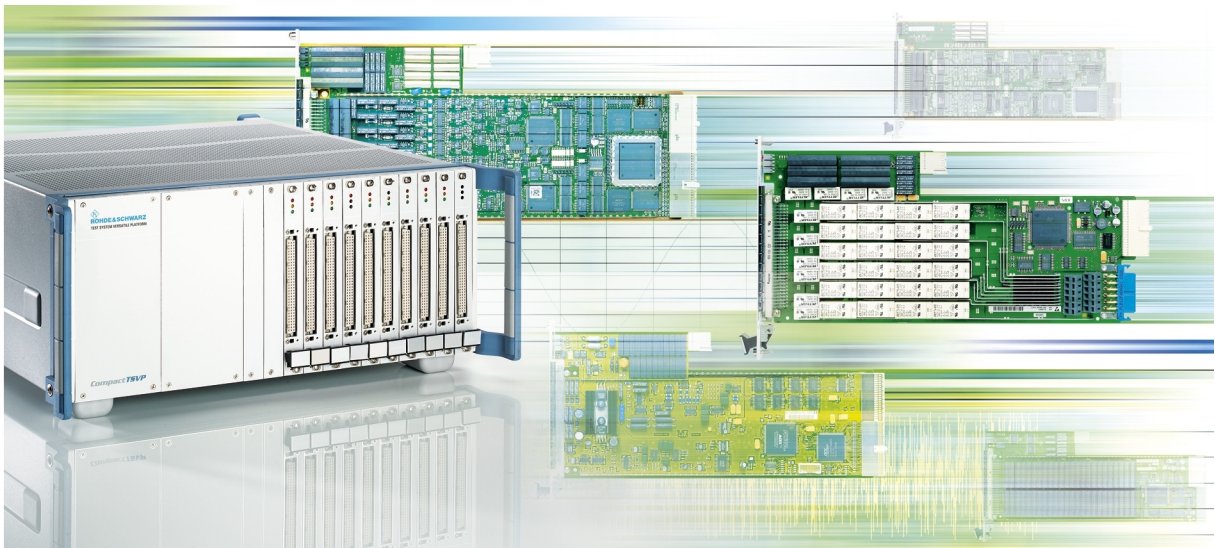


R&S® TS-ISC

TSVP In-System Calibration

User Manual



1505.2802.12 – 08

This manual describes the following R&S articles:

- R&S®TS-ISC In-System Calibration Kit (1505.2502.02)
- R&S®TS-PCAL2 Rear-I/O Module for In-System Calibration (1505.2519.02)
- Cabling Set for In-System Calibration, including
 - R&S®TS-PCALA calibration adapter
 - R&S®TS-PCALB calibration adapter
 - R&S®TS-PCALC calibration adapter
 - R&S®TS-PKL cable for connecting the adapters to the external multimeter
- R&S®TS-PKISC (1505.2560.02)

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

Basic Safety Instructions

Always read through and comply with the following safety instructions!

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

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

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

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

Safety labels on products

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

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

Basic Safety Instructions

Symbol	Meaning	Symbol	Meaning
	Caution ! Hot surface		Alternating current (AC)
	Protective conductor terminal To identify any terminal which is intended for connection to an external conductor for protection against electric shock in case of a fault, or the terminal of a protective earth		Direct/alternating current (DC/AC)
	Earth (Ground)		Class II Equipment to identify equipment meeting the safety requirements specified for Class II equipment (device protected by double or reinforced insulation)
	Frame or chassis Ground terminal		EU labeling for batteries and accumulators For additional information, see section "Waste disposal/Environmental protection", item 1.
	Be careful when handling electrostatic sensitive devices		EU labeling for separate collection of electrical and electronic devices For additional information, see section "Waste disposal/Environmental protection", item 2.
	Warning! Laser radiation For additional information, see section "Operation", item 7.		

Signal words and their meaning

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



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



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



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



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

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

Basic Safety Instructions

Operating states and operating positions

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

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

Electrical safety

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

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

Basic Safety Instructions

6. The product may be operated only from TN/TT supply networks fuse-protected with max. 16 A (higher fuse only after consulting with the Rohde & Schwarz group of companies).
7. Do not insert the plug into sockets that are dusty or dirty. Insert the plug firmly and all the way into the socket provided for this purpose. Otherwise, sparks that result in fire and/or injuries may occur.
8. Do not overload any sockets, extension cords or connector strips; doing so can cause fire or electric shocks.
9. For measurements in circuits with voltages $V_{rms} > 30$ V, suitable measures (e.g. appropriate measuring equipment, fuse protection, current limiting, electrical separation, insulation) should be taken to avoid any hazards.
10. Ensure that the connections with information technology equipment, e.g. PCs or other industrial computers, comply with the IEC 60950-1 / EN 60950-1 or IEC 61010-1 / EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the protective conductor terminal on site and the product's protective conductor must be made first before any other connection is made. The product may be installed and connected only by a licensed electrician.
13. For permanently installed equipment without built-in fuses, circuit breakers or similar protective devices, the supply circuit must be fuse-protected in such a way that anyone who has access to the product, as well as the product itself, is adequately protected from injury or damage.
14. Use suitable overvoltage protection to ensure that no overvoltage (such as that caused by a bolt of lightning) can reach the product. Otherwise, the person operating the product will be exposed to the danger of an electric shock.
15. Any object that is not designed to be placed in the openings of the housing must not be used for this purpose. Doing so can cause short circuits inside the product and/or electric shocks, fire or injuries.
16. Unless specified otherwise, products are not liquid-proof (see also section "Operating states and operating positions", item 1). Therefore, the equipment must be protected against penetration by liquids. If the necessary precautions are not taken, the user may suffer electric shock or the product itself may be damaged, which can also lead to personal injury.
17. Never use the product under conditions in which condensation has formed or can form in or on the product, e.g. if the product has been moved from a cold to a warm environment. Penetration by water increases the risk of electric shock.
18. Prior to cleaning the product, disconnect it completely from the power supply (e.g. AC supply network or battery). Use a soft, non-linting cloth to clean the product. Never use chemical cleaning agents such as alcohol, acetone or diluents for cellulose lacquers.

Operation

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

Basic Safety Instructions

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

Repair and service

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

Basic Safety Instructions

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

Batteries and rechargeable batteries/cells

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

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

Transport

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

Instrucciones de seguridad elementales

Waste disposal/Environmental protection

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

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

Instrucciones de seguridad elementales

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

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

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















Instrucciones de seguridad elementales

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

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

Señalización de seguridad de los productos

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

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

Instrucciones de seguridad elementales

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

Palabras de señal y su significado

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



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



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



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



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

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

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

Estados operativos y posiciones de funcionamiento

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

Instrucciones de seguridad elementales

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

Seguridad eléctrica

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

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

Instrucciones de seguridad elementales

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

Instrucciones de seguridad elementales

Funcionamiento

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

Instrucciones de seguridad elementales

Reparación y mantenimiento

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

Baterías y acumuladores o celdas

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

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

Transporte

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

Instrucciones de seguridad elementales

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

Eliminación/protección del medio ambiente

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

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

Quality management and environmental management

Certified Quality System
ISO 9001

Certified Environmental System
ISO 14001

Sehr geehrter Kunde,

Sie haben sich für den Kauf eines Rohde&Schwarz Produktes entschieden. Sie erhalten damit ein nach modernsten Fertigungsmethoden hergestelltes Produkt. Es wurde nach den Regeln unserer Qualitäts- und Umweltmanagementsysteme entwickelt, gefertigt und geprüft. Rohde&Schwarz ist unter anderem nach den Managementsystemen ISO9001 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. This product has been manufactured using the most advanced methods. It was developed, manufactured and tested in compliance with our quality management and environmental management systems. Rohde&Schwarz has been certified, for example, according to the ISO9001 and ISO 14001 management systems.

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 de ce produit ont été effectués selon nos systèmes de management de qualité et de management environnemental. La société Rohde&Schwarz a été homologuée, entre autres, conformément aux systèmes de management ISO9001 et ISO 14001.

Engagement écologique

- Produits à efficience énergétique
- Amélioration continue de la durabilité environnementale
- Système de management environnemental certifié selon ISO 14001



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.

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1 Usage

1.1 General

This user manual provides all the information required for installation, programming and operation of the TSVP In-System Calibration R&S TS-ISC. It also contains detailed information about the special features of the R&S TS-ISC. All processes described in the manual assume the reader is familiar with personal computers, the Windows XP / Windows 7 operating system and the basic principles of electrical measuring systems in modular form (CompactPCI or PXI modules).

1.2 Description of Product

The TSVP In-System Calibration R&S TS-ISC enables the modules of the R&S CompactTSVP and R&S PowerTSVP production testing platforms to be calibrated in the system and readjusted if required. This means that it is no longer necessary to remove the modules.

1.3 Associated Documentation

The following documentation is to be followed when using the TSVP In-System Calibration R&S TS-ISC:

- R&S Test Management Software G5, Getting Started
- R&S Test Management Software G5, User Manual
- Software Description for Rohde & Schwarz Generic Test Software Library R&S GTSL

1.4 Scope of Delivery

The scope of delivery for the TSVP In-System Calibration R&S TS-ISC includes the following components:

- R&S TS-PCAL2 calibration module
- Adapter and cable

Open the package carefully and check to make certain the hardware inside has been delivered in perfect condition. If the modules included in the delivery show any signs of damage that would interfere with their intended purpose, please contact ROHDE & SCHWARZ Customer Support.



Figure 1-1: R&S TS-PCAL2 calibration module with adapter and cable

1.4.1 R&S TS-PCAL2 Calibration Module

The R&S TS-PCAL2 card provides the signals necessary for calibration. The module includes the following components:

- Floating 5V reference source
- Three reference resistors
- Ground referenced current source (adjustable up to 1 A)
- Floating signal generator

DC:	$\pm 0 \dots 40 \text{ V}$
AC sinusoid:	0 ... 80 Vpp in frequency range 20 Hz ... 50 kHz
	0 ... 2 Vpp in frequency range 20 Hz ... 1 MHz

- Floating measuring system for voltage, current and resistance measurements.
- Relay matrix for connecting the components to the analog bus lines on an R&S TS-PMB module installed in the front of the R&S TSVP

1.4.2 Adapter and Cable

The external multimeter is connected to the different device under tests (DUT) using the cable and adapters. The following adapter components are used:

- Calibration adapter TS-PCALA

- Calibration adapter TS-PCALB
- Calibration adapter TS-PCALC
- Cable for connecting the adapters to the external multimeter

1.4.3 TS-LISC Software License



Starting with GTSL 3.30, no GTSL license is required.

Calibration is carried out using special testing software. The R&S TS-LISC GTSL license is required to operate this software.



License management and the "R&S GTSL License Viewer" are described in section 4 of *Software Description Generic Test Software Library R&S GTSL*.

1.5 System Requirements

To allow calibration of the TSVP modules in the system, the following requirements need to be met:

- R&S TS-PMB module (firmware version 03.01 or higher) installed
- Agilent multimeter 3458 A installed
- "High stability option 002" installed in Agilent multimeter 3458 A, if TS-PIO2 modules are to be adjusted
- GPIB USB-HS or GPIB-PXI module from National Instruments installed
- Windows XP or Windows 7 installed
- A printer must be installed
- GTSL 2.80 or higher installed

2 Commissioning

2.1 Installing the R&S TS-PCAL2 Module

Requirement: Installation of an R&S TS-PMB Matrix Module B



The selected Matrix Module B R&S TS-PMB must have a firmware version of at least 03.01. The firmware can be updated using the "FirmwareUpdate.exe" tool if required.



If an R&S TS-PCAL2 module has been installed, an R&S TS-PDC module must not be installed in the adjacent slots.

The procedure for installing the R&S TS-PCAL2 module is as follows:

NOTICE

Damaged backplane due to bent pins

Bent pins may result in permanent damage to the backplane.

Check the backplane connector for bent pins!

Any pins that are bent must be straightened!

When module is connected, it must be guided with both hands and carefully pressed into the backplane connector.

1. Shut down and turn off the R&S CompactTSVP / R&S PowerTSVP.
2. Select the corresponding rear I/O slot for the R&S TS-PMB matrix module B.
3. Remove the appropriate rear plate section on the R&S CompactTSVP / R&S Power TSVP housing by loosening the two screws.
4. Push in the R&S TS-PCAL2 module with moderate pressure.
5. Securely tighten the upper and lower screws on the front plate of the R&S TS-PCAL2 module.

2.2 Installing the Calibration Software

Installation of the calibration software is described in section 2 of the *Software Description for Rohde & Schwarz Generic Test Software Library R&S GTSL*. In the "Setup - Select Program Components" dialog box, you can select installation of the calibration software.

2.3 Configuring the Test System Environment

The "Tweak TM G5" configuration program is provided for adapting the test program to the infrastructure (unique test system name, drive paths for saving measured results etc.). The settings are subject to various security levels and can only be changed by users who know the associated passwords.

User name	Password
User	-
Test system administrator	_TSAdmin

The other levels are only accessible to program developers.

The configuration program is started using the following entry in the Windows Start menu:

"Start > All Programs > GTSL > Tools > Tweak TM G5"

The following setting should be made:

"Test System > Name"

Specifies the name of the test system.

3 Performing the Calibration

Extensive explanations of how to operate the testing software and interpret the measured results can be found in the following documents:

- R&S Test Management Software G5, Getting Started
- R&S Test Management Software G5, User Manual

The user manuals can be started from the Windows Start menu:

"Start > All Programs > GTSL > Documentation > User Manuals > In-System Calibration"

To calibrate R&S TSVP modules, the steps described in this section must be carried out.

3.1 Starting the Test Program

The program for performing the calibration is started from the Windows Start menu:

"Start > All Programs > GTSL > In-System Calibration"

3.2 Configuring the Test System

The **"Extras" > "System Configuration"** option in the menu opens up a dialog box for displaying the system configuration and changing certain system settings.

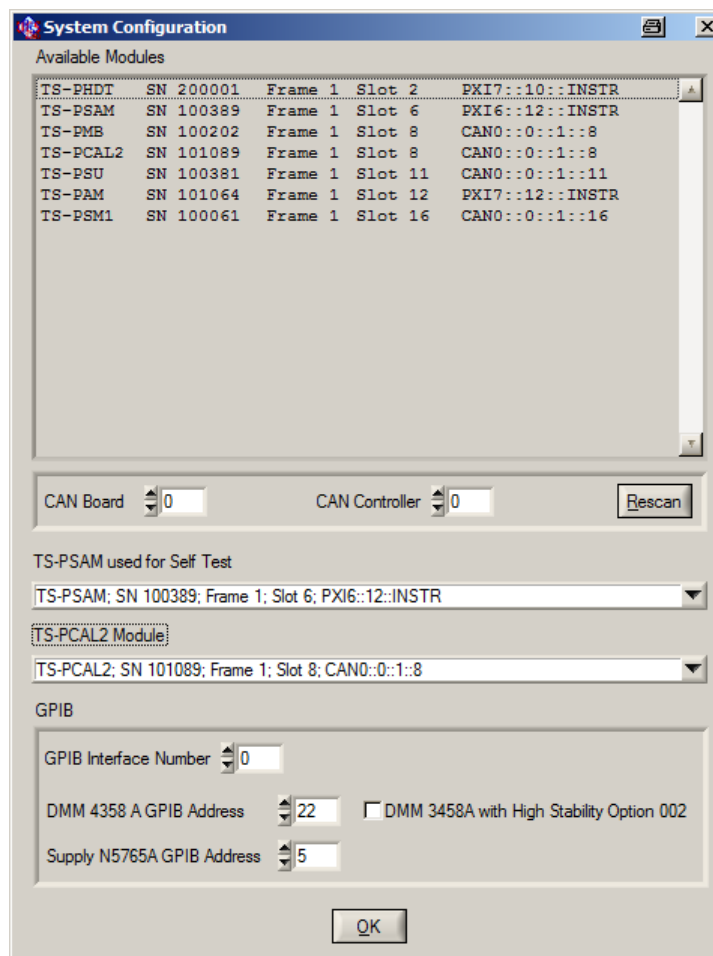


Figure 3-1: System Configuration dialog box

The upper section lists the modules found in the system and supported by the calibration software.

The **"CAN Board"** and **"CAN Controller"** settings relate to the configuration of the CAN bus for the TSVP modules. The default value for these settings is 0. For special system configurations, a different CAN controller can be selected in these fields. The **"Rescan"** button triggers a new search for modules in the system.



A Rescan must always be carried out if the module configuration is changed while the program is running. For example, this is the case if a connected R&S TS-PWA3 frame is turned on or off.

If the system contains several R&S TS-PSAM modules, the **"TS-PSAM used for Self Test"** setting can be used to specify which module will be used for the measurements in the self test. The selected module is also used for calibrating an R&S TS-PICT module.

If the system contains several R&S TS-PCAL2 modules, the **"TS-PCAL2 Module"** setting can be used to specify the one to be used.

The external DMM is controlled via GPIB. The **"GPIB Interface Number"** and **"GPIB Address"** settings are used to configure this interface. In addition, the availability of the "High Stability option 002" is set here.

When you exit the dialog box, the settings are applied and saved on the hard disk when the software is closed.

3.3 Specifying Device Under Test (DUT) and Test Parameters

The **"Edit" > "Configuration Database" > "Open Editor..."** command in the menu opens up a dialog box for selecting the device under test (DUT) and various test parameters.

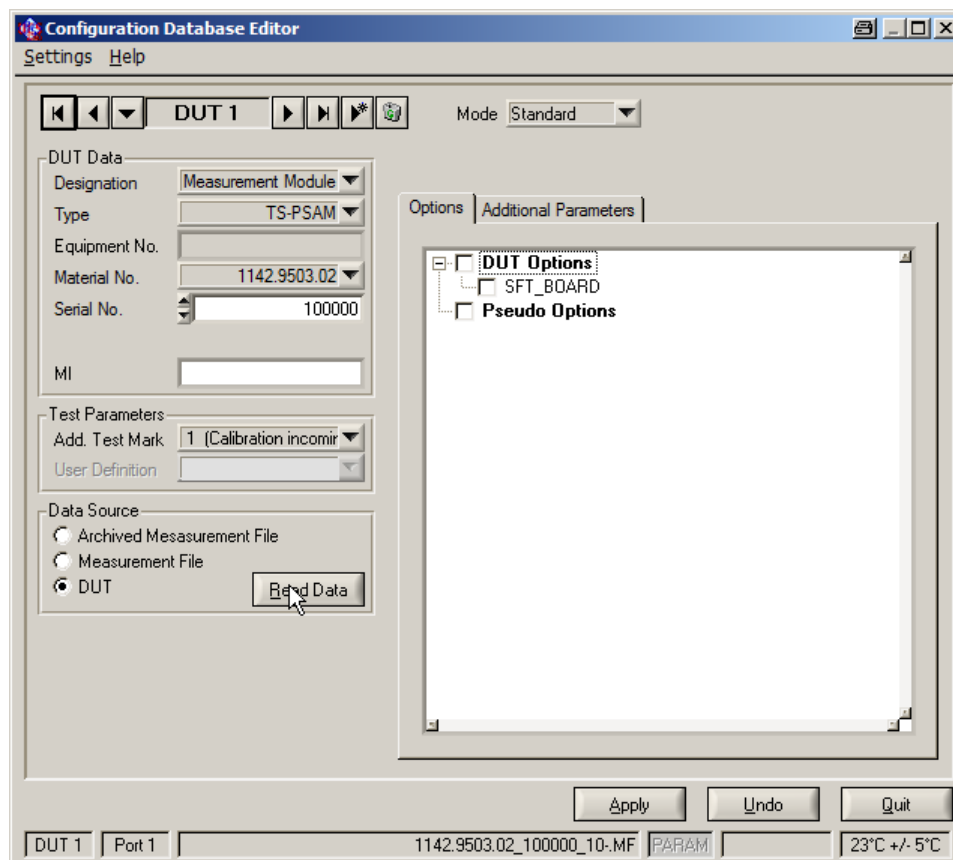


Figure 3-2: Test and Test Report Configuration Data dialog box

The easiest way to select the device under test to the tested is with the **"Read Data"** button in the **"Data Source"** section.

- Selecting **"DUT"** allows the device under test to be selected from the list of modules found in the system.

- Selecting "**Measurement File**" allows the device under test to be selected from a list of available measurement results files. The device under test-specific data in the "**Device Data**" section is then entered automatically.

For very simple device under tests (e.g. R&S TS-PRI0) that do not have an EEPROM, the data in the "**Device Data**" section must be entered manually or by selecting a measurement results file. If the system contains several of these modules the position in the frame can be selected when transferring the device under test data.

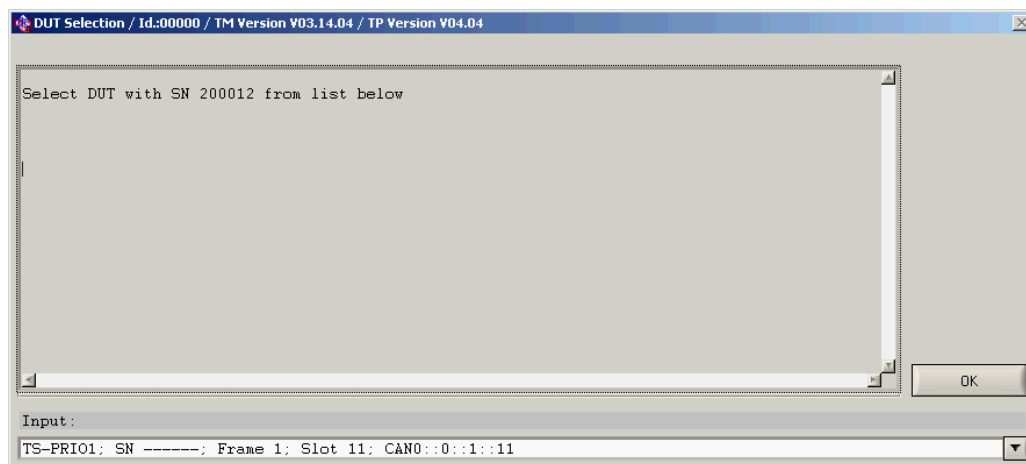


Figure 3-3: Dialog box for assigning the serial number

The "**Test Parameters**" section is used to specify the test conditions. Testing a device under test normally involves an incoming test (Add. Test Mark: "1 (Calibration Incoming Test)") and an outgoing test (Add. Test Mark: "2 (Calibration Outgoing Test)"). The "1" and "2" characters are used to create different names for the measurement results files:

e.g.

1142.9503.02_200000_101.MF Results of incoming test

1142.9503.02_200000_102.MF Results of outgoing test

Depending on the test condition selected, different test sequences are available. For the outgoing test, an adjustment sequence is normally available in addition to the calibration sequence. Only the results of the calibration sequence are entered in the test report.

If results in the incoming test are outside the tolerance range, adjustment of the device under test can be attempted. If the device under test is not defective, this eliminates the deviation.

If all results in the incoming test are within the tolerance range, an outgoing report can be created directly by selecting the "**Calibration Outgoing Test**" test condition and transferring the measurement results from the incoming test.

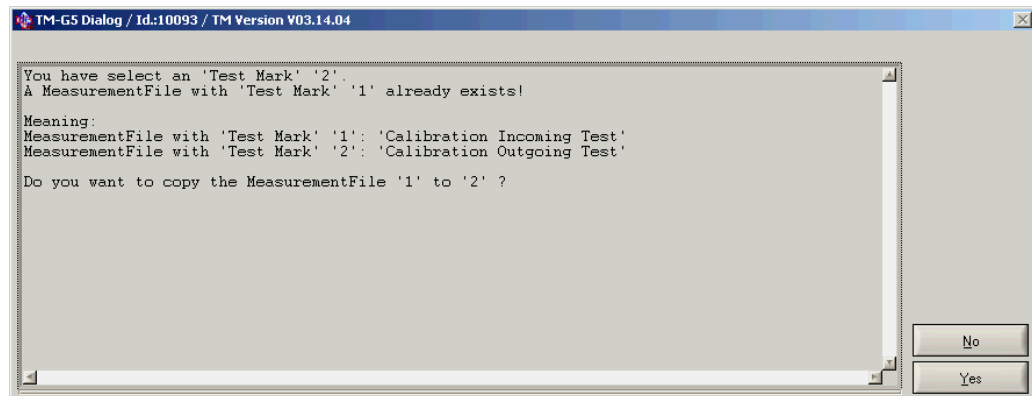


Figure 3-4: Transferring the results of the incoming test

If the device under test has been adjusted, a master test sequence (calibration sequence) must be performed in the outgoing test to verify that the adjustment has been successful and document it.

If a self test connector is available for a device under test, you can select **"SFT_BOARD"** under **"Options"**. In this case, the test cases for which a self test connector is necessary are carried out when running the self test.

The **"Apply"** button applies the changes. Clicking on **"Quit"** closes the **"Test and Test Report Configuration Data"** dialog box.

3.4 Performing the Measurements

3.4.1 Information on External Multimeter 3458A

The external multimeter is operated by the control computer via IEC bus (GPIB) and must be connected accordingly.

The **"Terminals"** switch must be set to match the inputs used. The **"Guard"** switch must be set to the **"Open"** position.

The measuring inaccuracies displayed assume that auto correction (ACAL) has been performed on the external multimeter. Auto correction should be performed at least every 24 hours or after a change of 1 °C in the temperature. The internal temperature of the multimeter is monitored.



The multimeter should be operated in an environment with a stable temperature. In addition, a warming up time of 2 hours should be incorporated.

For determining the uncertainties of measurement with the external multimeter 3458A, we assume that the last external calibration was at the most one year ago and that the calibration standards used featured a traceability identical to that of a manufacturer calibration.

When starting a test or a test sequence, the system checks whether auto correction is necessary.



The software always recommends auto correction after 24 hours. As the multimeter does not have access to time monitoring, the calibration software saves the time of the last prompt to perform auto correction.

For some measurements, "High Stability Option 002" is necessary for the external multimeter 3458A (e.g. adjustment of the R&S TS-PIO2 module). If it is not available, the test case is aborted with an error message.

The test sequence started is not carried out if the software recommends auto correction. Auto correction must be performed manually on the multimeter.

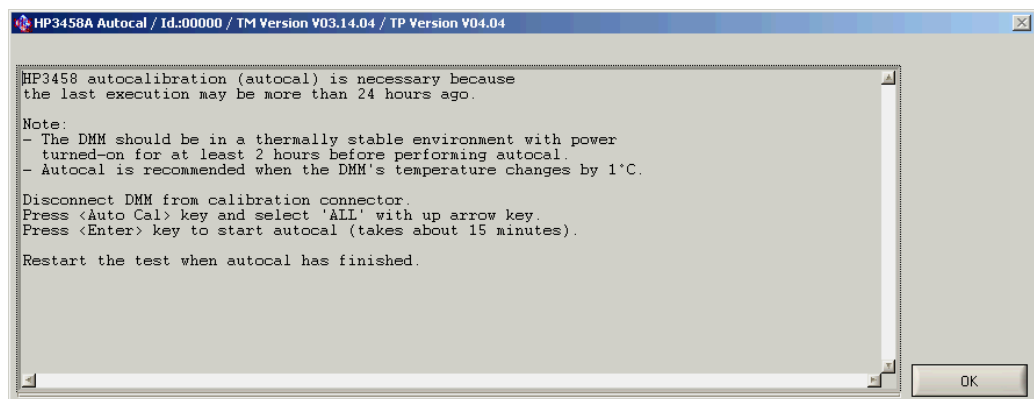


Figure 3-5: Auto correction recommendation

The following steps are necessary for autocorrection:

1. The multimeter must be disconnected from the calibration adapter (TS-PCALA, TS-PCALB or TS-PCALC).
2. Press the "Auto Cal" button and use the up arrow key to select "ALL".
3. Press the "Enter" key to start the process.
4. When auto correction is complete, restart the test sequence.

3.4.2 Starting the Test Sequences

In the TSVP calibration program incoming and outgoing test, the **Master Test Sequence** contains test cases that are necessary to ensure the function and the data sheet specifications of the device under test. User interactions are normally necessary while performing the tests. The additional **Adjustment Sequence** is available for adjusting a device under test. Details of the various modules are described in the following sections.



When calibrating R&S TSVP modules, the test cases are not divided into the **Master Test Sequence** and **Master Test Sequence Appendix**, as described in the R&S Test Management Software documentation.

The easiest way to start the test sequences is via a context menu (right mouse button):

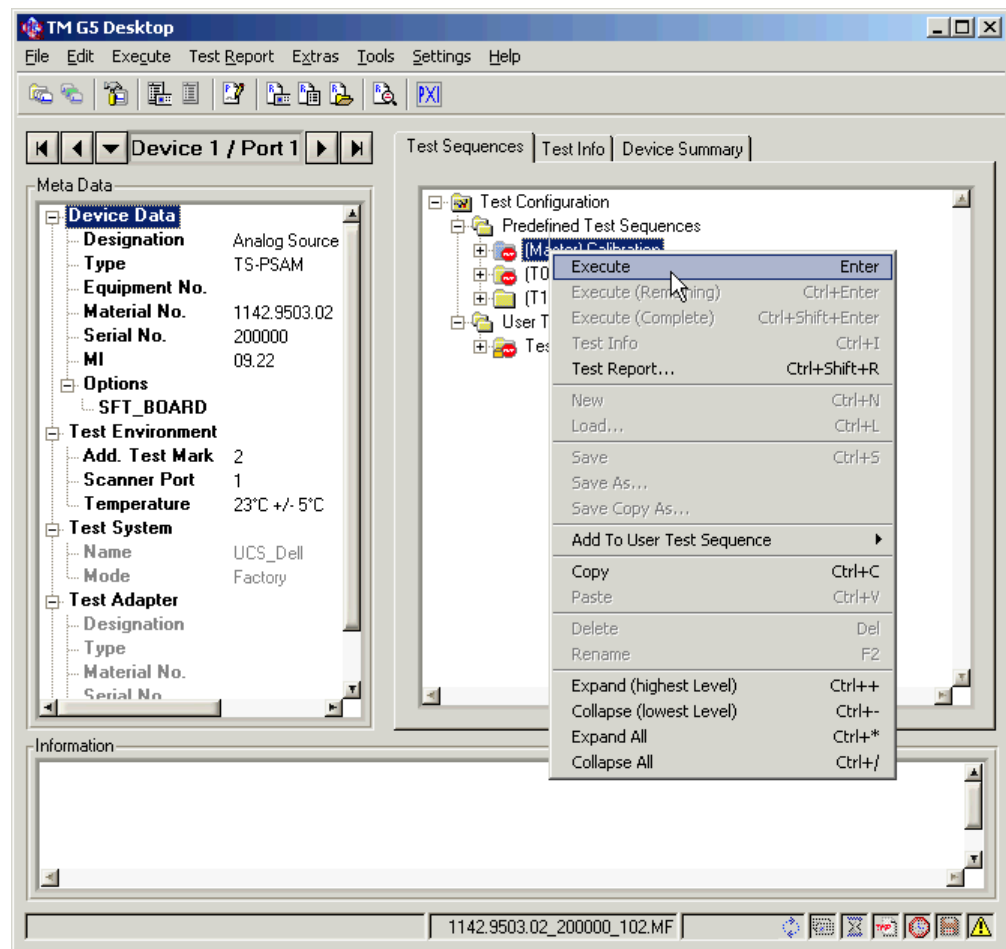


Figure 3-6: Starting a test sequence

Other options for editing and running the test sequences are described in the R&S Test Management Software documentation.

During a test sequence, the user is prompted to connect the TS-PCALA, TS-PCALB and TS-PCALC test adapters to a particular module. The number of the frame and the corresponding slot is specified. In addition, the DMM must be connected to the corresponding test adapter.

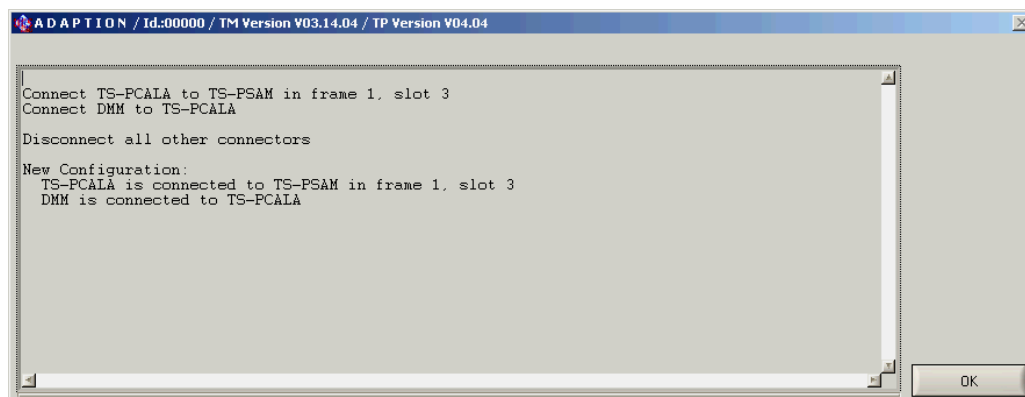


Figure 3-7: Change adapter dialog box

The current adapter is saved by the software. The dialog box is only displayed if a change is required.

NOTICE

Damaged device under test and measuring system

Connecting test adapters when not prompted can lead to incorrect measurements and may cause damage to the device under test or the measuring system.

Connect the test adapter only if a change is required.

3.4.3 Aborting and Interrupting Test Sequences

The "Interrupt Panel" in the R&S Test Management Software can be used to abort or interrupt a test sequence in progress. The details are described in the associated manual.



Figure 3-8: Interrupt Panel

3.4.4 Measurement Results and Test Report

The test results are saved in a measurement results file. The report is generated from this file. As soon as measurement results are available, the current report can be displayed and printed by selecting "Test Report" > "Customer Report" > "Current Device" in the menu.

For the "Self Test" test case, the TSVP self test for the current device under test is performed and a detailed report is generated, which is added to the measurement results file. The self test report can be exported using the paperclip button in the measurement results screen.

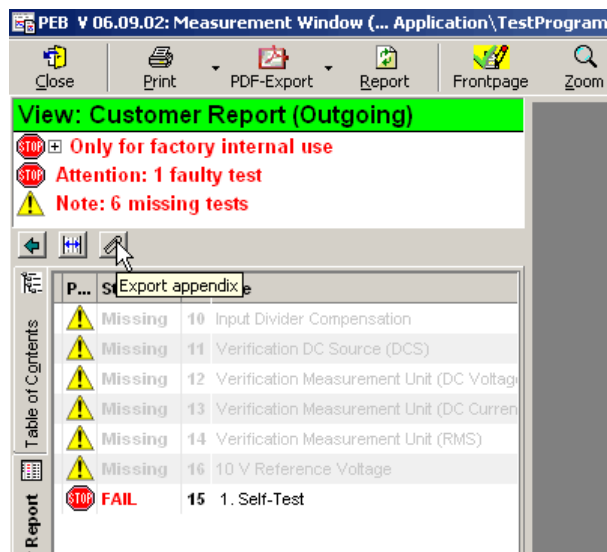


Figure 3-9: Exporting the self test report

Further details of handling the measurement results file (file name, saving, displaying) can be found in the R&S Test Management Software documentation.

4 Calibrating R&S TS-xxx Modules

4.1 R&S TS-PCAL2 with R&S TS-PMB



Before calibrating the R&S TS-PCAL2 module, allow a warming up time of at least one hour.

On the R&S TS-PCAL2 module there are sources and references that are required to calibrate other R&S modules in the R&S CompactTSVP / R&S PowerTSVP. Therefore, it should always be calibrated first to ensure that this module functions correctly.

The associated R&S TS-PMB module connected on the front is used to transmit the signals via the local analog bus to the backplane and via the front connector to the external multimeter. The function of the R&S TS-PMB module must therefore also be ensured.

4.1.1 Incoming Test

The master test sequence includes the calibration sequences and thus all test cases ensuring the values specified in the datasheet of the measurement module.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

4.1.2 Outgoing Test

The master test sequence includes the calibration sequences and thus all test cases ensuring the values specified in the datasheet of the measurement module.

A sequence for adjusting the device under test is also available.

4.2 R&S TS-PSAM



Before calibrating the R&S TS-PSAM module, allow a warming up time of at least 15 minutes.

During the test sequence, the adapters for the external multimeter must be changed several times. For measurements on the attenuator, the polarity of the DMM_HI and DMM_LO lines needs to be exchanged once directly on the multimeter.

4.2.1 Incoming Test

The master test sequence includes the calibration sequence and thus all test cases that ensure the values specified in the datasheet of the R&S TS-PSAM analog stimulus and measurement module.



It is recommended that the entire test sequence is always started, as some tests depend on the completion of previous tests.

If results are outside the tolerance range, adjustment of the R&S TS-PSAM module can be performed in the outgoing test. The measurement results from the incoming test are used to calculate the new correction values.

4.2.2 Outgoing Test

Like the incoming test, the master sequence includes the calibration sequence.

A sequence for adjustment of the R&S TS-PSAM analog stimulus and measurement module is also available. During the adjustment process (test step **"Write Correction Data"**) the results from the calibration sequence and the current correction values are used to calculate new correction values and transfer them to the module. To carry out the adjustment, the entire calibration sequence must therefore have been completed. This can also have been done as part of the incoming test. After adjustment, all results from the calibration sequence are set to invalid. The incoming test report is not changed. However, calibration must be repeated to document the success of the adjustment in the outgoing test report.

The outgoing test provides two other test steps in the **"Additional Tests"** sequence.

- **"Write Neutral Correction Data"**
- **"Compensation Adjustment"** (for modules from version 03.00)

The **"Write Neutral Correction Data"** test resets all correction values in the module EEPROM. As a result, it then needs to be completely readjusted. To do this, the following steps are required in the specified order:

1. Performing the **"Compensation Adjustment"** test (only for modules from version 03.00)
2. Performing the **"Calibration"** test sequence
3. Performing the **"Write Correction Data"** test
4. Performing the **"Calibration Sequence"** again to document the success of the adjustment.



With neutral correction values in the EEPROM, some test cases will fail in the self test.

The **"Compensation Adjustment"** test determines a new setting for the attenuator compensation (only for modules from version 03.00). A new standard adjustment must also be performed after this test.

1. Performing the **"Calibration"** test sequence
2. Performing the **"Write Correction Data"** test
3. Performing the **"Calibration"** again to document the success of the adjustment.

4.3 R&S TS-PFG



Before calibrating the R&S TS-PFG module, allow a warming up time of at least 15 minutes.

4.3.1 Incoming Test

The master test sequence includes all test cases ensuring the values specified in the datasheet of the R&S TS-PFG function generator.

If results are outside the tolerance range, adjustment of the R&S TS-PFG module can be performed in the outgoing test.

4.3.2 Outgoing Test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PFG function generator. After completion, an outgoing report is generated.

A sequence for adjusting the device under test is also available. During adjustment, all results from the calibration sequence are set to invalid. Therefore, calibration must be repeated to document the success of the adjustment.

4.4 R&S TS-PICT



Before calibrating the R&S TS-PICT module, allow a warming up time of at least 15 minutes.

In conjunction with the R&S TS-PSAM measurement module and the R&S EGTSL software, the module is used to realize in-circuit measurements.

In order for the ICT R&S TS-PICT expansion module to be calibrated, a functional R&S TS-PSAM module must therefore be installed in the system. If several R&S TS-PSAM cards are available, the module set in the system configuration is used for the self test.



Calibrating the corresponding R&S TS-PSAM module first is therefore recommended.

4.4.1 Incoming Test

The master test sequence includes all test cases ensuring the values specified in the datasheet of the R&S TS-PICT ICT expansion module.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

4.4.2 Outgoing Test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PICT ICT expansion module. After completion, an outgoing report is generated.

A sequence for adjusting the device under test is also available. If one of the **"Adjustment CMU"** or **"Adjustment AOS"** tests is performed, the existing correction values in the module EEPROM are overwritten with neutral data before the measurements are started. New correction values are available again when the two adjustment tests have been performed successfully. The **"Write Correction Data"** test transfers the new correction values to the device under test.

Performing the entire "Adjustment" sequence is therefore recommended if adjustment of the device under test is required.

During adjustment, all results from the calibration sequence are set to invalid. Therefore, calibration must be repeated to document the success of the adjustment.

4.5 R&S TS-PMB

A function test is performed for the R&S TS-PMB matrix module.

4.6 R&S TS-PSM1

A function test is performed for the R&S TS-PSM1 power switching module.

4.7 R&S TS-PSU, R&S TS-PSU12



Before calibrating the R&S TS-PSU and R&S TS-PSU12 modules, allow a warming up time of at least 15 minutes.

4.7.1 Incoming Test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PSU power supply/load module and the R&S TS-PSU12 12V power supply/load module.



It is recommended that the entire test sequence is always started, as some tests depend on the completion of previous tests.

If results are outside the tolerance range, adjustment of the modules can be attempted in the outgoing test. The measurement results from the incoming test are used to calculate the new correction values.

4.7.2 Outgoing Test

Like the incoming test, the master test sequence includes the calibration sequence.

The "**Adjustment Sequence**" for adjusting the module is also available. The entire calibration sequence must have been completed to perform adjustment (this can also be done in the incoming test). After adjustment, all results from the calibration sequence are set to invalid. The incoming test report is not changed. Therefore, calibration must be repeated to document the success of the adjustment in the outgoing test report.

The "**Write Neutral Correction Data**" test step is available in the "**Additional Tests**" sequence in the outgoing test. This test resets all correction values in the module EEPROM. As a result, the module then needs to be completely readjusted. To do this, the following steps are required in the specified order:

1. Performing the "**Calibration Sequence**" test sequence
2. Performing the "**Adjustment Sequence**" test sequence
3. Performing the "**Calibration**" test sequence again to document the success of the adjustment.

4.8 R&S TS-PAM



Before calibrating the R&S TS-PAM module, allow a warming up time of at least 30 minutes.

The **"DC Accuracy"** sub-sequence in turn consists of two sequences. These sequences for path A and path B in the R&S TS-PAM analyzer module contain two test cases, which must always be performed in the specified order.

4.8.1 Incoming Test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PAM analyzer module.



It is recommended that the entire test sequence is always started, as some tests depend on the completion of previous tests.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test. The measurement results from the incoming test are used to calculate the new correction values.

4.8.2 Outgoing Test

Like the incoming test, the master test sequence includes the calibration sequence.

The **"Adjustment Sequence"** for adjusting the R&S TS-PAM analyzer module is also available. The entire calibration sequence must have been completed to perform adjustment (this can also be done in the incoming test). During adjustment, the measuring channels are first reset. The DAC's must then be measured again and subsequently adjusted. When measuring the DAC's in the **"DAC Calibration"** test, errors can occur. The success of the DAC adjustment is verified in the calibration sequence in the **"DC Accuracy"** test.

After adjustment, all results from the calibration sequence are set to invalid. The incoming test report is not changed. Therefore, calibration must be repeated to document the success of the adjustment in the outgoing test report.

The **"Write Neutral Correction Data"** test step is available in the **"Additional Tests"** sequence in the outgoing test. This test resets all correction values in the module EEPROM. As a result, it then needs to be completely readjusted. To do this, the following steps are required in the specified order:

1. Performing the **"Calibration Sequence"** test sequence
2. Performing the **"Adjustment Sequence"** test sequence

3. Performing the "**Calibration**" test sequence again to document the success of the adjustment.



With neutral correction values in the EEPROM, some test cases are excluded from the self test.

4.9 R&S TS-PSM2

A function test is performed for the R&S TS-PSM2 multiplex/switching module 2.

4.10 R&S TS-PIO2



Before calibrating the R&S TS-PIO2 module, allow a warming up time of at least one hour.

For adjustment of the R&S TS-PIO2 analog/digital IO module 2, the "High Stability Option 002" is necessary for the external multimeter 3458A. If the option is not available, calibration can still be performed. However, the measuring inaccuracy will be increased accordingly. This is indicated once by a dialog box.

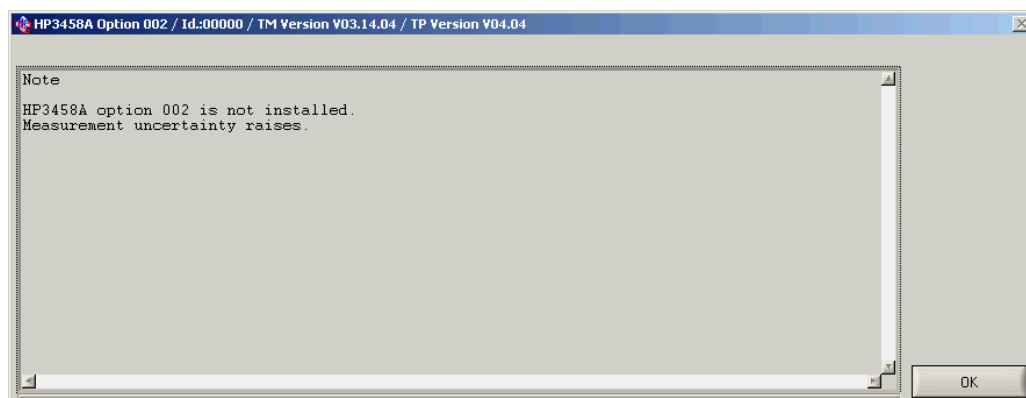


Figure 4-1: Warning Option 002 not installed

4.10.1 Incoming Test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PIO2 analog/digital IO module 2.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

4.10.2 Outgoing Test

Like the incoming test, the master test sequence includes the calibration sequence.

The **"Adjustment Sequence"** is also available for adjustment of the R&S TS-PIO2 analog/digital IO module 2. After adjustment, all results from the calibration sequence are set to invalid. Therefore, calibration must be repeated to document the success of the adjustment in the outgoing test report.

4.11 R&S TS-PRIO

A function test is performed for the R&S TS-PRIO module. However, the relays can only be tested using a self test connector.

As this module does not have an EEPROM, the serial number and the change index must be entered manually. The serial number is logged in the test report. The software does not currently evaluate the change index for this module.

Therefore, this module does not appear in the selection dialog box for the available device under tests if you are attempting to import the device under test data using the **"Read Data"** button.

If the system contains several R&S TS-PRIO modules the position in the frame can be selected when transferring the device under test data.

4.12 R&S TS-PDFT

A function test is performed for the R&S TS-PDFT digital function test module.

4.13 R&S TS-PHDT

A function test is performed for the R&S TS-PHDT high speed digital test module.

4.14 R&S TS-PKISC

Selecting this device under test type allows the TS-PCALA, TS-PCALB and TS-PCALC test adapters to be tested. A test case is also available for the cable between DMM and the test adapter. The sequence for the incoming and outgoing tests has the same structure for these device under tests. Adjustment is not necessary.

4.15 R&S TS-PSM3

To determine the correction values for this module the following measuring instruments are needed:

- Power supply with at least 30 A output current, GPIB interface, SCPI instruction set (e.g. Agilent 5765A)
- Calibration resistor 10 mOhm, 0.03 %, 2 A (e.g. burster 1240-0,01)
- High load calibration resistor 1 mOhm , 0.02 %, 30 A (z.B. burster 1282-0,001)

The following interconnections have to be made:

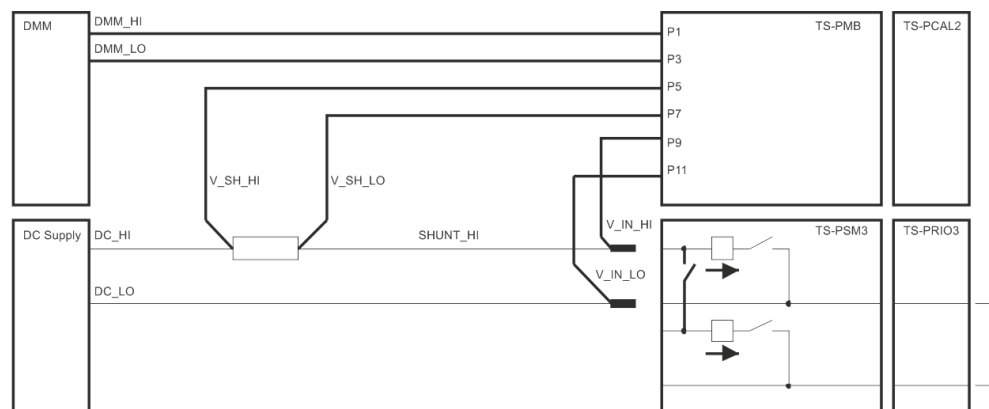


Figure 4-2: Test setup for R&S TS-PSM3

The lines V_IN_HI and V_IN_LO must be contacted directly at the plug contacts of the R&S TS-PSM3.

Since all channels are tested on the module, the manual effort required to contact the external power supply with the test leads is very high.

At R&S TS- PSM3 modules of Variant 02 calibration may be very complicated, since the connection of the power supply by default can not be done via plug contacts. This must be done under certain circumstances with adapter cables.

To check the signal paths via a R&S TS-PRIO3 module following jumpers are necessary on this module:

X12 (2A)

CH1 - CH2

CH3 - CH4

CH5 - CH6

CH7 - CH8

X14 (30A)

CH9 - CH10

CH11 - CH12

CH13 - CH14

CH15 - CH16



When calibrating a R&S TS-PSM3 module no signals must be connected to the rear plugs.



WARNING

Risk of severe burns

During the measurements a maximum current of 30 A can be reached and result in severe burns.

When changing the cabling, the output of the power supply always must be switched off!

4.15.1 Incoming Test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PSM3.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

4.15.2 Outgoing Test

The master test sequence includes the calibration sequence as the incoming test. Additionally the sequence "**Adjustment Sequence**" to adjust the R&S TS-PSM3 module is available. Here correction values are calculated and stored on the module. The correction values are used by a device driver function, which converts the voltages measured at the shunt resistors in current values. After the alignment all the results of the calibration sequence are set to invalid. The calibration has to be repeated in order to document the success of the adjustment in the end test report. The new correction values are calculated with the previously measured voltages and the results are stored in the report.

4.16 R&S TS-PSM4

To determine the correction values for this module the following measuring instruments are needed:

- Power supply with at least 16 A output current, GPIB interface, SCPI instruction set (e.g. Agilent 5765A)
- Calibration resistor 10 mOhm, 0.03 %, 2 A (e.g. burster 1240-0,01)

- High load calibration resistor 1 mOhm , 0.02 % , 16 A (e.g. burster 1282-0,001)

The following interconnections have to be made:

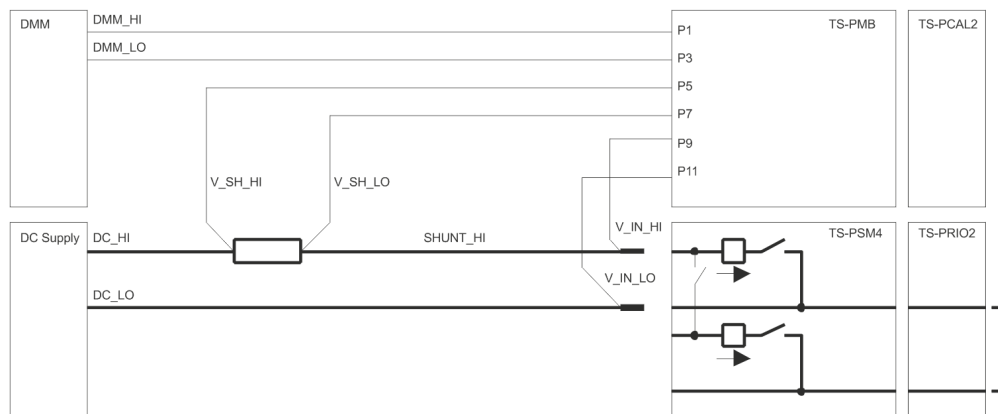


Figure 4-3: Test setup for R&S TS-PSM4

The lines V_IN_HI and V_IN_LO must be contacted directly at the plug contacts of the R&S TS-PSM4.

Since all channels are tested on the module, the manual effort required to contact the external power supply with the test leads is very high.

At R&S TS- PSM4 modules of variant 02 calibration may be very complicated, since the connection of the power supply by default can not be done via plug contacts. This must be done under certain circumstances with adapter cables.

To check the signal paths via a R&S TS-PRIO2 module following jumpers are necessary on this module:

X1, X2 (2A)

CH1 - CH2

CH3 - CH4

CH5 - CH6

CH7 - CH8

X3, X4, X5 (16A)

CH9 - CH10

CH11 - CH12

CH13 - CH14

CH15 - CH16

CH17 - CH18

CH19 - CH20



When calibrating a R&S TS-PSM4 module no signals must be connected to the rear plugs.

WARNING

Risk of severe burns

During the measurements a maximum current of 16 A can be reached and result in severe burns.

When changing the cabling, the output of the power supply always must be switched off!

4.16.1 Incoming Test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PSM4.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

4.16.2 Outgoing Test

The master test sequence includes the calibration sequence as the incoming test. Additionally the sequence "**Adjustment Sequence**" to adjust the R&S TS-PSM3 module is available. Here correction values are calculated and stored on the module. The correction values are used by a device driver function, which converts the voltages measured at the shunt resistors in current values. After the alignment all the results of the calibration sequence are set to invalid. The calibration has to be repeated in order to document the success of the adjustment in the end test report. The new correction values are calculated with the previously measured voltages and the results are stored in the report.

4.17 R&S TS-PSM5

To determine the correction values for this module the following measuring instruments are needed:

- Power supply with at least 50 A output current, GPIB interface, SCPI instruction set (e.g. Agilent 5765A)
- Calibration resistor 10 mOhm, 0.03 %, 2 A (e.g. burster 1240-0,01)
- High load calibration resistor 1 mOhm , 0.02 %, 50 A (z.B. burster 1282-0,001)

The following interconnections have to be made:

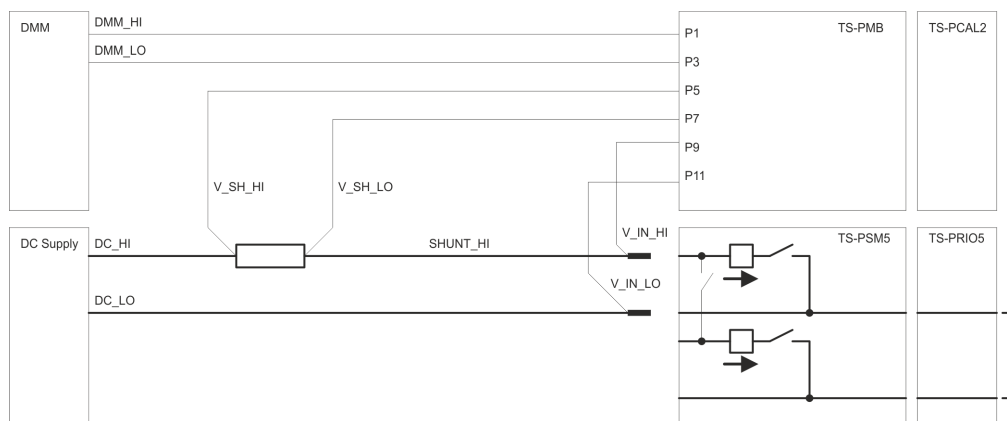


Figure 4-4: Test setup for R&S TS-PSM5

The lines V_IN_HI and V_IN_LO must be contacted directly at the plug contacts of the R&S TS-PSM5.

Since all channels are tested on the module, the manual effort required to contact the external power supply with the test leads is very high.

At R&S TS- PSM5B modules of variant 02 calibration may be very complicated, since the connection of the power supply by default can not be done via plug contacts. This must be done under certain circumstances with adapter cables.

To check the signal paths via a R&S TS-PRIO5 module following jumpers are necessary on this module:

2 A Terminals

CH1 - CH2

CH3 - CH4

50 A Terminals

CH5 - CH6

CH7 - CH8



When calibrating a R&S TS-PSM5 module no signals must be connected to the rear plugs.

⚠ WARNING

Risk of severe burns

During the measurements a maximum current of 50 A can be reached and result in severe burns.

When changing the cabling, the output of the power supply always must be switched off!

4.17.1 Incoming Test

The master test sequence includes the calibration sequence and thus all test cases ensuring the values specified in the datasheet of the R&S TS-PSM5.

If results are outside the tolerance range, adjustment of the module can be performed in the outgoing test.

4.17.2 Outgoing Test

The master test sequence includes the calibration sequence as the incoming test. Additionally the sequence "**Adjustment Sequence**" to adjust the R&S TS-PSM5 module is available. Here correction values are calculated and stored on the module. The correction values are used by a device driver function, which converts the voltages measured in current values. After the alignment all the results of the calibration sequence are set to invalid. The calibration has to be repeated in order to document the success of the adjustment in the end test report. The new correction values are calculated with the previously measured voltages and the results are stored in the report.

4.18 R&S TS-PIO4

A function test is performed for the R&S TS-PIO4 digital function test module.

5 Specifications

The technical data of the TSVP In-System Calibration R&S TS-ISC are shown in the corresponding data sheets. In the event of any discrepancies between data in this user manual and technical data in the data sheet, the data sheet takes precedence.

Table 5-1: Ordering Information

Designation	Type	Order No.
In-System Calibration Kit	R&S TS-ISC	1505.2502.02
ISC Rear I/O Module	R&S TS-PCAL2	1505.2519.02
ISC Cabling Set	R&S TS-PKISC	1505.2560.02
Platform R&S CompactTSVP	R&S TS-PCA3	1152.2518.02

Annex

A Calibration / Adjustment Procedures

A.1 General

Generally, first a **calibration** of the device under test is performed within the scope of an incoming test. For some modules, the measurement results of this test are used for an optional **adjustment**. If measured values are beyond the tolerance range, the device under test can be adjusted in the outgoing test. Following an **adjustment**, the **calibration** must be repeated as part of the outgoing test to document the success.

For TSVP modules, for which adjustment is not intended, the self-test is primarily performed of the calibration sequence. The execution times are documented in this case.

Several user interactions are generally required after the sequences have been started. In the "LED Test", for example, the function of the LEDs on the front of the modules must be confirmed. For this reason, it is best to check the LEDs when the system is switched on.

Before starting the test sequences, take into consideration the heating period of the modules and the external multimeter.

A.2 R&S TS-PCAL2

A.2.1 Calibration

Time min:s	Note
00:00	Start of the sequence
00:05	Adaption: R&S TS-PCALA on R&S TS-PMB
15:15	End of the sequence

A.2.2 Adjustment

Time min:s	Note
00:00	Start of the sequence Adaption: R&S TS-PCALA on R&S TS-PMB
08:00	End of the sequence

A.3 R&S TS-PSAM

A.3.1 Calibration

Time min:s	Note
00:00	Start of the sequence
00:25	Adaption: Plug SFT board (if available)
00:30	Adaption: Remove SFT board, R&S TS-PCALA on DUT
03:30	Adaption: Change HI / LO polarity on the DMM
04:00	Adaption: Change the HI / LO polarity on the DMM, R&S TS-PCALA on R&S TS-PMB
07:15	Adaption: Disconnect R&S TS-PCALA from R&S TS-PMB, R&S TS-PCALC on DUT
12:00	End of the sequence

A.3.2 Adjustment

For this module, in the adjustment process, the topical correction values and the results from the measurements during calibration are used to calculate new correction values and transfer them to the flash memory of the module. For this reason, the calibration sequence must be performed before starting the adjustment.

Time min:s	Note
00:00	Start of the sequence
00:05	End of the sequence

A.4 R&S TS-PFG

A.4.1 Calibration

Time min:s	Note
00:00	Start of the sequence
00:15	Adaption: Plug SFT board (if available)
00:20	Adaption: Remove SFT board, R&S TS-PCALA on DUT

Time min:s	Note
06:00	Adaption: Change R&S TS-PCALA from DUT to R&S TS-PMB
06:15	End of the sequence

A.4.2 Adjustment

Time min:s	Note
00:00	Start of the sequence Adaption: R&S TS-PCALA on R&S TS-DUT
09:00	End of the sequence

A.5 R&S TS-PICT

A.5.1 Calibration

Time min:s	Note
00:00	Start of the sequence
00:10	Adaption: R&S TS-PCALA on R&S TS-PMB
02:30	End of the sequence

A.5.2 Adjustment

Time min:s	Note
00:00	Start of the sequence Adaption: R&S TS-PCALA on R&S TS-PMB
01:30	End of the sequence

A.6 R&S TS-PSU, R&S TS-PSU12

A.6.1 Calibration

Time min:s	Note
00:00	Start of the sequence
00:25	Adaption: Plug SFT board (if available)
00:35	Adaption: Remove SFT board, R&S TS-PCALA on DUT
04:00	End of the sequence

A.6.2 Adjustment

Time min:s	Note
00:00	Start of the sequence
00:05	Adaption: R&S TS-PCALA on DUT
01:00	End of the sequence

A.7 R&S TS-PAM

A.7.1 Calibration

Time min:s	Note
00:00	Start of the sequence
00:25	Adaption: Plug SFT board (if available)
00:30	Adaption: Remove SFT board
00:45	Adaption: R&S TS-PCALC on DUT
25:00	End of the sequence

A.7.2 Adjustment

In the adjustment process, the topical correction values and the results from the measurements during calibration are used to calculate new correction values and transfer them to the flash memory of the module. Subsequently, the DAC's will be calibrated

and the determined correction values transferred to the module. For this reason, the calibration sequence must be performed before starting the adjustment.

Time min:s	Note
00:00	Start of the sequence
00:15	End of the sequence

A.8 R&S TS-PIO2

A.8.1 Calibration

Time min:s	Note
00:00	Start of the sequence
01:50	Adaption: Plug SFT board (if available)
01:55	Adaption: Remove SFT board
02:00	Independent automatic correction (if required)
03:10	Adaption: R&S TS-PCALB on DUT
17:00	End of the sequence

A.8.2 Adjustment

Prior to the measurement, the calibration software checks the temperature stability. Subsequently, the adjustment will be performed. The times stated are based on a properly heated module.

Time min:s	Note
00:00	Start of the sequence
00:05	Adaption: R&S TS-PCALC on DUT
03:45	End of the sequence

A.9 R&S TS-PMB

A.9.1 Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:30	Adaption: Plug SFT board (if available)
00:35	Adaption: Remove SFT board
00:45	End of the sequence

A.10 R&S TS-PSM1

A.10.1 Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:30	Adaption: Plug SFT board (if available)
00:35	Adaption: Remove SFT board
00:45	End of the sequence

A.11 R&S TS-PSM2

A.11.1 Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:30	Adaption: Plug SFT board (if available)
00:45	Adaption: Remove SFT board
00:55	End of the sequence

A.12 R&S TS-PRIO

A.12.1 Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:10	Adaption: Plug SFT board (if available)
00:15	Adaption: Remove SFT board
00:30	End of the sequence

A.13 R&S TS-PDFT

A.13.1 Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:05	Adaption: Plug SFT board 1 (if available)
00:10	Adaption: Remove SFT board 1, plug SFT board 2 (if available)
00:20	End of the sequence

A.14 R&S TS-PHDT

A.14.1 Calibration (Self-Test)

Time min:s	Note
00:00	Start of the sequence
00:25	Adaption: Plug SFT board (if available)
00:30	Adaption: Remove SFT board
00:40	End of the sequence

A.15 R&S TS-PKISC

A.15.1 Calibration

Time min:s	Note
00:00	Start of the sequence
00:05	Adaption: Short-circuiting of the banana plugs of the measurement cable Plug cable on R&S TS-PMB
00:45	Adaption: Plug R&S TS-PCALA on R&S TS-PMB, short-circuited cable on R&S TS-PCALA
01:00	Adaption: Remove short-circuits, connect cable to DMM
01:30	Adaption: Remove R&S TS-PCALA, plug R&S TS-PCALB on R&S TS-PMB, connect to DMM
02:15	Adaption: Remove R&S TS-PCALB, plug R&S TS-PCALC on R&S TS-PMB, connect to DMM
03:15	End of the sequence

A.16 R&S TS-PSM3

A.16.1 Calibration

The time for calibration is approx. 30 minutes.

A.16.2 Adjustment

The time for adjustment is approx. 5 seconds.

A.17 R&S TS-PSM4

A.17.1 Calibration

The time for calibration is approx. 30 minutes.

A.17.2 Adjustment

The time for adjustment is approx. 5 seconds.

A.18 R&S TS-PSM5

A.18.1 Calibration

The time for calibration is approx. 15 minutes.

A.18.2 Adjustment

The time for adjustment is approx. 5 seconds.

A.19 R&S TS-PIO4

A.19.1 Calibration (Self-Test)

Time min:sec	Note
00:00	Start of sequence
02:30	Adaption: Plug SFT - board 1 (if available)
03:00	Adaption: Remove SFT - board 1, plug SFT board 2 (if available)
03:30	End of Sequence