dialog, the IP address of the instrument can also be used.

The user data is necessary in order to obtain access authorization for the instrument. This data is preset on the instrument. The user name and the password are both set to **Instrument**. Nothing is required in the **Domain** input field.

3. The instrument and user data are entered in the **General** tab of the **Remote Desktop Connection** extended menu. You can access this data with the **Options>>** button.

4. You can save the login data using the **Save as** button.
If this is saved in the file **default.rdp**, the connection to the instrument will be the default when the program is started. If you save the data under another name, the settings for connecting to the instrument will be shown in the selection list which is called up by pressing the button in the **Computer:** input line.

5. Set the resolution for display of the instrument screen in the **Display** tab to 640 x 480 pixels.



6. Establish the connection by clicking the **Connect** button.
Once the connection is established, the generator screen will appear on the external computer. You can operate the instrument with the mouse and/or keyboard. Keys on the front panel that do not have a direct match on the keyboard can be replaced using key combinations (see the table in Chapter 3, section “Key Overview”).

   If you want to manually operate several instrument units from a remote computer, you will need to open a separate **Remote Desktop Control** window for each instrument. This is possible by restarting the program on the external computer as many times as necessary.

1.5.6 Configuration for Remote Operation (VNC)

As an alternative, the instrument can be operated by using VNC.
The following requirements must be met for remote operation of the broadcast tester or test transmitter:

- On the external computer, Windows 95 or later must be installed along with the **VNC Viewer** program, and a LAN interface must be configured for the network
- The broadcast tester or test transmitter and the computer must be connected via the LAN (see “Configuring the instrument for network operation”)
- The program **VNC Server** must be installed and activated on the broadcast tester or test transmitter.
- The instrument data must be entered on the external computer in the program **VNC Viewer** (IP address or computer name of the instrument in the network; see “Querying the Computer Name”)
- The instrument must be logged on to the external computer with the proper session password.

Installing the VNC Server Program on the Instrument

The setup program is already on the hard disk of the instrument (C:\Program Files\VNC). It can be started from there .

Install VNC server as described in the enclosed documentation on the broadcast tester or test transmitter.

Configure VNC as shown in the following figure:

The recommended password is **SFE**.

Starting Remote Desktop on the External Computer

If necessary, install the **VNC Server** program on the external computer.

Start the program from the Windows menu **Start - All Programs - RealVNC – VNC-Viewer**.
The instrument must be selected as the instrument for remote operation, i.e. its IP address or its computer name must be entered in the **Connection details** window (**VNC server**).

Click the OK button to establish the connection. You will be prompted for the session password.

After you enter the password **SFE**, the screen of the test system will appear on the external computer.
If you need to directly operate the instrument, it is not necessary to log off the external user.
The external user can end remote operation on the external window by closing the VNC application.

1.6 Windows XP Recovery Partition

The R&S SFE100 provides recovery partition. A backup of the factory system partition (C:\) is stored per default and can be recovered in case of a system crash.
When recovered, the system partition (C:/) is deleted, formatted and newly written. The data partition (D:\) is not affected.

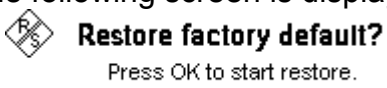
1.6.1 Call the Windows XP Recovery Menu

1. Switch the R&S SFE100 off and on again.

   While the boot screen is visible, the three LEDs on the front panel start blinking.

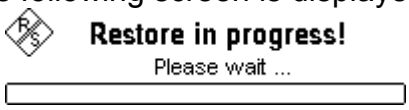
2. If a recovery is needed, press the “BACK” button within 4 seconds.

   The following screen is displayed:

3. Within the next 4 seconds, press OK. Otherwise the restore is skipped and the regular boot process continues.

   After pressing OK within 4 seconds, the recovery process starts and the following screen is displayed:

   After the restore process is finished, a “warm boot” is carried out and R&S SFE100 continues with normal operation.

2 Brief Introduction

The R&S SFE100 is a multi-standard test transmitter with real-time coding for broadcast signals. R&S SFE100 models are available for analog or digital standards, supporting all common TV standards and a number of audio broadcasting standards.

The R&S SFE100 is a compact and reliable instrument that can be equipped with a power amplifier that is unique in this class and makes the R&S SFE100 particularly valuable in production test systems. Plus, it can be used as a simple and economical signal generator and as a second RF channel for special applications available with the R&S SFU.

The R&S SFE100 can be equipped with the appropriate digital or analog baseband signal sources. This makes it possible to replay test signals from Rohde & Schwarz libraries as well as proprietary test signals. The R&S SFE100 thus combines two functions in one box, which significantly simplifies even complex production test systems. An optional arbitrary waveform generator allows you to generate any type of modulation signal and to replay proprietary waveform files regardless of the available real-time coders.

Occupying only one height unit, the R&S SFE100 is extremely compact. Nevertheless, all functions can be selected locally on the instrument. Alternatively, the R&S SFE100 can be remotely controlled from a PC. In this case, the test transmitter is operated via the same convenient graphical user interface as is used for the R&S SFE and the R&S SFU. For applications that do not require local control, an R&S SFE100 model without display and keys is available.

2.1 Features

This section gives an overview of the R&S SFE100's key features. See also the Product Brochure provided on the CD-ROM.

2.1.1 Multi-Standard Signal Generator with Real-Time Coding

The R&S SFE100 is a multi-standard instrument specially designed for use in production. Real-time coding offers a number of advantages in this area as well. Real-time coders generate endless and seamless test signals. Therefore, the signal generators do not need to be synchronized with the production cycle. Moreover, very long sequences can be replayed and the modulation parameters can be set however required.

- Coder for real-time signal generation

  The R&S SFE100 has a powerful hardware platform for baseband signal processing. The platform provides the I and Q bit streams for the broadband vector modulator.

  All modulation modes for the real-time coder of the R&S SFE100 have been implemented as firmware, making it quick and easy to add transmission standards.

- Adjustable modulation parameters

  For each transmission standard, various modulation parameters such as constellation, code rate, and FFT mode must be defined. These parameters can be varied irrespective of the transport stream or A/V signal to be transmitted. All conceivable configurations of a standard can thus be tested. The real-time coder automatically adjusts the corresponding signaling information for the receiver.

2.1.2 Options for All Common Digital and Analog Broadcasting Standards

As a single-standard instrument, the R&S SFE100 comes with a factory-installed coder. R&S SFE100 models are available for digital and analog broadcasting standards, all major standards and technologies are supported. For signal generation systems in production, this is a major advantage: No matter whether digital or analog receivers or terrestrial, satellite, or cable set-top boxes are being manufactured, all test signals can be generated with the same type of test transmitter.

Options are available for the following standards:

- Digital terrestrial TV: DVB-T, ATSC/8VSB, ISDB-T, ISDB-T_B, DTMB
- Digital satellite TV: DVB-S, DVB-S2, DirecTV
- Digital cable TV: DVB-C, J.83/B, ISDB-C
- Digital mobile TV: DVB-H, T-DMB, ISDB-T 1-Segment, CMMB, MediaFLO™, ATSC-M/H
- Analog TV: B/G, D/K, M/N, I, L standards
- Digital audio broadcasting: DAB, DAB+, HD Radio™, ISDB-T_{SB}, DRM
- Analog audio broadcasting: FM stereo with RDS, FM mono, AM

2.1.3 Wide Frequency Range with Very Good Signal Quality

The instrument's RF characteristics make it clear that the R&S SFE100 is a high-quality signal generator despite its compact design and economical price. It covers the entire frequency range that is relevant for broadcast applications, from IF, VHF, and UHF up to the L band. And it does so with a signal quality that is unprecedented in this class.

- Frequency range 100 kHz to 2.7 GHz

  The frequency can be adjusted in steps of 1 Hz. Either the center frequency or the channel number is entered, which is especially useful in analog TV.

- Low phase noise and high MER

  Advanced COFDM modulation methods place high demands on the stability and spectral purity of the oscillator signal. With an SSB phase noise of typ. < -115 dBc (at 300 MHz and 20 kHz carrier offset), the R&S SFE100 offers very high MER values of typically over 40 dB. Moreover, the R&S SFE100 stands out for its low broadband noise and high harmonics suppression.

2.1.4 Integrated Power Amplifier for High Output Levels

In production test systems, the signals of multiple test transmitters are combined in a coupling network and then distributed over large distances. To compensate for the accompanying losses, a high signal level is required. The R&S SFE100 offers an optional extremely powerful integrated amplifier for this purpose. It thus attains a level of performance that exceeds that of competitor instruments even when they have extra external equipment attached.

- Maximum output power +27 dBm

  The optional power amplifier of the R&S SFE100 provides maximum output power of 0.5 W in bands I to V.

- Level range -10 dBm to +27 dBm

  The level can be adjusted in steps of 0.1 dB.

- RF monitor output with 50 dB attenuation

  With the power amplifier built in, the RF output is located on the rear of the R&S SFE100, thereby simplifying rack mounting. The receptacle on the front panel then functions as RF monitor output whose signal level is 50 dB less than that of the RF output.

- Signal level –100 dBm to +15 dBm CW without power amplifier

  Without the optional power amplifier, the R&S SFE100 has the characteristics of a signal generator. The output level is then adjustable by means of an electronic attenuator over a wide dynamic range of -100 dBm to +15 dBm in 0.1 dB steps.

2.1.5 Integrated Transport Stream Player or Audio/Video Generator

Digital transmission methods require transport streams as the baseband signal; ATV modulators on the other hand require analog CCVS signals. Every R&S SFE100 model can be equipped with the baseband source that is appropriate for the individual transmission standard – external baseband generators are no longer required. This significantly reduces the number of instruments involved, especially in complex production test systems.

- TS generator (R&S SFE100-K20)

  An optional transport stream generator in the baseband internally provides test streams for the real-time coder and allows you to generate endless and seamless high-bit-rate MPEG-2 transport streams. An external MPEG-2 generator is thus no longer necessary. The SDTV transport stream library integrated as standard includes ATSC and DVB test streams. The numerous Rohde & Schwarz transport streams cover a wide variety of applications and test scenarios.

- Transport stream libraries from Rohde & Schwarz

  A large number of additional libraries can be integrated. They make development faster and easier and allow new products to be tested.

- SDTV – test streams for DVB and ATSC
- HDTV – tests of HDTV receivers
- DVB-H – tests of mobile receivers
- ISDB-T – test streams
- H.264 – test streams
- TCM – STB tests
- The range of transport stream libraries is constantly being expanded.
- Compatible with the advanced stream combiner from Rohde & Schwarz

  The R&S DV-ASC advanced stream combiner provides full flexibility when generating your own streams, which can be used with the R&S SFE100-K20 TS generator. It allows you to generate your own transport streams, also for DVB-H.

- TRP player (R&S SFE100-K22)

  The optional TRP player ideally complements the TS generator and lets you replay your own transport streams in TRP format. The transport streams can be copied via the USB or LAN interface to the R&S SFE100 file system and then replayed from there. In addition, the TRP player is used to replay T-DMB and DAB ETI streams, which it does by replaying predefined ETI test streams for T-DMB and DAB from the T-DMB/DAB library (R&S SFU-K221).

- ATV video generator (R&S SFE100-K23)

  By using the ATV video generator, you can generate test patterns and audio signals for analog TV. The ATV video generator includes FuBK and color bar test patterns for PAL, SECAM, and NTSC.

- ATV video library from Rohde & Schwarz

  The ATV video library provides a wealth of test patterns for analog TV that far exceeds the scope of the ATV video generator alone. It also includes Cross Hatch, Color Bar, Philips, and Monoscope/Reteoma.

2.1.6 Arbitrary Waveform Generator

In addition to the optional real-time coder, Rohde & Schwarz offers an arbitrary waveform generator (ARB) for the R&S SFE100 DTV. It can replay proprietary I/Q waveforms as well as waveform libraries from Rohde & Schwarz for various transmission standards, thus opening up a wide range of additional applications. This allows you to generate any externally computed RF signals – from complex modulation signals to special interferers such as notched noise. I/Q waveform files can be loaded into the instrument via the USB or LAN interface.

- 256 Msample memory space

  A hardware resampler and the resulting large sequence length reduce the memory space needed for storing I/Q waveforms on the hard disk. This allows you to store a large number of I/Q waveforms directly on the hard disk.

- Sample rate up to 100 Msample/s

  Due to its high sample rate, the ARB generator can generate signals with a baseband bandwidth up to 30 MHz.

- Waveform libraries from Rohde & Schwarz

  Additional waveform libraries permit the quick evaluation of new modulation modes. I/Q waveform libraries are available for the following signals: T-DMB/DAB (R&S SFU-K351), DVB-H (R&S SFU-K352), DRM (R&S SFU-K353), DTV interferer (R&S SFU-K354), MediaFLO™ (R&S SFU-K355), Cable Interferer (R&S SFU-K356), and HD Radio (R&S SFU-K357). The range of available waveform libraries is continuously being expanded.

- Compatible with R&S WinIQSIM™

  Waveforms generated with the R&S WinIQSIM™ PC software can be loaded into the ARB generator of the R&S SFE100 and replayed.

2.1.7 Convenient Control Elements, Remote Control and Remote Operation

When used in production, signal generators are usually set up in racks where space is very limited. This means that all functions need to be selectable directly on the instrument. On the other hand, it must be possible to configure and monitor all instruments of the entire system via remote control / operation. The R&S SFE100 makes both possible, since it has both a keypad and display on the front panel and a convenient graphical user interface for remote control / operation.

- Keypad and liquid crystal display (LCD) on the front panel

  The graphical display of the R&S SFE100 models 2, 3 lets you view the current settings quickly and easily. Parameters and their settings can be selected with the cursor keys and the ENTER key.

- External monitor, mouse and keyboard

  With this equipment, you can use the convenient graphical user interface of the R&S SFE.

- Easy software updates via USB 2.0 or LAN

  Owing to USB 2.0 and LAN interfaces, you can perform software updates for the R&S SFE100 quickly and with little effort. You merely need to copy the new software to the R&S SFE100 by means of a USB memory stick or via FTP and start the fully automatic installation.

- Remote operation with Remote Desktop or VNC

  The R&S SFE100 can be easily remote-controlled via an Ethernet connection or in a LAN network over IP. It is preconfigured for DHCP use by means of the preinstalled Remote Desktop software or the VNC software that comes with the instrument. For remote operation, the R&S SFE100 has the same highly convenient graphical user interface that has already proven successful in the R&S SFE and R&S SFU.

- Remote control via LAN

  Remote control is possible by means of SCPI control commands via LAN (VXI11). The R&S SFE100 can thus be integrated into existing test programs very easily.

- Remote-control commands compatible with those of the R&S SFU and R&S SFE

2.2 Applications

In the production of broadcast consumer electronic equipment such as set-top boxes and televisions, a number of test signals for various transmission standards are required at various frequencies and with different contents. The required signal generators are usually kept in a central transmitter room. The signals are combined in a coupling network and distributed to the individual test stations in the factory via cable, partly over considerable distances. For each channel, a baseband signal is generated, modulated to the corresponding RF, and then amplified to a sufficient level before being fed to the distribution network. This task normally requires three different instruments – baseband generator, modulator, and power amplifier.

The R&S SFE100 is optimally designed for this application: It combines the baseband signal source, modulator, and power amplifier in only one instrument. This makes such a system far less complex. The advantages are readily apparent: A system with the R&S SFE100 is not only more economical; it also requires less space, is more reliable, easier to maintain, and involves less spare equipment.

2.3 Benefits

2.3.1 Integrated Instrument for Efficient Production

The cost pressure within the fiercely competitive consumer electronics market is enormous. The focus on material and development costs is accompanied by the growing importance of cost-optimized production. And this is where the advantages of the R&S SFE100 truly become apparent: With its integrated baseband generator and power amplifier, the R&S SFE100 combines three instruments in one. This not only translates into lower procurement and operating costs. It also increases reliability and simplifies maintenance – which all adds up to more efficient production.

2.3.2 Remote Compatibility Eliminates Duplicated Effort

Not only are sales prices for consumer electronic equipment falling steadily – innovation cycles are also becoming ever shorter. The time window available between the start of product development and the start of series production is becoming tighter and tighter. This makes it all the more important to be able to transfer results from development quickly and easily to production. The R&S SFU, R&S SFE, and R&S SFE100 broadcast signal generators from Rohde & Schwarz provide a valuable contribution: They are designed with optimum compatibility in mind. Test scenarios as well as remote-control programs from development can be transferred to production easily and smoothly.

2.3.3 Same Look and Feel as the R&S SFU and R&S SFE

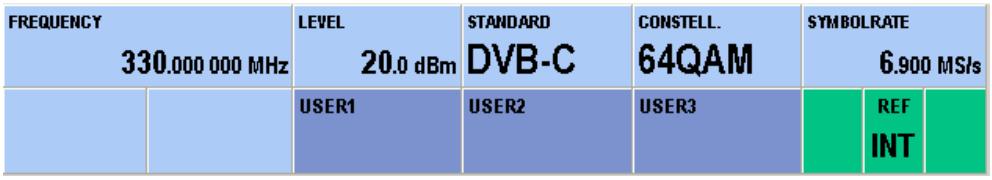
Both the tried-and-true operating concept and the straightforward graphical user interface of the R&S SFU and R&S SFE are largely the same in the R&S SFE100. Customers who are already familiar with the R&S SFU or R&S SFE will be able to operate the R&S SFE100 immediately and without any additional training. This makes switching between the R&S SFU, R&S SFE, and R&S SFE100 easy and effortless.

2.4 Sample Settings

This chapter describes how to perform selected basic tasks. For detailed information on the operating concept, refer to Chapter 3, "Manual Operation".
The instrument can be operated manually using the front panel or graphical user interface. A number of examples showing the different displays for the same operating situation are shown below:

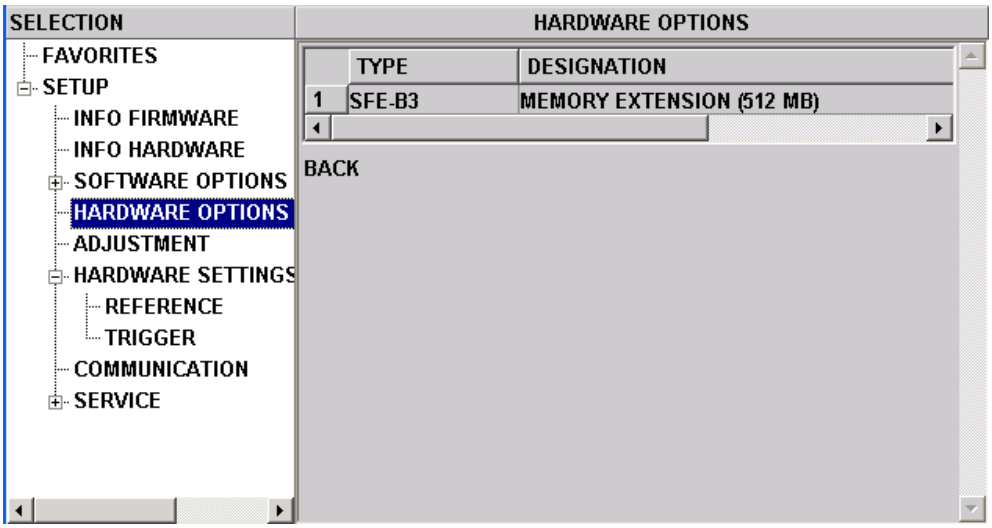
Info area:
Front panel:

Remote operation or with external monitor:



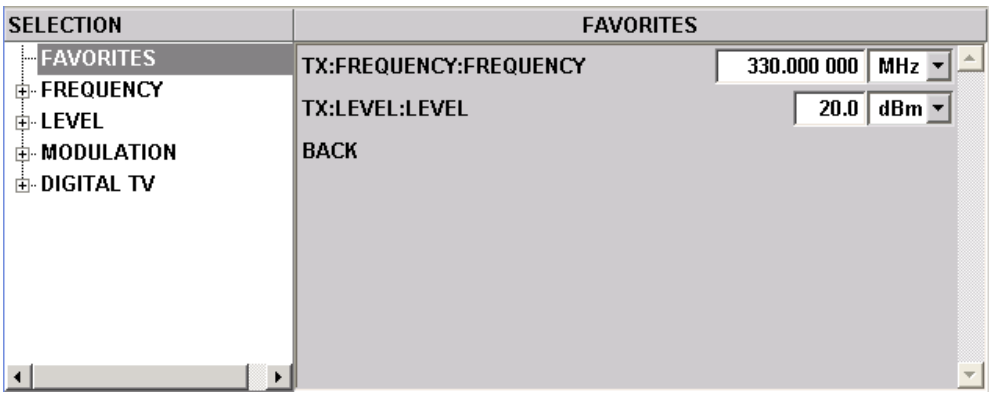
Setup:
Front panel:

Remote operation or with external monitor:



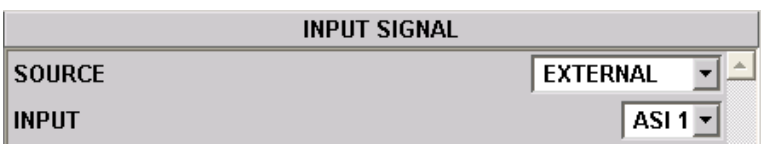
Tree:
Front panel:

Remote operation or with external monitor:



Work view:
Front panel:

Remote operation or with external monitor:



2.4.1 Using the Front Panel

2.4.1.1 Transmitter Model DVB-C

An MPEG2 transport stream is fed into the R&S SFE100 via the serial interface 1 (TS1 IN) on the rear side.

This MPEG2 transport stream undergoes channel encoding and modulation in the instrument for transmission in compliance with the DVB-C specification and is output as an RF signal on the RF output jack.

The communications parameters are as follows:

Center frequency	330 MHz
Level	−20.0 dBm
Transmission standard	DVB-C
Constellation	64QAM
Symbol rate	6.9 MS/s
Roll off	0.15
Transport stream input	ASI front

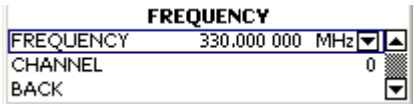
Setting the FREQUENCY output

Press ENTER to enter TREE operation.

Use the  and  keys in the tree to select the FREQUENCY item.

If you press the  key or the  key while the FREQUENCY item is selected, the tree is expanded and the FREQUENCY submenu is displayed.

In the FREQUENCY menu, select the FREQUENCY item again and confirm your entry with ENTER. This will activate the work view.



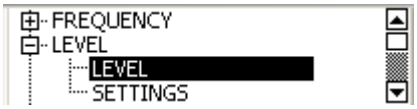
Use the cursor keys to select the FREQUENCY field in the work view. The output frequency of 330 MHz can then be set.

Using the  and  keys, move the cursor to the digit you want to change in the frequency entry. You can change the numeric value using the  and  keys. Pressing the ENTER key confirms the entry.

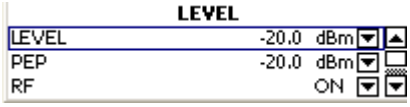
Exit by pressing the BACK key to get back to the TREE.

Setting the LEVEL output

Use the  and  keys in the tree to select the LEVEL item. If you press the  key or the  key while the LEVEL item is selected, the tree is expanded and the LEVEL submenu is displayed.



In the LEVEL menu, select the LEVEL item again and confirm your entry with ENTER. This will activate the work view.



Use the cursor keys to select the LEVEL field in the work view.

The output level of −20 dBm can then be set. Using the  and  keys, move the cursor to the digit you want to change in the level entry.

You can change the numeric value using the  and  keys. Pressing the ENTER key confirms the entry.

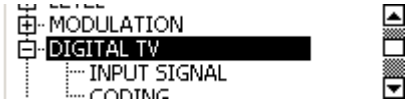
Exit by pressing the BACK key to get back to the TREE.

Modulation settings and the TRANSMISSION STANDARD

The SIGNAL SOURCE and the TRANSMISSION STANDARD are fixed to DTV and DVBC under MODULATION.

Selecting the transport stream input and setting the DVB-C transmission parameters

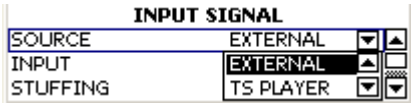
Use the  and  keys in the tree to select the DIGITAL TV item. If you press the  key or the  key while the DIGITAL TV item is selected, the tree is expanded and the DIGITAL TV submenu is displayed.



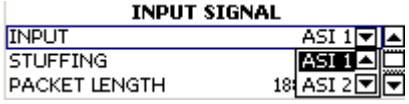
In the DIGITAL TV menu, select the INPUT SIGNAL item and confirm your entry with ENTER. This will activate the work view.

Use the cursor keys to select the SOURCE field in the work view.

When you press the ENTER key the selection EXTERNAL, TS PLAYER, TEST SIGNAL will be displayed.



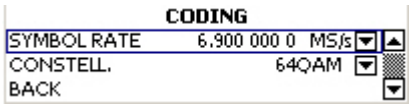
Use the  and  keys to select EXTERNAL and confirm with ENTER.
Use the cursor keys to select the INPUT field in the work view.
When you press the ENTER key the selection ASI1 and ASI2 will be displayed.



Use the  and  keys to select ASI 1 and confirm with ENTER.

The STUFFING field in the work view must be set to ON. This ensures that the incoming transport stream will be adapted to the proper data rate of the coder. The data rate of the coder will depend on the transmission parameters. The data stream is padded with NULL PACKETS to allow adaptation to the transmission parameters.
Press the BACK key to exit the work view.

In the DIGITAL TV menu, select the CODING item and confirm your entry with ENTER. The work view will be activated.
Use the cursor keys to select the SYMBOL RATE field in the work view.

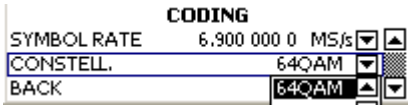


The symbol rate of 6.9 MS/s can then be set. Using the -> and <- keys, move the cursor to the digit you want to change in the SYMBOL RATE item. You can change the numeric value using the UP and DOWN keys. Pressing the ENTER key confirms the entry.

Use the cursor keys to select the CONSTELLATION field in the work view.

Use the 

key to make your selection between 16QAM, 32QAM, 64QAM, 128QAM or 256QAM

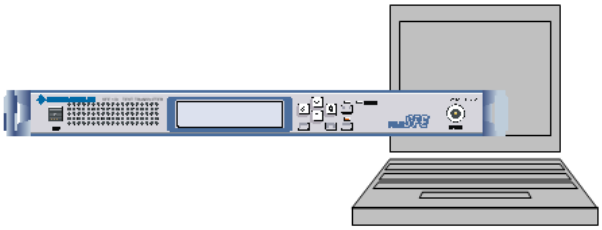


Use the  and  keys to select 64QAM and confirm with ENTER.

All of the parameters listed earlier are now set.

The Info area is redisplayed after a short time if no further keys are pressed.

2.4.2 Using the Graphical User Interface



2.4.2.1 Transmitter Model DVB-C

An MPEG-2 transport stream is fed into the R&S SFE100 via the serial interface 1 (TS1 IN) on the rear side.

This MPEG-2 transport stream undergoes channel encoding and modulation in the instrument for transmission in compliance with the DVB-C specification and is output as an RF signal on the RF output jack.

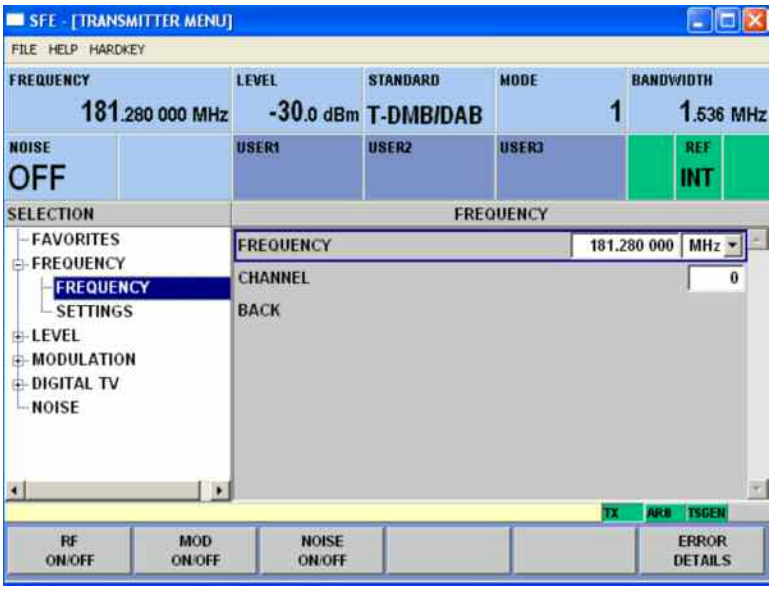
The communications parameters are as follows

Center frequency	330 MHz
Level	−20.0 dBm
Transmission standard	DVB-C
Constellation	64QAM
Symbol rate	6.9 MS/s
Roll off	0.15
Transport stream input	ASI front

Setting the FREQUENCY output

In the tree (left side), select the FREQUENCY menu using the mouse. If you press the left mouse button or the ENTER key while the FREQUENCY menu is selected, the tree is expanded and the FREQUENCY submenu is displayed.

Figure 2.4-1 FREQUENCY menu

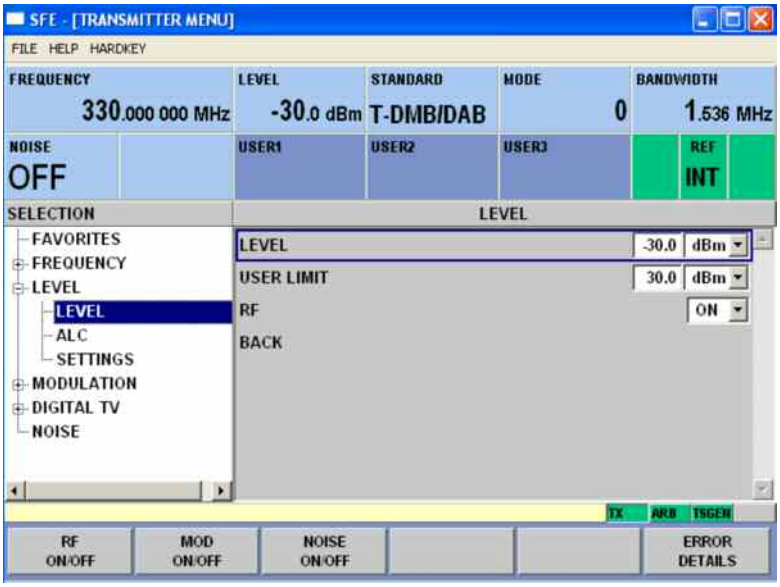


In the FREQUENCY menu, select the FREQUENCY item again. This will activate the work view on the right side.
Use the mouse to select the FREQUENCY field in the work view.
Enter "330" and press the ENTER key.

Setting the LEVEL output

In the tree (left side), select the LEVEL menu using the mouse. If you press the left mouse button or the ENTER key while the LEVEL menu is selected, the tree is expanded and the LEVEL submenu is displayed.

Figure 2.4-2 LEVEL menu



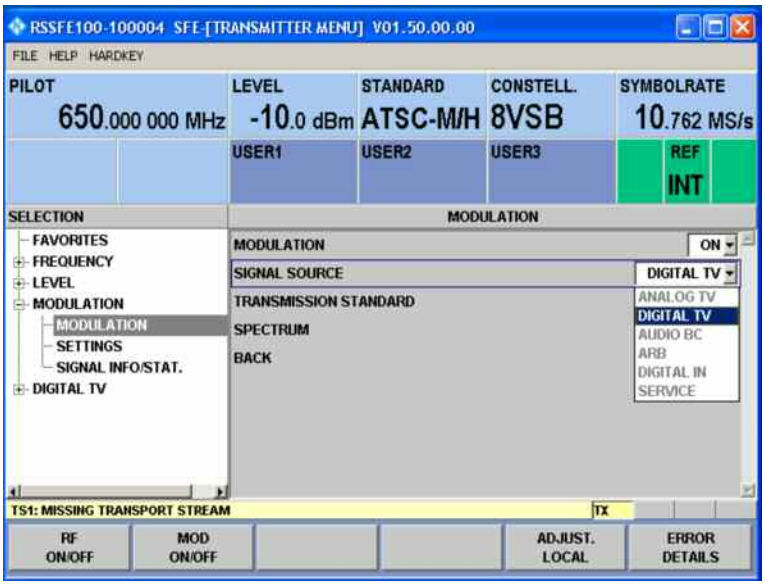
In the LEVEL menu, select the LEVEL item again. This will activate the work view on the right side.
Use the mouse to select the LEVEL field in the work view.

Enter "-20" and press the ENTER key.

Modulation settings and selecting the TRANSMISSION STANDARD

In the tree (left side), select the MODULATION menu using the mouse. If you press the left mouse button or the ENTER key while the MODULATION menu is selected, the tree is expanded and the MODULATION submenu is displayed.

Figure 2.4-3 MODULATION menu



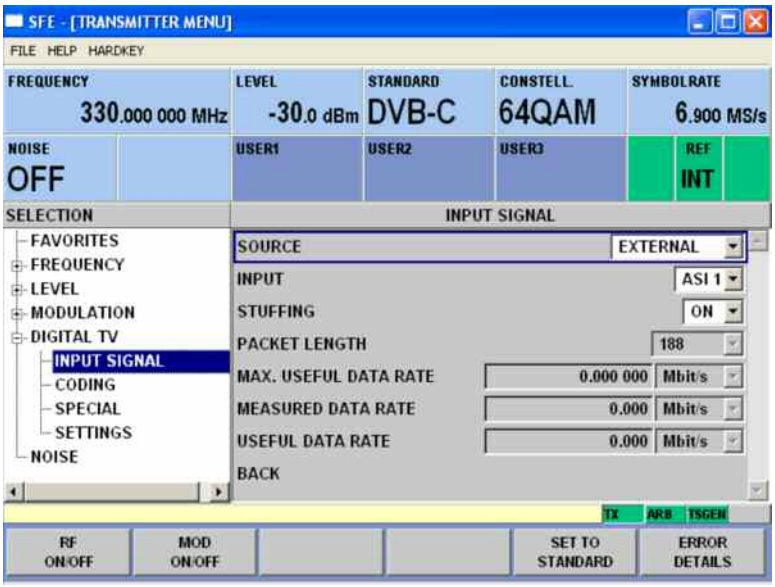
In the MODULATION menu, select the SIGNAL SOURCE item. This will activate the choice box on the right side.
Depending on the R&S SFE100 model, if not fixed, select and confirm DIGITAL TV.

Also in the MODULATION menu, select the TRANSMISSION STANDARD item. This will activate the choice box on the right side.
Depending on the options installed, select and confirm DVB-C in this example.

Selecting the transport stream input and setting the DVB-C transmission parameters

In the tree (left side), select the DIGITAL TV menu using the mouse. If you press the left mouse button or the ENTER key while the DIGITAL TV menu is selected, the tree is expanded and the DIGITAL TV submenu is displayed.

Figure 2-1 DIGITAL TV menu



In the DIGITAL TV menu, select the INPUT SIGNAL item and confirm your entry with ENTER. This will activate the work view on the right side.

Select the SOURCE field in the work view.

When you press the ENTER key (or the left mouse button), the selection EXTERNAL, TS PLAYER, TEST SIGNAL will be displayed.

Select and confirm EXTERNAL.

Use the mouse or the cursor keys to select the INPUT field in the work view.

When you press the ENTER key the selection ASI FRONT, ASI REAR, SPI FRONT, etc. will be displayed.

Select and confirm ASI FRONT.

The STUFFING field in the work view must be set to ON. This ensures that the incoming transport stream will be adapted to the proper data rate of the coder. The data rate of the coder will depend on the transmission parameters. The data stream is padded with NULL PACKETS to allow adaptation to the transmission parameters.

In the DIGITAL TV menu, select the CODING item and confirm your entry with ENTER. The work view on the right side of the display will be activated.
Use the cursor keys or the mouse to select the SYMBOL RATE field in the work view.

The symbol rate of 6.9 MS/s can then be set:

- Enter "6.9" using the digit keys and the decimal point and confirm your entry with the ENTER key (assuming the units field to the right already shows units of "MS/s").

  If the units field indicates another unit, you can select this field with the cursor keys. After you confirm, you can select the unit. Once you have selected and confirmed "MS/s", you can enter the appropriate symbol rate.

  The symbol rate you entered will now be displayed in the INFO area in the SYMBOL RATE field.

- Use the cursor keys or mouse to select the CONSTELLATION field in the work view.

  Use the ENTER key to make your selection:
  16QAM, 32QAM, 64QAM, 128QAM or 256QAM

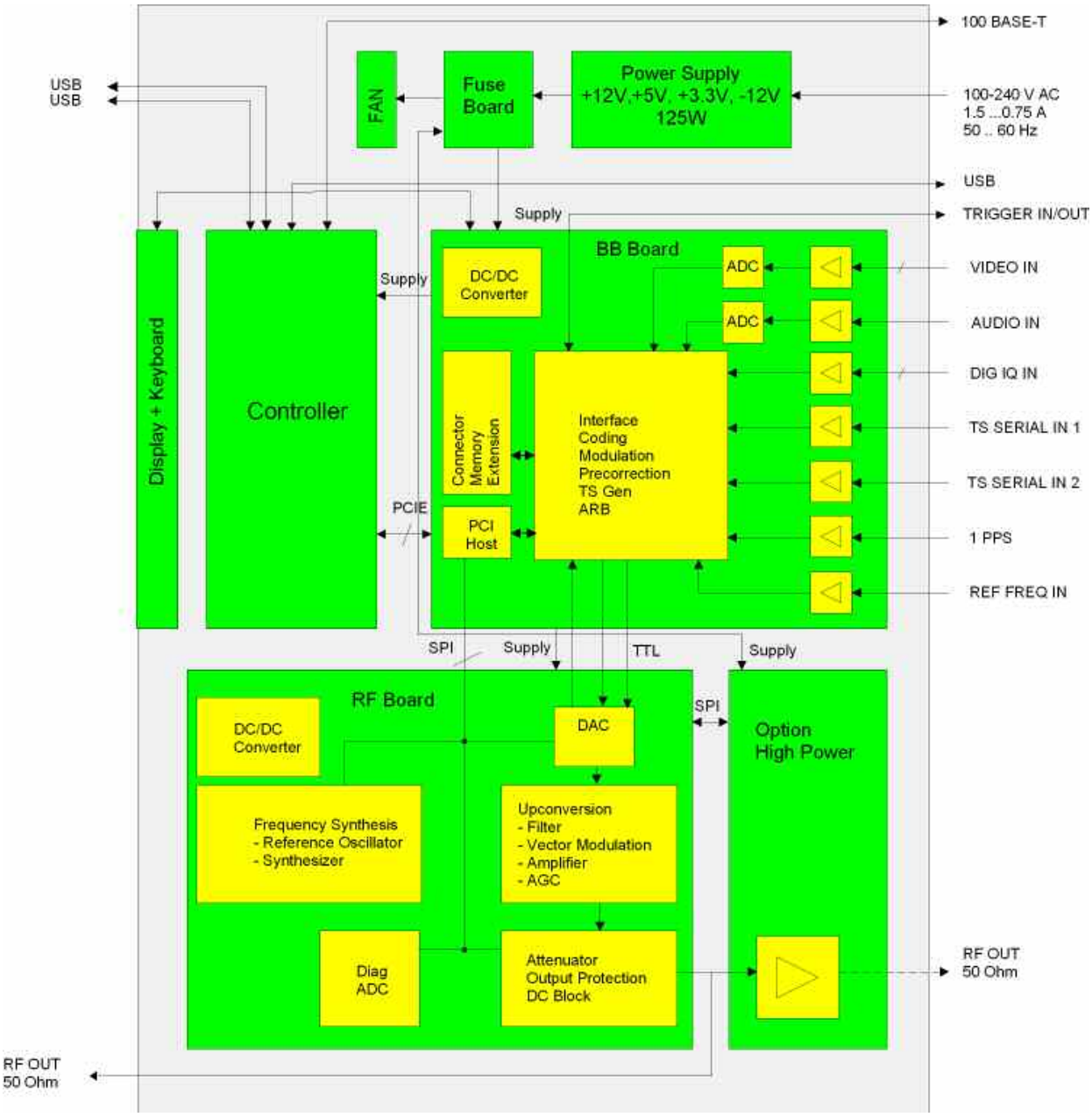
  Use the mouse to select and confirm 64QAM.

  The constellation you entered will now be displayed in the INFO area in the CONSTELLATION field.
  Press the ESC key (or select and confirm the BACK field) to exit the work view.

  All of the parameters listed earlier are now set (unless you made special settings in the previous settings).

2.5 Basic Instrument Concept

Figure 2.5-1 The R&S SFE100 hardware platform



2.5.1 The Instrument's Baseband Section

The instrument's baseband section contains the hardware for generating and processing I/Q signals. It is entirely digital in design.

Depending on the R&S SFE100 model, the baseband section provides all of the transport stream (TS) interfaces and handles processing of the transport streams. The TS/Video generator option is also found here. The ARB hardware option can also be installed on this subassembly.

The coder part of the FPGA receives the processed transport stream signals and performs the FEC for the selected digital TV standard. The subassembly generates digital I/Q signals which are forwarded to the RF section.

2.5.2 The Instrument's RF Section

The D/A converter converts the digital signal into an analog I/Q signal. This analog I/Q signal feeds the I/Q modulator. The following part contains the synthesizer, output section with I/Q modulator and attenuator.

The frequency range is from 100 kHz to 2.7 GHz.

3 Manual Operation

Manual Operation is performed using the controls on the front panel or the graphical user interface displayed on an external monitor or a monitor of a PC. For sample settings refer to Section 2.6.

The description in the Operating Manual, Chapter 4, is based on manual operation using the graphical user interface. If you operate the instrument using the front panel, navigate as described in "Using the Front Panel".

Remote control is performed using SCPI commands. For details on remote control refer to the Operating Manual, Chapters 5 and 6.

3.1 Operating Concept

The instrument can be operated manually in the following ways:

- Using the Front Panel
- Using the Graphical User Interface

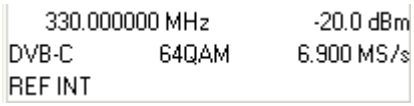
3.1.1 Using the Front Panel (Model 02 and 03 only)

In this operating method, the instrument is operated using the keys and the display on the front panel. For instruments without front panel display, operate the instrument as described in "Using the Graphical User Interface".

Note:
All important setting parameters can be changed via the front panel. A small number of setting parameters are only accessible via remote operation. However, this does not restrict normal operation in any way.

3.1.1.1 Front Panel Display

Only the R&S SFE100 models 02 and 03 possess a front panel display.



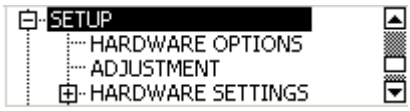
The display shows all important parameters (e.g. frequency, level, modulation type) and the principal transmission parameters for the respective modulation.

The source for the reference connection, CW signal (MOD OFF) and disabled RF signal (RF OFF) is also displayed.

The disabled RF is additionally indicated by an LED above the RF ON/OFF key.

A LED indicates whether the instrument is being remote-controlled.

Instrument setup is performed within the tree structure and not as a separate application as is the case with remote operation.



Warnings and errors are also displayed within the tree structure.

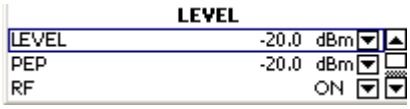
If an error or a warning is present the main display of the R&S SFE100 shows an indicator too.

3.1.1.2 Navigating in the Tree

From the main display, press the ENTER key to activate the tree. The  and  keys are used to select tree elements. Pressing ENTER or the  key opens lower-level trees. Navigation in these lower-level trees is the same as in the main tree.

3.1.1.3 Navigating in the Work View

When you have reached the last sub tree in a particular tree element, pressing ENTER or  opens the work view, in which you can change parameters or numeric values.

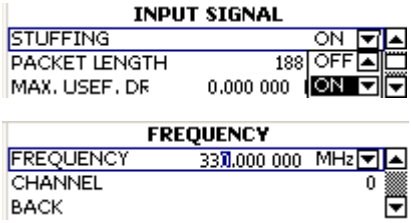


3.1.1.4 Measured Value Displays or Settings in the Work View

Measured values or parameters which cannot be changed are shown in square brackets [ ]

3.1.1.5 Actions in the Work View

Pressing ENTER selects a parameter; this parameter can then be changed.
You can switch between parameters (toggle function), e.g. ON/OFF.
You can make a selection, e.g. 1 out of n items.
You can enter values, e.g. a frequency value.

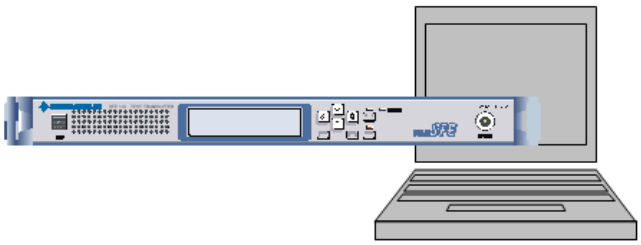


3.1.2 Using the Graphical User Interface

In this operating method, the graphical user interface is displayed on an external monitor or on a monitor of a PC.

- **External monitor, keyboard and mouse:**
  Connect a DVI monitor, USB keyboard and USB mouse to the R&S SFE100. Access to all functions is provided by the menu bar. Note that older instruments do not possess an interface to connect a monitor. For details refer to Chapter 1.

- **PC (remote operation):**
  If the instrument is operated using a PC, this is called "Remote Operation".
  Connect the instrument to an Ethernet network and use Remote Desktop or VNC to display the virtual screen of the R&S SFE100 on the PC monitor. Use the PC keyboard and mouse to operate the R&S SFE100.



To make operation of the R&S SFE100 easier, virtual hardkeys are available in the HARDKEY menu, e.g. APPL, HOME, PRESET, ASSIGN and LOCAL .
For further information on remote operation refer also to Section 1.5, "Connecting the Instrument to a Network (LAN)" and Section 3.8, "Remote Operation".

3.1.2.1 Navigating in the Tree

The menu tree is used to navigate in the application's menus. The tree consists of main items and sub items (where necessary). The position in the tree of the currently selected application is marked accordingly.

Use the  buttons or the mouse to navigate in the vertical direction.
To navigate in the tree, place the mouse pointer on a tree element and mark it by clicking with the mouse. The marker will appear at the location where the cursor is currently located. This marker will move accordingly.

Any sub items present in the branches of the tree can be opened and closed for a given main item.

Open and close the sub items with the 

key.
Double-clicking with the mouse will have the same effect.

When navigating with the  and  keys in the opened tree, you will automatically branch to the sub-tree. After passing through the sub-tree, you will reach the next main item in the tree.
There is a work view associated with each tree element, which is always displayed in relation to the marking in the tree. The work view changes dynamically based on how you navigate in the tree.
If the marker is on a sub item in the tree or on a main item without any sub items, the work view can be activated by pressing the 

key.
Double-clicking with the mouse will have the same effect.
The tree will stay marked at the place that you switched to in the work view.

3.1.2.2 Navigating in the Work View

You can use the cursor keys to navigate in the work view. The marker in the work view will follow the cursor commands. Using ENTER you can mark all of the selectable items in the work view one after another. When using the mouse, you can place the mouse pointer on a selected item.

Use the 

key (ESCape) or the  key to exit the work view. The BACK menu item in the work view has the same function.

If you exit a given work view, you can press the 

key to reactivate it.

The  key does not have the same effect.

3.1.2.3 Measured Value Displays or Settings in the Work View

If all of the measured values and settings in the work view are visible at once without scrolling, then you do not need to activate the work view. If an item is marked in the tree, then the corresponding work view is continually updated and displayed along with the associated measured values and settings.

3.1.2.4 Actions in the Work View

You can switch between parameters (toggle function), e.g. ON/OFF.
You can make a selection, e.g. 1 out of n items.
You can enter values, e.g. a frequency value.
However, the relevant parameter must be marked in the work view to perform such actions. Pressing the 

key or double-clicking with the mouse immediately executes a toggle function. A selection or value input is now activated.
A window will open after you make your selection. Use the cursor or rotary knob to make the desired selection and confirm your entry with the 

key. Use the 

key to exit the window without changing the values. The input area is activated in case you need to input values. A value that is already present can be modified using the cursor keys. The change will take effect immediately. Use the digit keys on the external keyboard to enter a new numeric value. Confirm your entry with the 

key. If you want to exit the input area without making a change, press the ESC key.

As soon as the action is confirmed in the work view and is executed, the parameter will be updated (assuming it is used in an INFO field).

3.1.2.5 Fast Access to Commonly Used Menu Items Using Softkeys

Important menu items are accessed using the softkeys.
The softkeys have fixed assignments that are independent of the application.

3.1.2.6 Fast Access to Commonly Used Menu Items Using FAVORITES

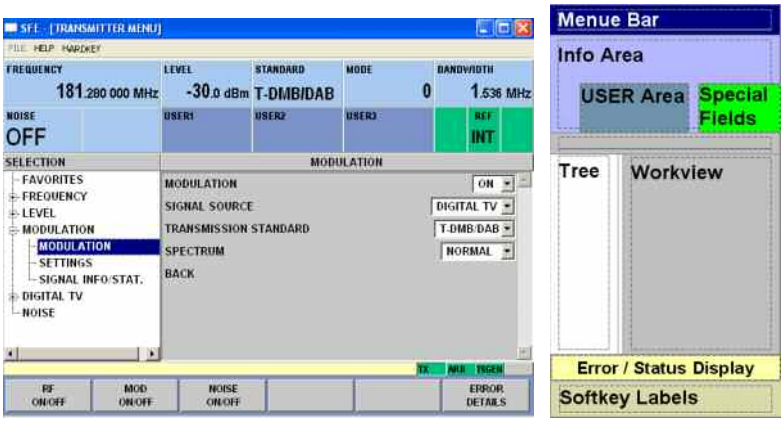
To allow fast access to commonly used menu items, you can add any of the menu items to your FAVORITES. (You can also delete them from the FAVORITES if you need to.)
Menu items can be added to the list of FAVORITES from any application. This allows fast operation across individual applications.

Activate the HOME key to call up the FAVORITES in the tree of the application in question. Since the FAVORITES can contain menu items from all of the applications, the operating speed will be significantly higher with the HOME key.

3.1.2.7 TX / ARB and TSGEN Display

The display content depends on the R&S SFE100 model and the selected operating mode:

Figure 3.1-1 Display areas



Menu bar
The current application is displayed in the menu bar.
Here, you can use FILE for file management purposes and HELP for starting the help function.

Information area
The information area shows the most important communications parameters. Some of the INFO fields have fixed assignments for each application.

User area
Free INFO fields are known as USER fields. Users can enter their preferred display parameters in these fields.

Special fields
Besides the INFO fields and the USER fields, there are three other special fields:

- **LEFT**
  The special field on the left indicates whether the instrument is being remote-controlled (and if so, how).

- **CENTER**
  The special field in the center shows what has been selected. The instrument reference is supplied externally (REF EXT) or the internal instrument reference is used (REF INT).

- **RIGHT**
  The special field on the right indicates the status of the output signal or the modulation in the TX application. For MOD OFF, RF OFF, the field is red-colered; otherwise it is green-colored.

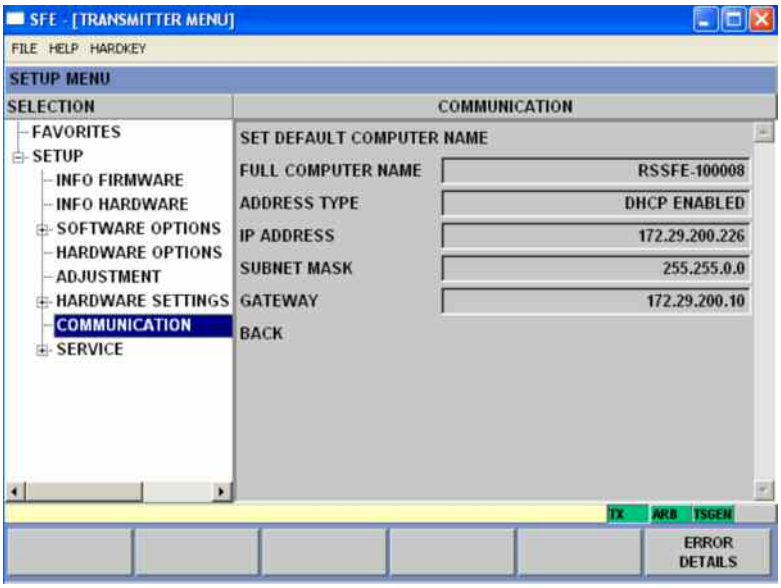
Tree and Work View
The tree is arranged on the left side. You can use the tree to navigate in the menus. You can open and close the existing branches of the tree. If the tree is longer than the tree field, only a portion of the tree will appear, but you can scroll through all of it.
Located to the right of the tree is the work view which corresponds to the selected tree element. Use the work view to enter data, make selections and turn parameters ON and OFF.

Error / status display
Error messages for the current application are shown in the upper line.
Warnings for the current application are shown in the lower line.
The right part of the two lines contains fields which show all of the active applications.
If the field for an application is green, this means that no errors or warnings are present.
Yellow indicates that there is a warning for the application in question.
Red indicates that there is an error for the application in question.

Softkey labels
There are eight softkeys. The labeling for the softkeys will vary from application to application.

3.1.2.8 Setup Display

Figure 3.1-2 Screen layout for SETUP



Menu bar

The menu bar shows all of the information that is relevant for the SETUP menu.
In this menu, you can operate the hardkeys on the instrument's front panel on-screen using the mouse. This is also necessary in the case of remote operation (e.g. VNC).

Tree and Work View

The tree is arranged on the left side. You can use the tree to navigate in the SETUP menus. You can open and close the existing branches of the tree.
Located to the right of the tree is the work view which corresponds to the selected tree element. In the work view for SETUP, you can input data and make settings that apply to the whole instrument (i.e. all applications).
The user can also get information about the software version used in the instrument.
Calibration routines and software updates are also activated here.

Error / status display

Error messages or messages for the current application are shown in this line.
The right part of the line contains fields which show all of the active applications.

Softkey labels

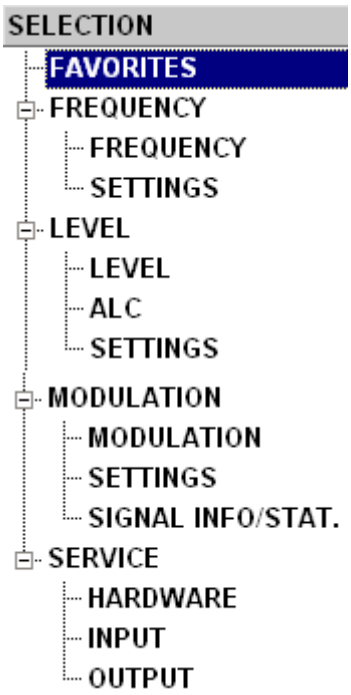
There are six softkeys. The labeling for the softkeys can vary from tree element to tree element.

3.2 Menu and Tree Overview

The menu, setup and trees for various applications are shown below:

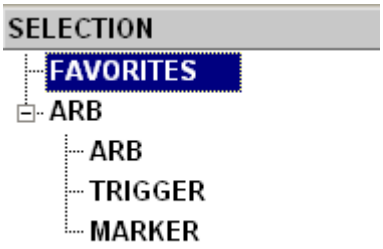
TX tree overview

Figure 3.2-1 The TX menu



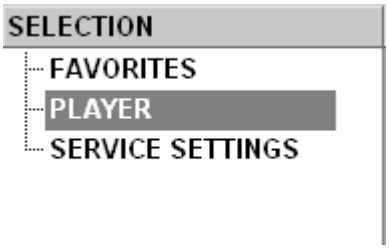
ARB tree overview

Figure 3.2-2 The ARB menu



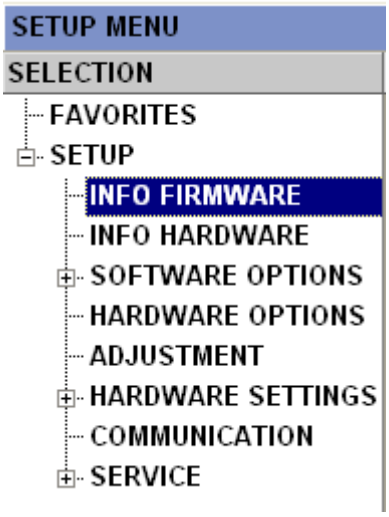
TSGEN tree overview

Figure 3.2-3 The TSGEN / TSREC menu



Setup tree overview

Figure 3.2-4 The Setup menu



3.3 Overview of Keys

The table lists all key functions available on the front panel. The table also gives the PC keyboard key combinations which can be used to trigger the functions of the keys on the front of the instrument.

Key on front panel	With PC keyboard	Function
	Cursor keys	Moves the cursor.
	Backspace	Deletes the last entry (digit, sign or decimal point)
	Enter	Confirms an entry.
	F3	Switches the instrument from remote control to front-panel control
	CTRL + F1	Switches the RF output off and on

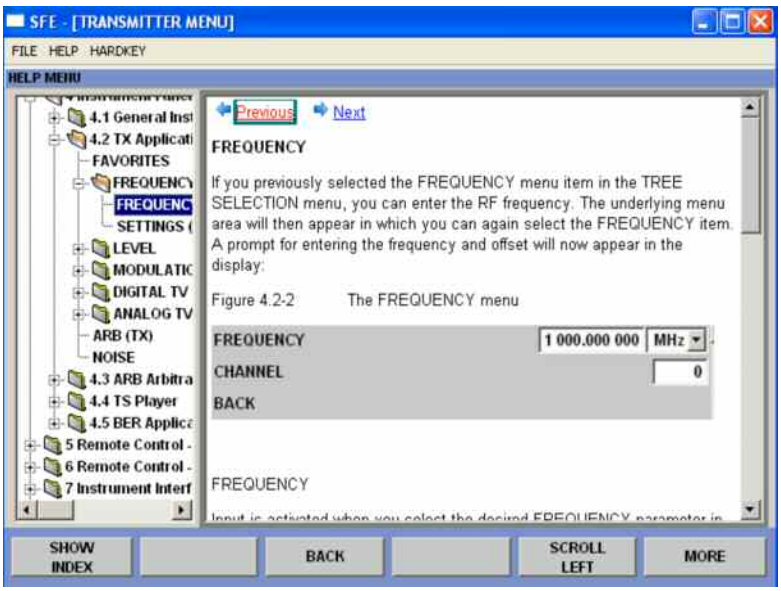
The following virtual keys are available in the case of remote operation. These keys are not available on the front panel:

	F4	Sets the instrument to a defined state.
	F3	Switches from remote control or remote operation to manual operation.
	F2	Starts management of FAVORITES.
	F1	Opens and closes the context-sensitive help function.
	F5	Activates the menu for saving instrument settings.
	F6	Opens the SETUP menu for general instrument settings.
	F8	Resets tree navigation.
	F9	Selects another application.

3.4 Help System

The instrument has a context-sensitive help system. The help system provides a help page for every parameter and can be called up at any time while the instrument is being operated.
The help system has a navigation bar, i.e. starting from the context-sensitive page, you can navigate to other help pages by using the contents list, the index, scroll arrows, and page-internal links.

Figure 3.4-1 Help menu



In addition to the context-sensitive help, online help for all functions of the instrument is compiled on the supplied CD-ROM. This help can be called up on any computer using the Internet Explorer (version 4.0 and higher).

Operating context-sensitive help

Function	Front panel	Mouse
Open help **Help page for selected parameter is displayed.**	Press HELP key.	Click HELP/CONTENTS
Close help	Press HELP key again.	Click HELP/CONTENTS
Activate link Help opens linked page.	Highlight link using rotary knob or arrow keys and activate with rotary-knob click or ENTER key.	Click link.
Scroll through help	Highlight **Previous** or **Next** in help window using cursor keys and activate with rotary-knob click or ENTER key.	Click **Previous** or **Next**.
Select item from contents list Help page for selected item is displayed.	Press **Show Contents** button below index list. Highlight item you want using rotary knob or cursor keys and then press rotary knob or ENTER key.	Click **Show Contents** Click item.
Select index item Help page for selected item is displayed.	Press **Show Index** button below contents. Type desired term in entry field and then press rotary knob or ENTER key or highlight item using rotary knob or cursor keys and then press rotary knob or ENTER key.	Click **Show Index** Click item.

3.5 Remote Operation

The instrument can be remote-controlled from an external PC. This allows the convenient operation of the instrument from the desktop although the instrument is integrated in a rack in the next room.

Remote operation (in contrast to **remote control**) does not use remote-control commands but separate Windows software, which is installed on the external PC.

There are two choices: use of VNC or Remote Desktop.

3.5.1 Remote Desktop

When launched, the Windows XP **Remote Desktop Connection** software simulates the instrument user interface. This allows the instrument to be manually operated from the external computer in the same way as from the instrument itself.

Two preconditions for manual control are a connection between the instrument and the PC via a LAN network and the installation of the software on the PC.

The procedures for setting up a connection and installing the remote operation software on the external computer are described in Chapter 1.

Remote operation is started on the external computer by calling up the **Remote Desktop Connection** program and clicking the **Connect** button. The instrument must be selected for remote operation, i.e. its computer name must be displayed in the **Computer:** window.

If the PC is configured for the remote-control of multiple instruments, the instruments are in the list selected with the button. The user ID and password (**instrument** in both cases) can be stored when the software is first installed. The entries are made in the extended menu "Options>>".

After login, the instrument firmware of the instrument boots on the external PC. After booting is completed, the instrument's screen appears and the instrument is ready for remote operation from the external computer. The start settings that were active before the connection was established are used unless another start setting is explicitly selected in the **File** menu. The individual functions are operated using the mouse and keyboard. Front-panel keys that are not directly available on the keyboard can be substituted by key combinations (see table in the section below).

The device GUI of the instrument is disabled when the connection is set up. Operation from the instrument itself is not possible during remote operation. Access by an external computer and the identity of the remote user is indicated on the login display of Windows XP Embedded.

For return to direct operation on the instrument, the external user must be logged off and the local user logged on.

The external user can log off in the **Start** menu on the external controller by clicking **Disconnect** in the lower right-hand corner of menu.

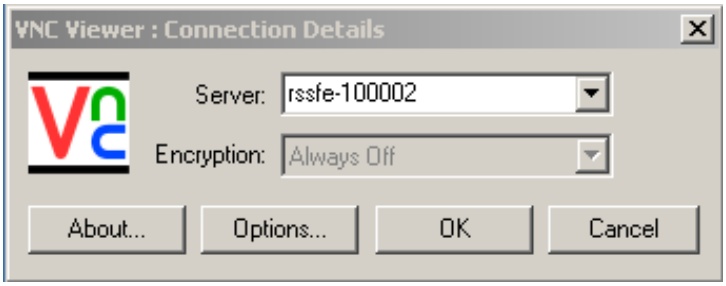
This logoff is also possible in the remote-control message window on the instrument.
Login of the local user is possible only in the remote-control display on the instrument. In the R&S SFE, the local user can log in with the name "**instrument**" as standard; the password is also "**instrument**".

After local login, the instrument software starts with the settings made during remote operation unless another start setup was explicitly selected in the **File** menu.

3.5.2 VNC

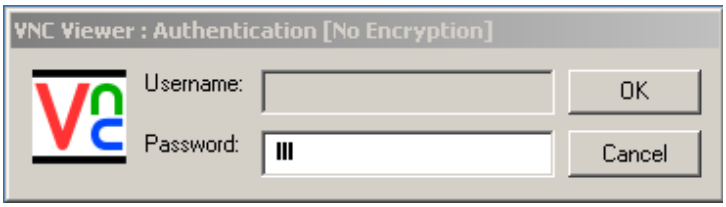
Once it is launched, VNC simulates the user interface of the instrument. This allows the instrument to be manually operated from the external computer in the same way as from the instrument itself. For remote manual control to work, the following requirements must be met: There must be a connection between the instrument and computer via a LAN, the VNC viewer must be installed on the computer, and the VNC server must be installed on the R&S SFE or R&S SFE100.
Remote operation is launched on the external computer by launching the VNC viewer. The R&S SFE must be selected as the instrument for remote operation, i.e. its IP address or computer name must be entered in the Connection details window.

Figure 3.5-1 Connection details



Click OK to establish the connection. You will be prompted for the session password.

Figure 3.5-2 VNC authentication



After you enter the password **SFE**, the screen of the instrument will appear on the external computer.
If you need to directly operate the R&S SFE, it is not necessary to log off the external user.
The external user can end remote operation on the external window by closing the VNC application.