

# R&S® TS-PSAM

## Analog Stimulus Measurement Module

### User Manual



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This manual describes the following R&S®TSVP module:

- R&S®TS-PSAM

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

# 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)

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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.

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- 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 (povos 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 ISO 9001 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.

### Europe, Africa, Middle East

Phone +49 89 4129 12345  
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# 1 Usage

## 1.1 General

The R&S TS-PSAM Analog Stimulus and Measurement Module is a measurement module for the R&S CompactTSVP. The module is used to perform analog measuring tasks, in-circuit measurements, and the R&S CompactTSVP self-test. The module's floating DC supply voltage is provided via the associated R&S TS-PDC rear I/O module.

The R&S TS-PSAM module is inserted in the front of the R&S CompactTSVP chassis. It is based on the cPCI/PXI standard.

The front connector ends flush with the front panel of the R&S CompactTSVP chassis and is used for contacting the test products or measurement sensors. At the back, the R&S TS-PSAM module is connected to the cPCI control bus and the PXI trigger bus. Instead of using the front connector, analog measurement signals can be routed via the R&S CompactTSVP's analog measuring bus.

A LabWindows IVI DMM driver is provided for the DMM functions on the card. All other functions are controlled using specific extensions of the driver. As is typical for a LabWindows CVI driver, Function Panels and Online Help are available.

## 1.2 Features of the R&S TS-PSAM

### 1.2.1 Hardware Components

The R&S TS-PSAM modules includes a ground-connected discharge circuit, a floating programmable voltage source, and a floating measurement unit. These components can be switched to the R&S CompactTSVP's analog bus via a relay matrix. Measuring tasks can be synchronized using the trigger lines across the PXI bus and the trigger inputs on the front connector. Two relay multiplexers with four channels each are also provided. The major features of these three function blocks will be explained in detail in the following section:

#### floating DC voltage source (DCS)

- adjustable voltage and current limiting
  - $\pm 5$  V, 100 mA max.
- fast settling time
- four-quadrant operation
- sense wires

**floating measurement unit (MU)**

- Measurement range DC
  - 10 mV - 125 V
  - 1  $\mu$ A - 1 A
- Measurement range AC rms<sub>rms</sub>
  - 20 mV - 125 V
  - 100  $\mu$ A - 1 A
- triggered measurements across the PXI Triggerbus
- 2 triggers derived from the measurement signal with programmable threshold
- 4 filters
- 16-bit converter
  - Sampling rate 200 kHz (max. )
  - Single or „multipoint“ measurement with storage depth up to 8 k samples

**Discharge circuit (DCH)**

- Discharge current 400 mA (max. )
- Discharge voltage 125V (max. )

## 1.2.2 Applications

On this topic see also [Figure 1-1](#) to [Figure 1-6](#).

The module is used to perform analog measuring tasks, in-circuit measurements, and the R&S CompactTSVP self-test. In these tests, the module functions as a measuring device with adjustable sampling rate for voltage, current and resistance measurements. The measurement unit and the adjustable DC voltage source are cross-connected with each other in a suitable manner for measuring resistance. If necessary, the source can also be connected with GND. The measurement unit and the DC voltage source can also be operated independently of one another. In the in-circuit test (ICT), the R&S TS-PSAM module performs the following measuring tasks:

- Discharging capacitors
- 2- and 4-wire resistance measurements ([Figure 1-1](#) to [Figure 1-4](#))
- Contact test
- Short circuit test
- Connection test

### 1.2.2.1 Examples of use

On this topic see also [Figure 1-1](#) to [Figure 1-4](#)

Resistance measurements are taken with the aid of the DC voltage source and the measurement unit. 2- and 4-wire measurements are possible. Two different procedures may be followed depending on the resistance value to be measured. If necessary, the source can be connected to GND.

- **Mode C** for small resistances  
In this method, a constant current is applied and the voltage is measured. (see [Figure 1-1](#) and [Figure 1-2](#))

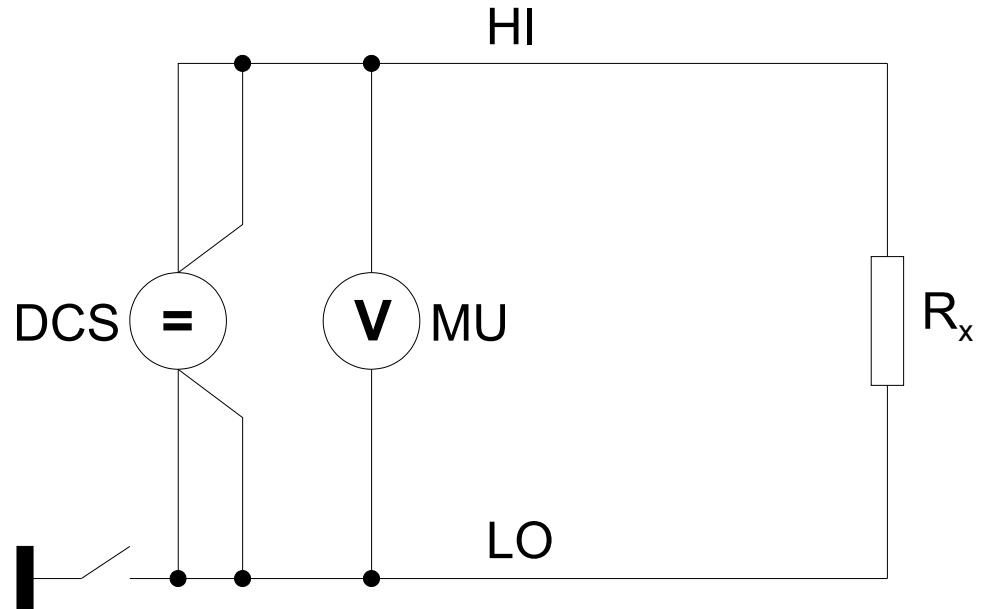


Figure 1-1: Cross-connection for 2-wire resistance measuring in Mode C

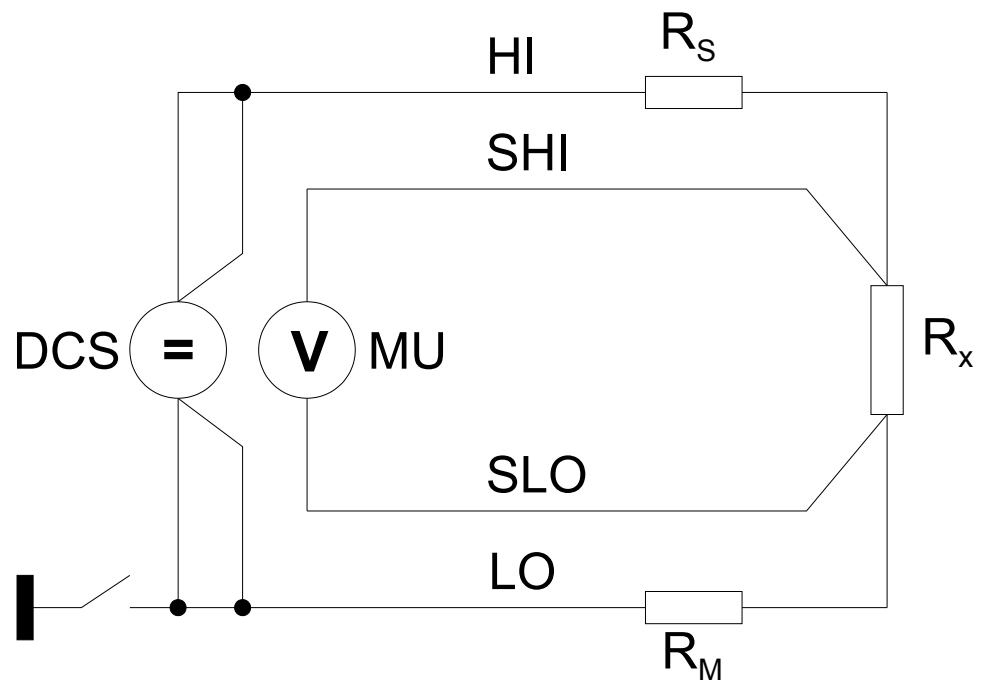


Figure 1-2: Cross-connection for 4-wire resistance measuring in Mode C

- **Mode V** for large resistances

In this method, the voltage is applied and the current is measured. (see [Figure 1-3](#) and [Figure 1-4](#))

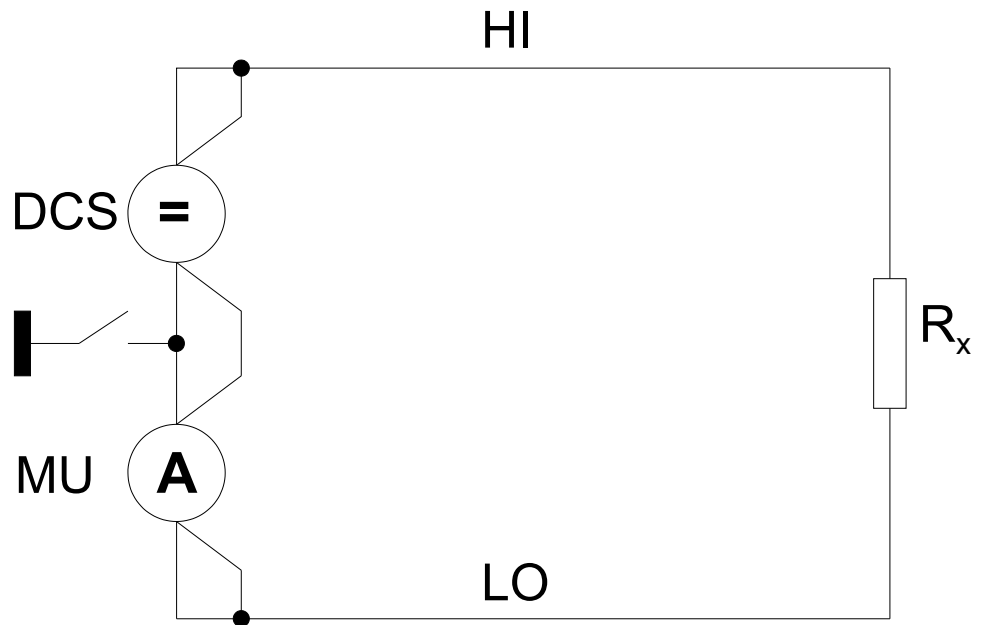


Figure 1-3: Cross-connection for 2-wire resistance measuring in Mode V

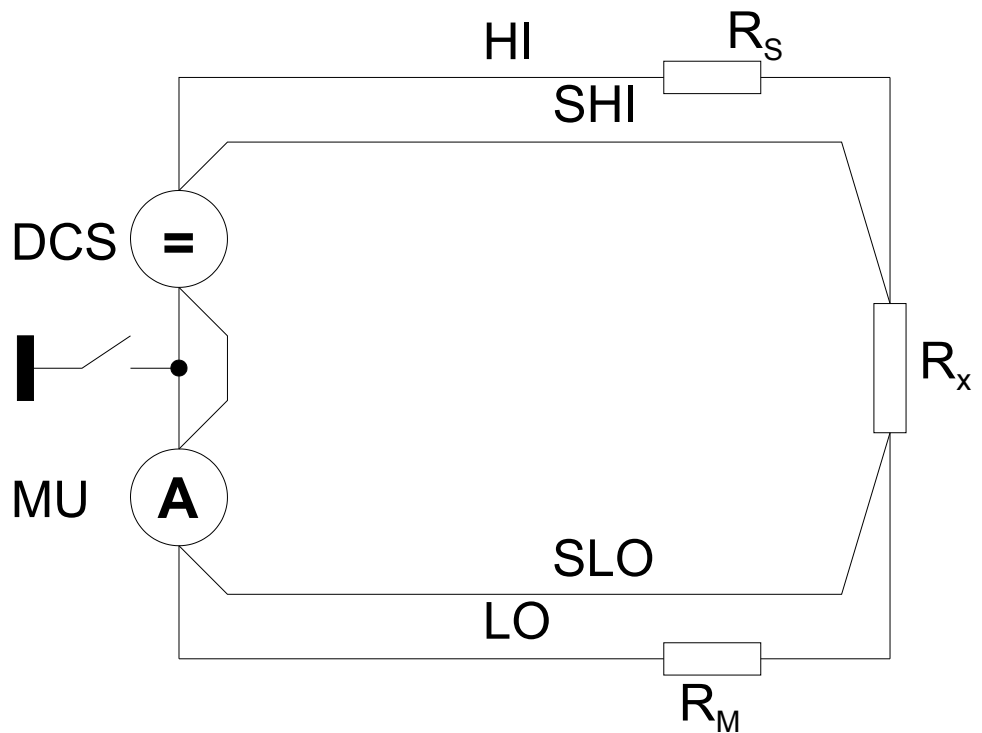


Figure 1-4: Cross-connection for 4-wire resistance measuring in Mode V

### 1.2.2.2 Expanded applications

On this topic, see also [Figure 1-5](#) and [Figure 1-6](#)

Further in-circuit measurements can be made in conjunction with the R&S TS-PICT module (ICT expansion module). These are:

- Diode and transistor test
- Guarded resistance measurements (3, 4 and 6 wires)
- Impedance measurements (3, 4 and 6 wires)

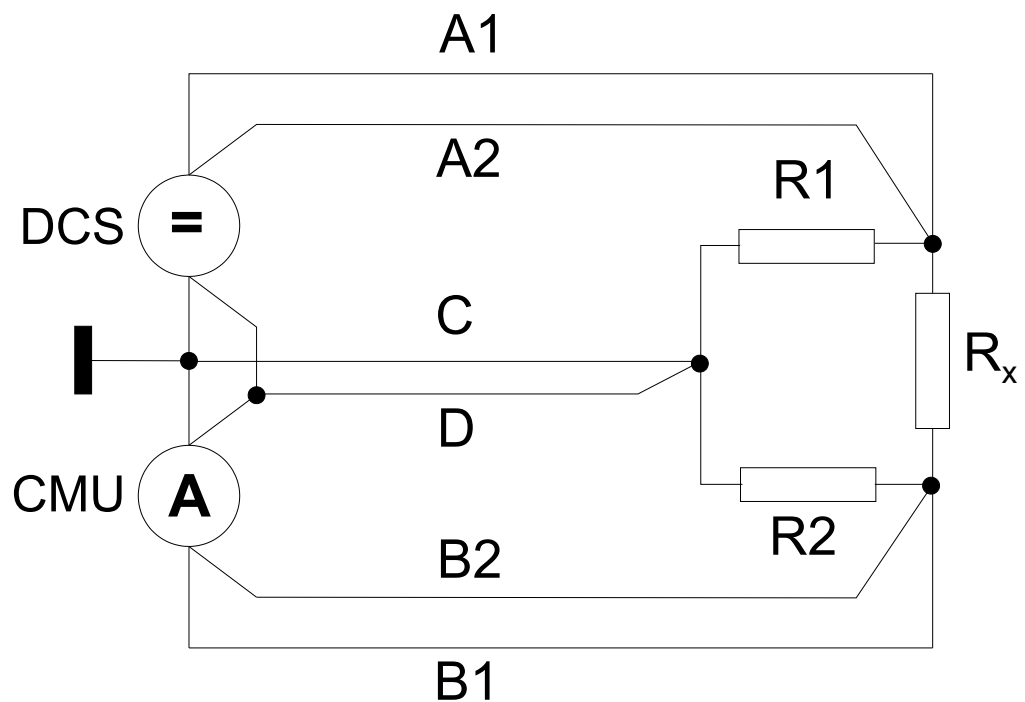
For this purpose, the R&S TS-PICT module provides a special AC voltage source (AOS) and current measurement unit (CMU).

The UUT is connected for the in-circuit test (ICT) via the R&S TS-PMB module (matrix module B).

#### Examples of use

On this topic, see also [Figure 1-5](#) and [Figure 1-6](#)

The following section presents some examples of cross-connection for guarded measurements.



*Figure 1-5: Cross-connection in a guarded resistance measurement (6-wire)*

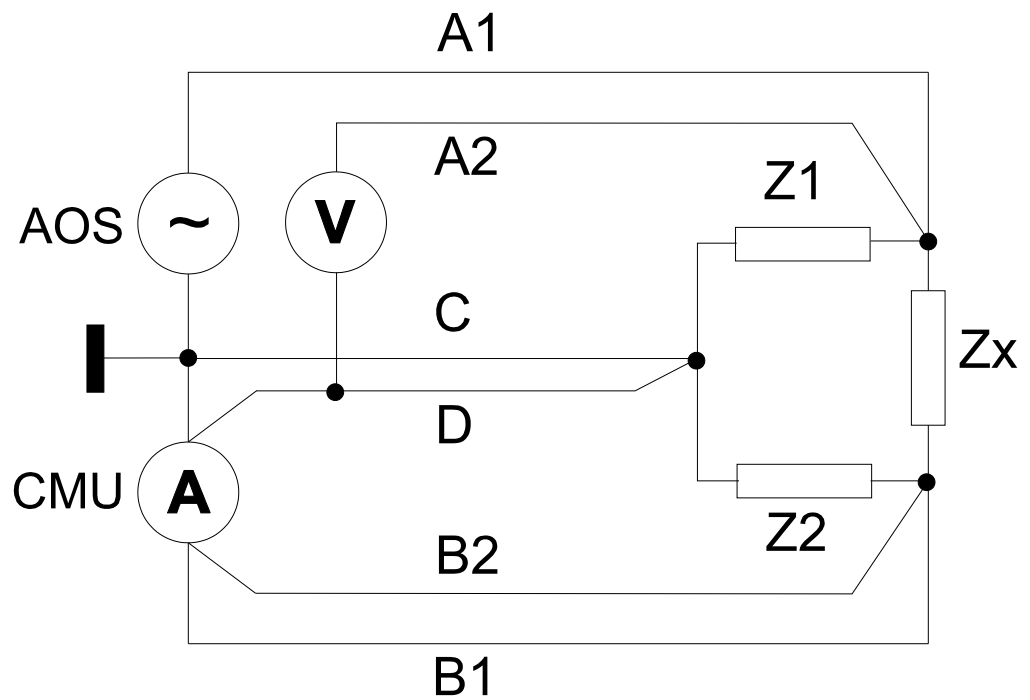


Figure 1-6: Cross-connection in a guarded impedance measurement (6-wire)

### 1.2.3 Features of the R&S TS-PDC Module

The R&S TS-PDC module is used as an floating DC voltage source for the R&S TS-PSAM module. It is configured with two identical DC/DC converters. The following floating direct voltages are obtained from an input voltage of 5 VDC:

- +15 VDC  $\pm 5\%$ , 0,5A (2x)
- -15 VDC  $\pm 5\%$ , 0,5A (2x)
- +5 VDC  $\pm 5\%$ , 0,5A (2x)
- +3,3 VDC  $\pm 5\%$ , 0,25A (2x)



## 2 View

Figure 2-1 shows the R&S TS-PSAM module without the associated TS-PDC rear I/O module. The R&S TS-PDC rear I/O module is shown in Figure 2-2.



*Figure 2-1: View of the R&S TS-PSAM module*

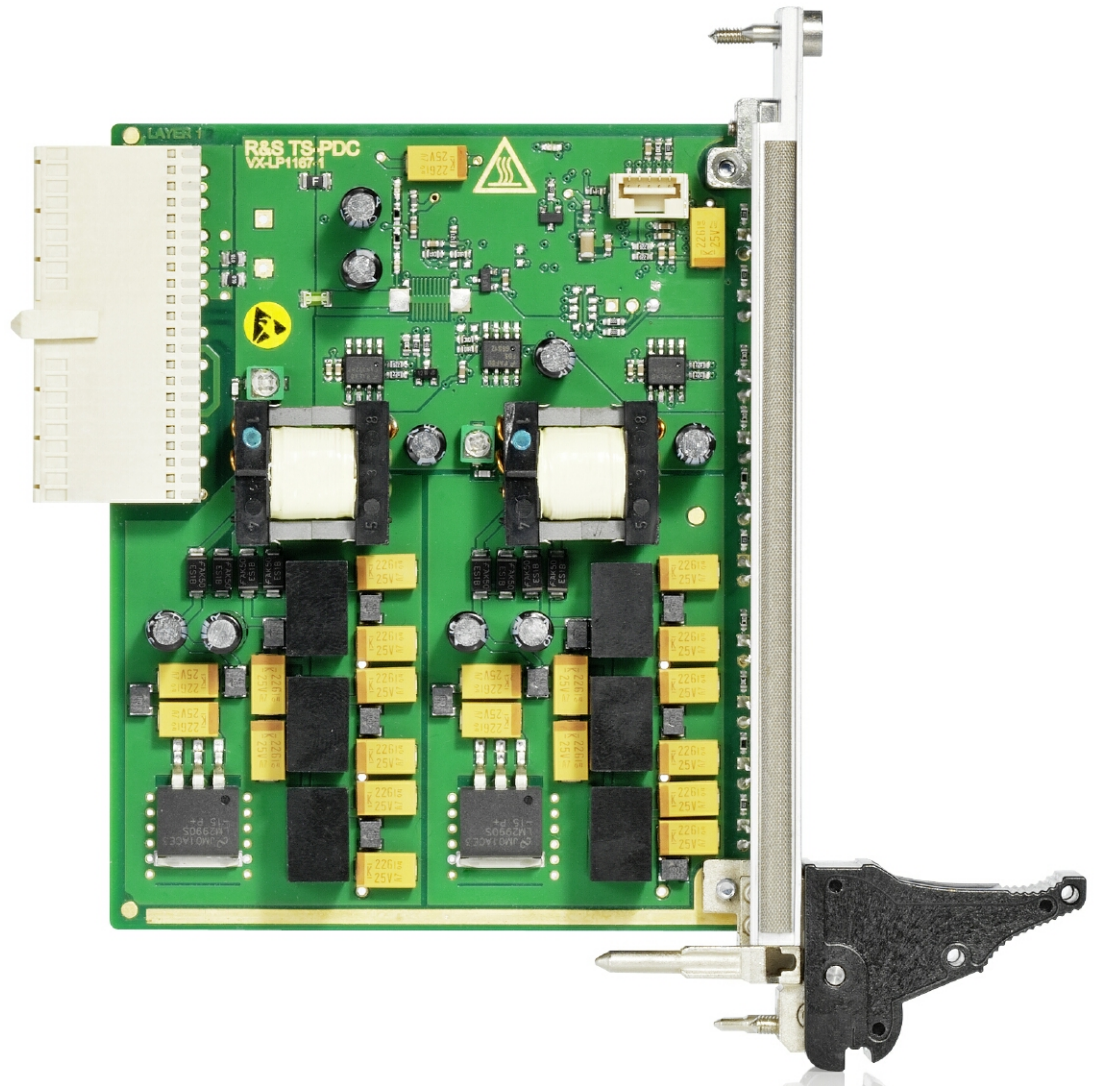


Figure 2-2: View of the R&S TS-PDC rear I/O module.



The Module R&S TS-PDC exists in 3 different models:

- Grouted in a black housing - version up to 1.8 (1157.9804.02 obsolete)
- Encapsulated in metal housing with cooling fins - version 1.9 (1157.9804.02 obsolete)
- Without case - version from 2.0 (1157.9804.12 actual version)

### 3 Block diagrams

Figure 3-1 shows the block diagram of the R&S TS-PSAM module and Figure 3-2 shows the block diagram of the R&S TS-PDC module. Figure 3-3 is a simplified functional block diagram of both modules in the R&S CompactTSVP.

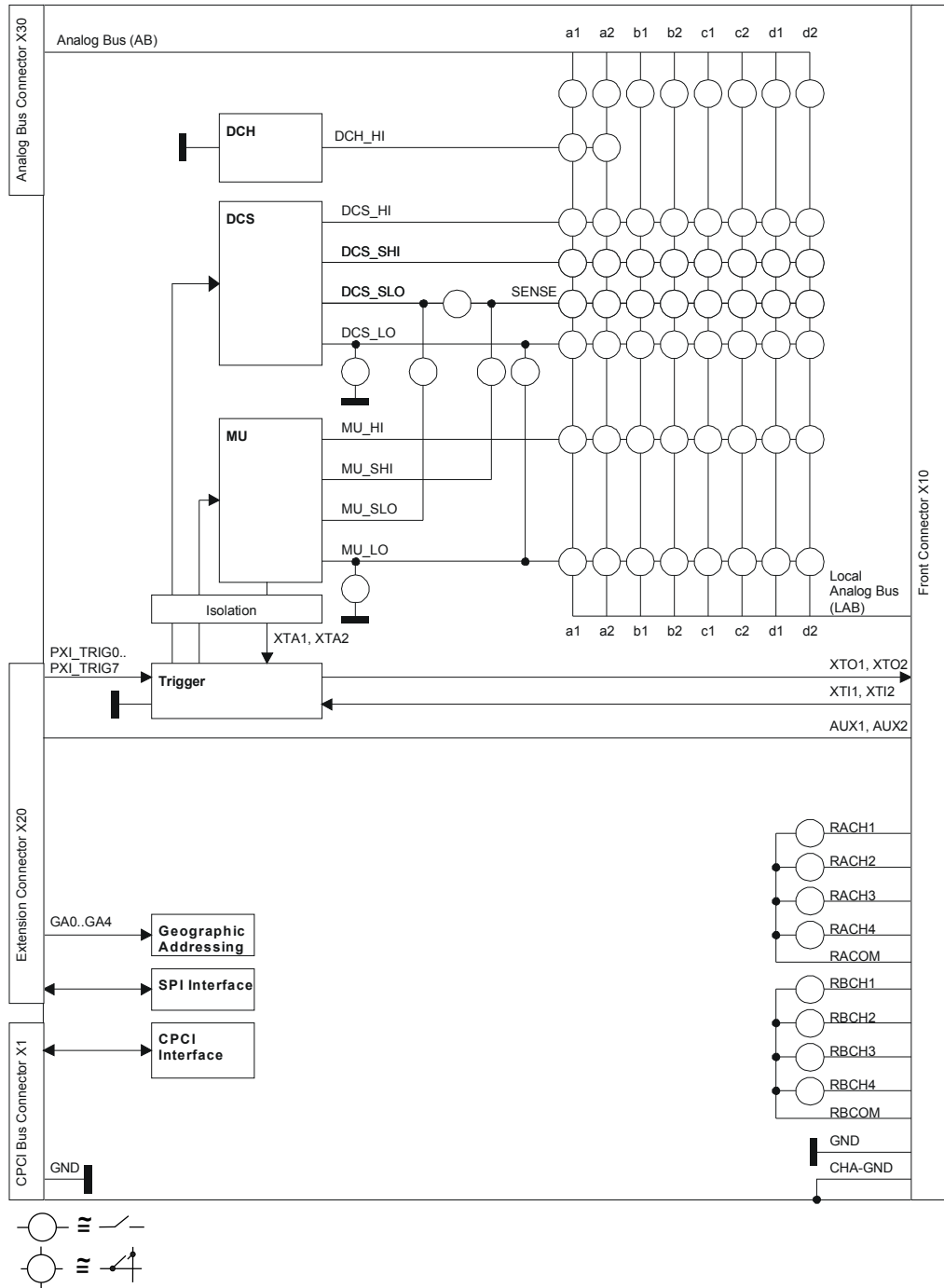


Figure 3-1: Block Diagram of R&S TS-PSAM

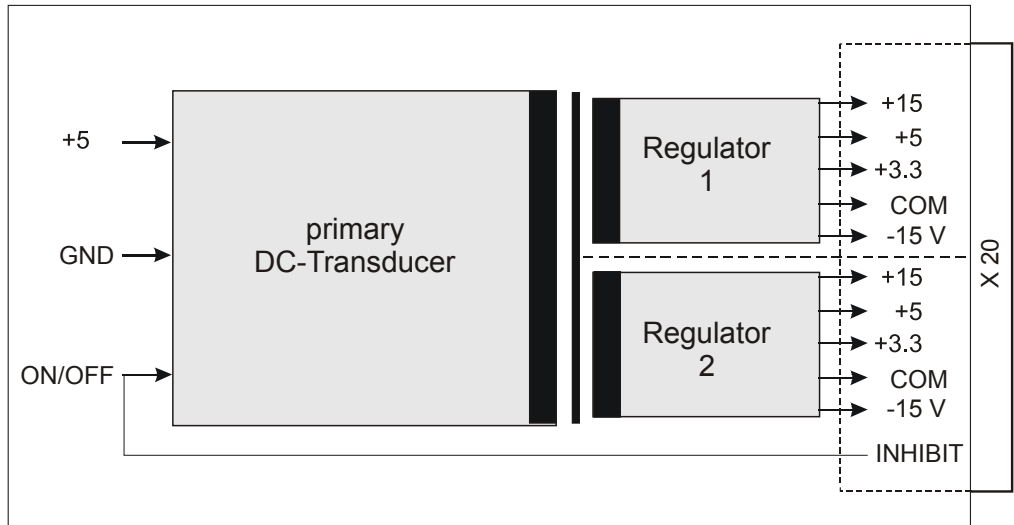


Figure 3-2: Block Diagram of R&S TS-PDC

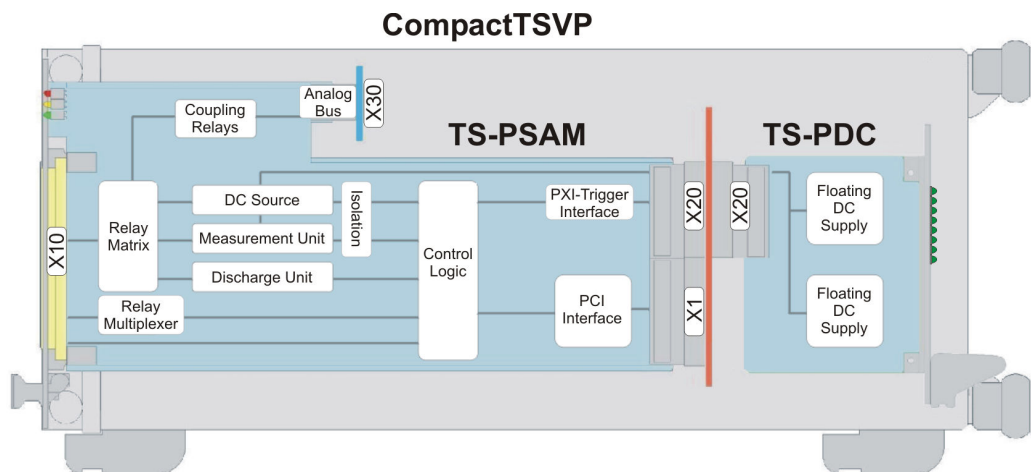


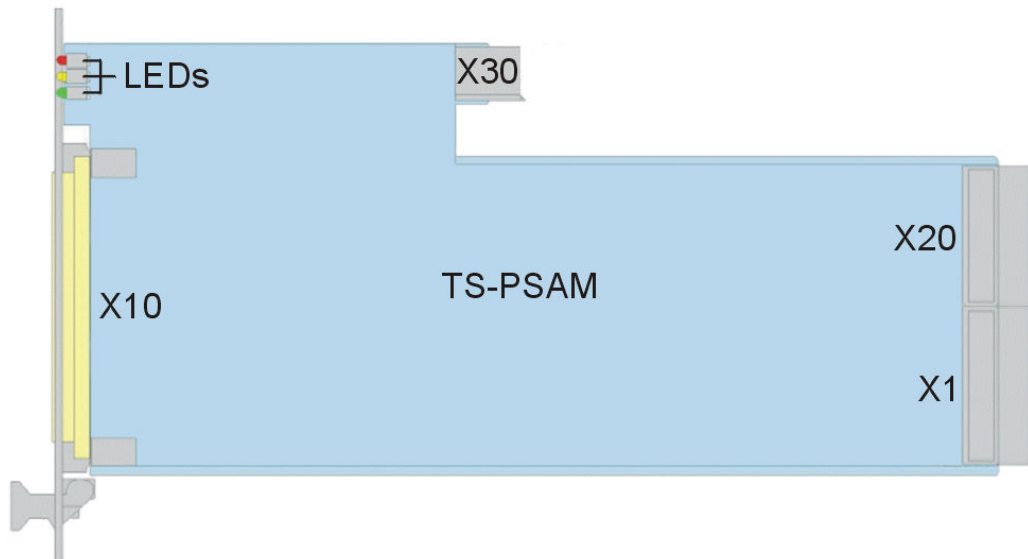
Figure 3-3: Functional block diagram of R&S TS-PSAM with R&S TS-PDC in the R&S CompactTSVP

## 4 Layout

### 4.1 Mechanical construction of the R&S TS-PSAM

On this topic, see also [Figure 4-1](#)

The R&S TS-PSAM module is designed as a long cPCI plug-in module for mounting in the front of the R&S CompactTSVP. The board height of the module is 3 HU (134 mm). In order to ensure that it is inserted correctly into the Compact TSVP, the front panel is furnished with a locating pin. The module is secured in place with the two retaining screws on the front panel. Front connector X10 is used for connecting the UUTs. Connector X30 connects the R&S TS-PSAM module to the analog bus backplane in the R&S CompactTSVP. Connectors X20/X1 connect the R&S TS-PSAM module to the cPCI backplane/PXI control backplane.



**Figure 4-1:** Arrangement of connectors and LEDs on the R&S TS-PSAM module

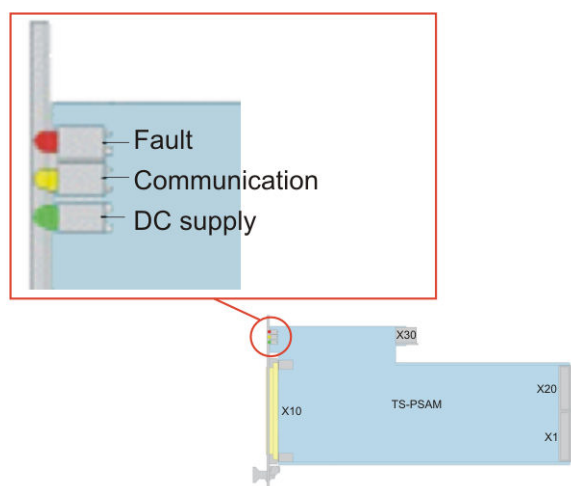
**Table 4-1:** Connectors on the R&S TS-PSAM module

Symbol	Use
X1	cPCI Bus
X10	UUT
X20	Extension (PXI), Rear I/O
X30	Analog Bus

## 4.2 Display elements on the R&S TS-PSAM Module

On this topic, see also [Figure 4-2](#)

Three light-emitting diodes (LEDs) are located on the front of the R&S TS-PSAM module to show the current status of the module. These LEDs have the following meanings:



**Figure 4-2: Arrangement of LEDs on the R&S TS-PSAM module**

**Table 4-2: LEDs on the R&S TS-PSAM module**

LED	Description
red	Fault condition (ERR): Lights up when a fault is detected on the R&S TS-PSAM module during the power-on test after the supply voltage is switched on. This means that there is a hardware problem on the module. (see also <a href="#">Chapter 8, "Self-Test"</a> , on page 29)
yellow	Communication (COM): Lights up when data is exchanged across the interface.
green	Supply voltage OK (PWR): Lights up when all necessary supply voltages are present (inc. the R&S TS-PDC voltages).

## 4.3 Mechanical construction of the R&S TS-PDC

On this topic, see also [Figure 4-3](#)

The R&S TS-PDC module is a rear I/O module for mounting in the back of the R&S CompactTSVP. The board height of the module is 3 HU (134 mm). The module is secured in place with the two retaining screws on the front panel. Connector X20 connects the R&S TS-PDC module to the extension backplane in the R&S CompactTSVP.

The R&S TS-PDC module must always use the corresponding rear I/O slot for the main module (e.g. R&S TS-PSAM module).

### NOTICE

The R&S TS-PDC module must always be inserted in the corresponding rear I/O slot (same slot code) of the R&S TS-PSAM module.

If modules are inserted incorrectly (e.g. cPCI/PXI standard modules in the front), both modules may be damaged irreparably.

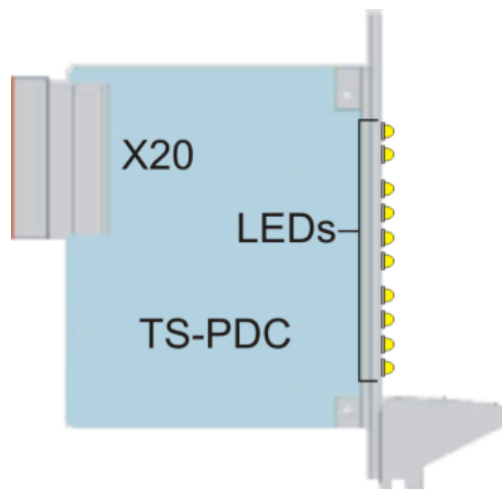


Figure 4-3: Arrangement of the connector and LEDs on the R&S TS-PDC module

Table 4-3: Connector for the R&S TS-PDC module

Symbol	Use
X20	Extension (Rear I/O)

## 4.4 Display elements of the R&S TS-PDC Module

### 4.4.1 R&S TS-PDC Version lower than 2.0 (1157.9804.02)

The actual status of the module is signaled by 8 green LEDs, whereat each LED indicates the presence of an output voltage.

In fault-free operation all 8 LEDs must light up simultaneously.

### 4.4.2 R&S TS-PDC from Version 2.0 (1157.9804.12)

The actual status of the module is signaled by 10 LEDs.

In the switched-on state the green LED PWR indicates the power-on state. In fault-free operation additionally the 8 green LEDs for each generated output voltage light up.

In the case of overload or over temperature the module shuts down by itself. The error is signaled by the red LED ERR.



Figure 4-4: LEDs on the R&S TS-PDC module from Version 2.0



## 5 Function Description

### 5.1 Function description of the R&S TS-PSAM Module

On this topic, see also [Figure 5-1](#) and [Figure 5-2](#)

#### 5.1.1 Primary matrix and analog measuring bus

On this topic, see also [Figure 5-1](#)

The stimulus and measurements can be cross-connected in any permutation through a full matrix to a local analog bus (8-wires LABx). The discharge circuit can only be connected to wires a1 and a2. Cross-connection to the TSVP's analog measuring bus is possible via separate bus coupling relays.

##### Configuration relays

The following relays are used for internal configuration:

- Ground relays
- MU and DCS configuration relays

#### NOTICE

Configuring the R&S TS-PSAM for current or resistance measurements causes the input of the measurement unit to become lowly resistive. An external voltage applied to the input will therefore lead to a current flow through the instrument, which may destroy the relays on the module. It is therefore strongly recommended to configure the R&S TS-PSAM for "voltage measurement" before the input is connected with the test points.

#### 5.1.2 Voltage and current measurement unit (MU)

(MU = Measurement Unit)

AC and DC voltages and currents are measured with the MU. Both MU inputs can be switched to the local 8-wire analog bus via the full matrix.

##### DC voltage measurement

The DC voltage measurement unit is a floating measuring device with programmable pre-filtering and adjustable input voltage ranges. Analog/Digital conversion is performed with a serial A/D converter whose output data are stored in a FIFO memory.

Low Pass Filter (-3 dB): (MU Filter)	4 ranges, 400 Hz, 4 kHz, 40 kHz, 100 kHz (the same applied for current measurements)
Overvoltage protection:	200 V max.

Analog bandwidth (-3 dB):	>500 kHz
A/D converter:	Resolution: 16-bit sampling rate: 200 kHz max.
FIFO:	8 k

### AC voltage measurement

AC voltage is measured using an RMS-to-DC converter. AC voltage that is present at the inputs is converted to a DC output voltage that is proportional to the real RMS value of the input signal. The converted DC output voltage is processed by the A/D converter.

### DC current measurement

The measurement unit for current is capable of taking readings in a range from a few hundred nanoamperes to a 1 A. It can be switched to the 8-wire analog bus without limitation through a full matrix. Currents larger than 100 mA are measured using a shunt resistor. On the other hand, currents smaller than 100 mA are measured actively using a current-voltage converter (I/U converter).

### AC current measurement

The AC current is converted to an AC voltage using a shunt or I/U converter; the AC voltage is converted to a DC voltage with an RMS-to-DC converter, and the DC voltage is processed by the A/D converter.

## 5.1.3 DC stimulus source (DCS)

(DCS = DC Source)

The DCS is a potentialless, programmable DC voltage source with adjustable current limiting and sense wires for compensating voltage drops in circuits to the load. Depending on the test requirements, it can function either in voltage mode or in current limiting mode.

### DC stimulus source specification

**Table 5-1: Voltage mode**

Voltage range:	0 ... $\pm 5$ V
Current:	0 ... $\pm 100$ mA max.

**Table 5-2: Current limiting mode**

Voltage range:	$\pm 0,1$ V ... $\pm 5$ V max.
Current limit ranges:	$\pm 100$ mA, 10 mA, 1 mA, 0,1 mA

### 5.1.4 Resistance measurement

With the DC Stimulus (DCS) and current measurement unit (MU), resistances can be measured in the following ways:

- A known DC voltage  $V_s$  is applied to the resistor that is to be measured and the resulting current is measured with the MU.
- A known DC current  $I_s$  is applied to the resistor via the DCS and the resulting drop in voltage at the resistor is measured with the MU.

### 5.1.5 Discharge unit DCH

(DCH = Discharge Unit)

The discharge unit is provided to allow the controlled discharge of capacitors on the UUT, to prevent the circuit relays in the test system from being irreparably damaged or the UUT from becoming charged as a result of the test procedure. For this purpose, a constant discharge current is generated with an active current limiter. The circuit is protected against overload by an integrated heat cutout. The residual voltage after discharge is typically less than 100 mV. The DCH can be connected to the local analog bus via relays.

In order to minimize loading on the circuit relays, the circuit path should be set first, before the DCH is activated.

**Table 5-3: Specifications**

Discharge current ranges: (typical)	400 mA, 275 mA, 150 mA und 10 mA
Discharge mode	Constant current
Maximum voltage:	±125 VDC
Discharge residual voltage	<100 mVDC
Discharge power: (average)	2 W max.
Überspannungsschutz	200 VDC max.
Overvoltage protection	Thermal sensor

### 5.1.6 Trigger logic

On this topic, see also [Figure 5-2](#)

The R&S TS-PSAM module can be synchronized with other system components by trigger signals from the PXI trigger bus, or by local trigger events or “software triggers”. In all such events, the R&S TS-PSAM module can function as a “trigger master” or “a trigger slave”.

#### Trigger inputs

The internal FPGA Hardware uses the global trigger input signals from the PXI trigger bus (PXI\_TRIG0 ... PXI\_TRIG7) and the local TTL trigger inputs on the front connector (XTI1, XTI2). In addition, the trigger signals (XTA1, XTA2) derived from the analog

input signal and the four internal feedback trigger circuits of the trigger logic blocks (IT01 ... IT04) are all used to detect a trigger event. The signals to be considered and their levels (high/low) are selected in configuration registers.

### Trigger logic blocks

The FPGA contains four independently functioning trigger logic blocks for generating complex trigger sequences:

1. Multiple trigger pulses with various delay periods and the same time reference
2. Cascade triggers
3. Multiple trigger pulses with adjustable duty factor
4. Trigger logic blocks 3 and 4 are reserved for internal use (DCS, ADC), blocks 1 and 2 are available to the user

### Trigger outputs

The outputs from the trigger logic blocks can be switched to the trigger outputs on the front connector (XTOx) and to the PXI trigger bus (PXI\_TRIGx). The polarity of the trigger signal is programmable. The trigger output signals are TTL compatible and are buffered using driver circuits.

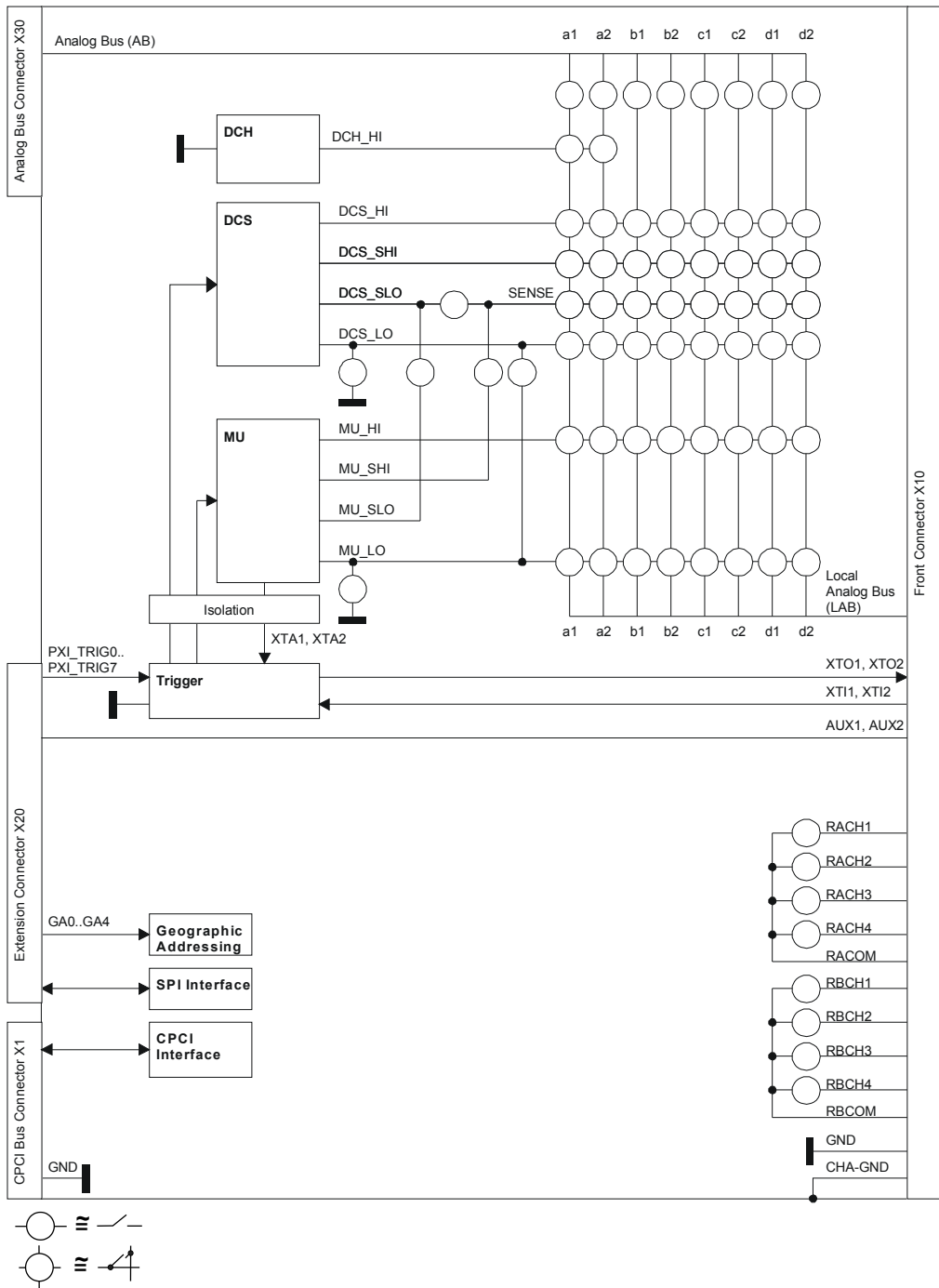


Figure 5-1: Block Diagram of R&S TS-PSAM

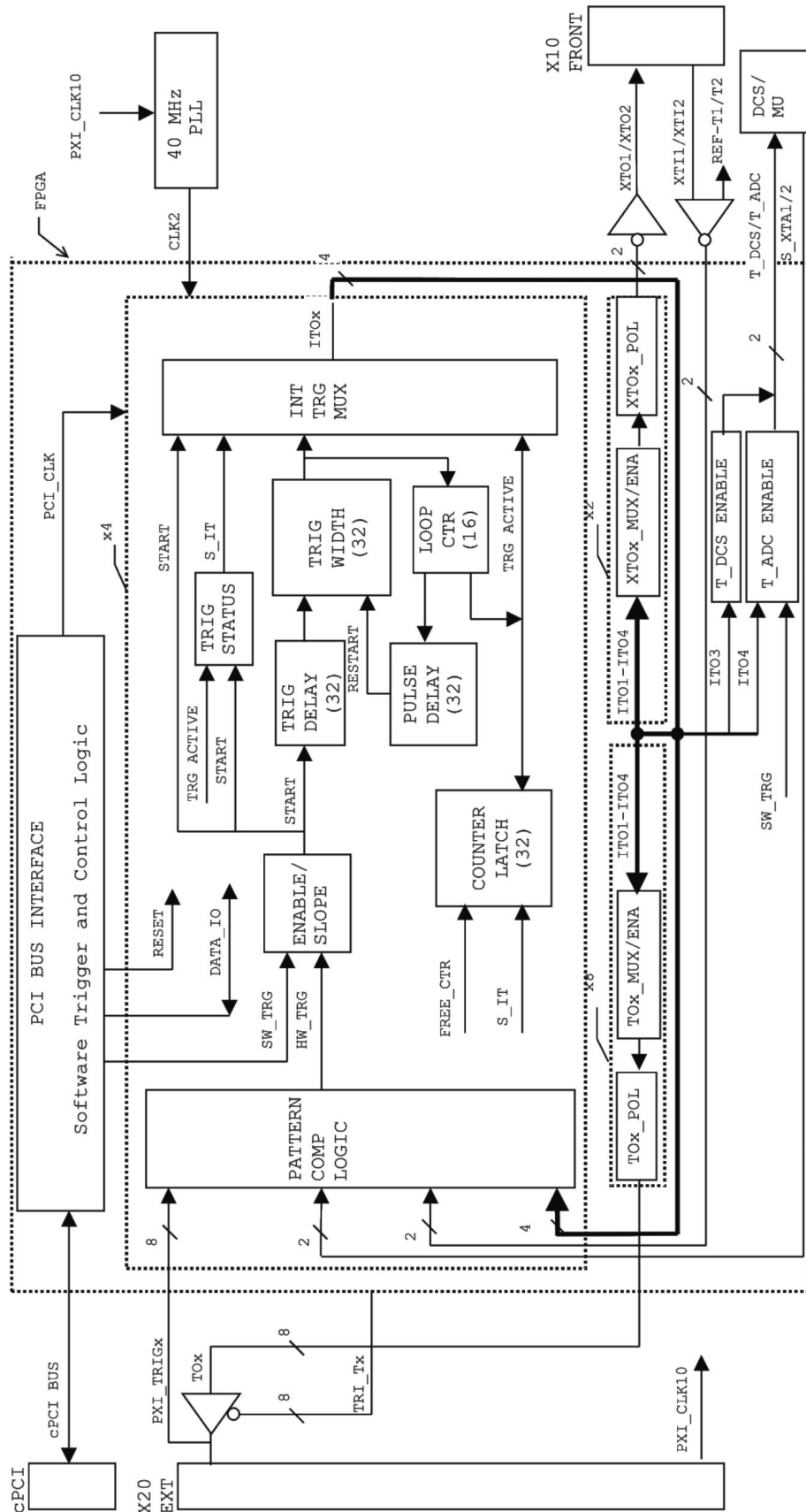


Figure 5-2: Block Diagram of the Trigger Hardware

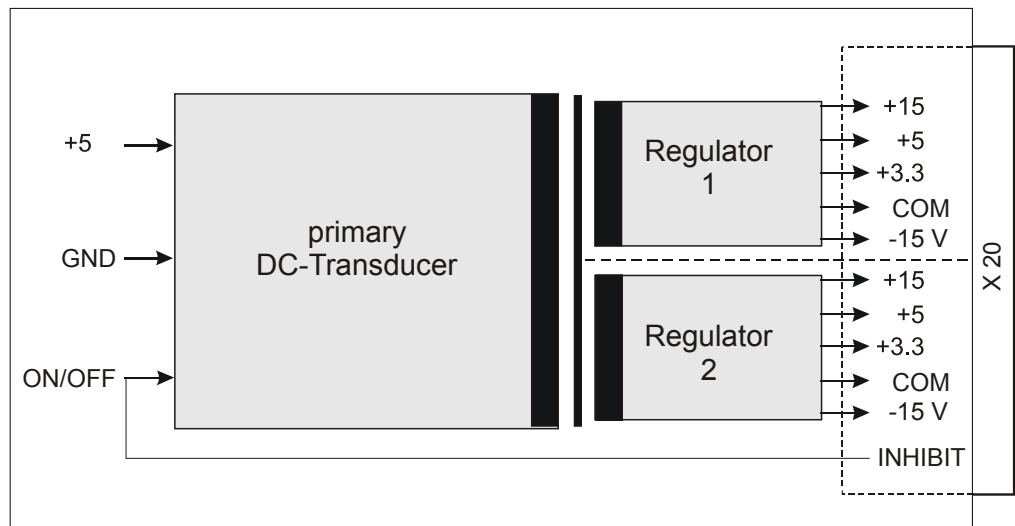
## 5.2 Function Description of the R&S TS-PDC Module

On this topic, see also [Figure 5-3](#)

The DC/DC converter is configured as a primary reference DC/DC converter. The input voltage (5 VDC) is transferred to two secondary potentials and rectified to the nominal voltage by line controllers. The status of the output voltage is displayed in each case by an LED.

The following DC voltages are generated:

- +15 VDC, 0,5A (2x)
- -15 VDC, 0,5A (2x)
- +5 VDC, 0,5A (2x)
- +3,3 VDC, 0,25A (2x)



**Figure 5-3: Block Diagram of R&S TS-PDC**

## 6 Commissioning

### 6.1 Installing the R&S TS-PSAM Module

To install the plug-in module, proceed as follows:

- Run down and power off the TSVP
- Select a suitable front slot (slots 5-15 possible, preferably slot 8)
- R&S TS-PSAM should be connected to slot 8 and R&S TS-PICT to slot 9 for an in-circuit test configuration
- Remove the front panel from the rear side of the TSVP chassis by slackening off the screws

---

#### **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.

- 
- Apply moderate pressure to insert the plug-in module (use locating pin to attach)
  - The plug-in module is correctly located when a distinct 'stop' can be felt
  - Tighten the top and bottom screws on the front panel of the plug-in module

---

#### **NOTICE**

Install the associated R&S TS-PDC rear I/O module as described in Section 6.2.

---

### 6.2 Installing the R&S TS-PDC Module

To install the plug-in module, proceed as follows:

- The R&S TS-PSAM module must have been installed beforehand
- Select the corresponding rear I/O slot for the R&S TS-PSAM module
- Remove the corresponding rear panel portion from the R&S CompactTSVP chassis by loosening the two screws



**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.

- Push in the plug-in module using moderate pressure.
- The rear I/O module R&S TS-PDC must be inserted with extra caution, making certain the connector is correctly guided into the socket opening in the backplane. It must not be inserted at an angle or with incorrect alignment, etc. The short circuit board guides alone do not ensure absolutely reliable guiding.
- Multiple adjacent R&S TS-PDC modules should be inserted in order “from left to right” and removed in the opposite order. Because the spaces are so narrow, care must be taken not to damage any components on the solder side of the module.
- The module is correctly located when a distinct 'stop' can be felt.
- Tighten the two retaining screws on the front panel of the module.

## 7 Software

### 7.1 Driver Software

A LabWindows IVI DMM driver is provided for the DMM functions on the card. All other functions are controlled using specific extensions of the driver. The driver is part of the ROHDE & SCHWARZ GTSL software. All the functions of the driver are described fully in the on-line help and in the LabWindows CVI Function Panels.

During driver installation, the following software modules are installed:

**Table 7-1: Driver Installation R&S TS-PSAM**

Module	Path	Comment
rpsam.dll	<GTSL directory>\Bin	Driver
/rpsam.chm	<GTSL directory>\Bin	Help files
rpsam.fp	<GTSL directory>\Bin	LabWindows CVI Function Panel file, function panels for CVI development interface
rpsam.sub	<GTSL directory>\Bin	LabWindows CVI attribute file. This file is required by some „function panels“.
rpsam.lib	<GTSL directory>\Bin	Import Library
rpsam.h	<GTSL directory>\Include	Header file for the driver



To use the driver, the IVI and VISA libraries from National Instruments are necessary.

### 7.2 Soft Panel

On this topic, see also [Figure 7-1](#)

A soft panel R&S TS-PSAM is provided for the module. The soft panel is based on the LabWindows CVI driver. It enables the measurement module to be operated interactively. The measurement values are output in digital or graphical format (Multipoint Measurements).

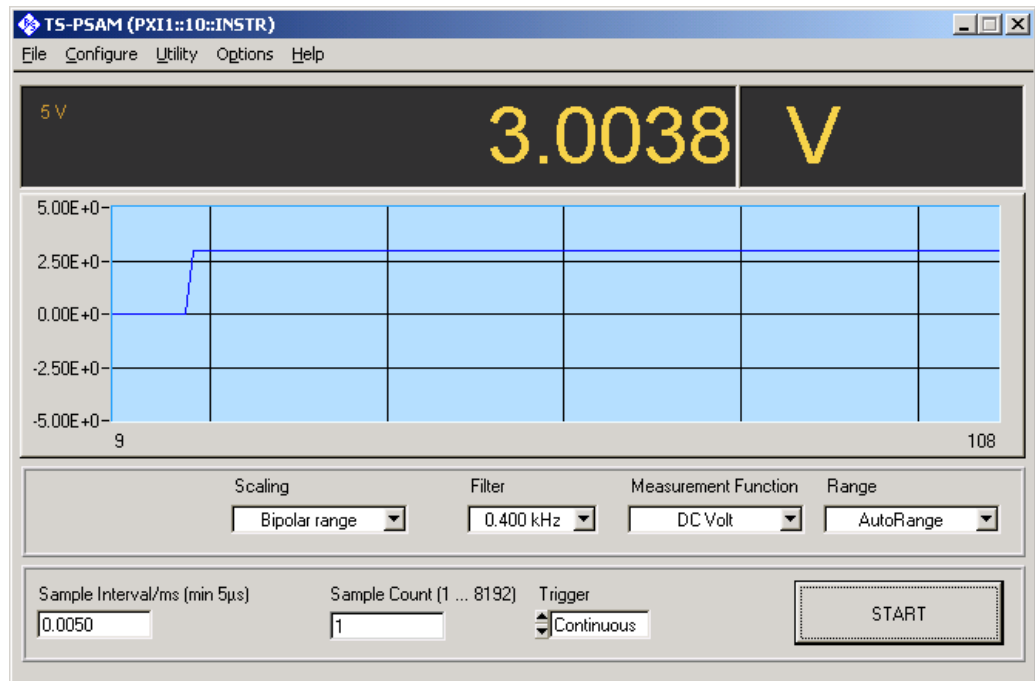


Figure 7-1: Soft Panel R&S TS-PSAM

## 7.3 R&S TS-PSAM Programming Example

```

/*
   Simple voltage measurement with TS-PSAM
*/

#include "rspsam.h"

main()
{
    ViSession handle;
    ViReal64 result;

    rpsam_InitWithOptions ("PXI1::14::0::INSTR", VI_TRUE, VI_TRUE, "",
        & handle);

    rpsam_Connect (handle, "DMM_HI", "ABa1");
    rpsam_Connect (handle, "DMM_LO", "ABc1");

    rpsam_ConfigureMeasurement (handle, RSPSAM_VAL_DC_VOLTS,
        RSPSAM_VAL_AUTO_RANGE_ON, 0.0001);

    rpsam_Read (handle, 5000, & result);
}

```

```
    rpsam_close (handle);  
}
```

## 8 Self-Test

The R&S TS-PSAM has a built-in self-test capability. The following tests are implemented:

- LED-Test
- Power-on test
- TSVP Self-Test

### 8.1 LED Test

After power-on, all three LED's light up for around one second to indicate that the 5 V supply is present and all LED's are working. The following statements can be made about the different LED states:

**Table 8-1: Statements about the LED Test**

LED	Description
One LED does not light up	Hardware problem on the module LED faulty
No LED's light up	No +5 V supply



If diagnostics suggest a problem with the supply voltage, the LEDs for the associated rear I/O module, R&S TS-PDC, must be inspected visually. If a supply voltage failure is confirmed, the R&S TS-PDC module must be replaced.

### 8.2 Power-on test

The power-on test runs at the same time as the LED test. The following statements can be made about the different statuses of the red and green LEDs:

**Table 8-2: Statements about the power-on test**

LED	Description
green LED off	all supply voltages present
green LED off	at least one supply voltage from R&S TS-PSAM module or the R&S TS-PDC module is not present
red LED off	no errors were detected
red LED on	The FPGA/μP was not successfully loaded



If diagnostics suggest a problem with the supply voltage, the LEDs for the associated rear I/O module, R&S TS-PDC, must be inspected visually. If a supply voltage failure is confirmed, the R&S TS-PDC module must be replaced.

---

### 8.3 TSVP Self-Test

The TSVP self-test runs an in-depth test on the module and generates a detailed log. This is done with the “Self-Test Support Library”.

The R&S TS-PSAM module is used as a measurement unit of R&S modules in the TSVP. The correct operation of the modules is ensured by measurements on the analog bus.



You can find information about starting the self-test and the order of required work steps as well as a detailed description of parameters and sequences that are tested in the *R&S CompactTSVP / R&S Power TSVP Service Manual*.

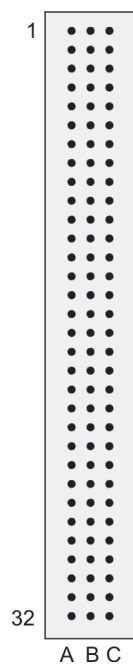
---

## 9 Interface description

Below the interface description for the R&S TS-PSAM module and the R&S TS-PDC module is shown.

### 9.1 Interface description for R&S TS-PSAM

#### 9.1.1 Connector X10 (Front Connector)



**Figure 9-1: Connector X10 (mating side)**

**Table 9-1: Pin assignment for connector X10**

Pin	A	B	C
1	LABA1	GND	LABA2
2	LABB1	GND	LABB2
3	LABC1	GND	LABC2
4	LABD1	GND	LABD2
5	GND	GND	GND
6	IL1	GND	IL2
7	GND	GND	GND
8			

Pin	A	B	C
9	RACH1		RBCH1
10	RACH2		RBCH2
11	RACH3		RBCH3
12	RACH4		RBCH4
13	RACOM		RBCOM
14			
15			
16			
17			
18			
19			
20			
21			
22			
23			
24	GND	GND	GND
25		GND	
26	GND	GND	GND
27	AUX1	GND	AUX2
28	GND	GND	GND
29	XTO1	GND	XTO2
30	XTI1	GND	XTI2
31	GND	GND	GND
32	GND	GND	<b>CHA-GND</b>

The CHA-GND signal is connected to the front panel of the R&S TS-PSAM. The front panel is capacitively coupled to GND.



### 9.1.2 Connector X20 (Extension Connector)

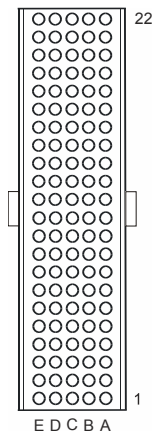


Figure 9-2: Connector X20 (mating side)

Pin	F	E	D	C	B	A	X20  C O N N E C T O R
22	GND	GA0	GA1	GA2	GA3	GA4	
21	GND	PXI_LBR3	PXI_LBR2	PXI_LBR1	GND	PXI_LBR0	
20	GND	PXI_LBL1	GND	PXI_LBL0	AUX1	AUX2	
19	GND	AUX1	AUX2	PXI_LBL3	GND	PXI_LBL2	
18	GND	PXI_TRIG6	GND	PXI_TRIG5	PXI_TRIG4	PXI_TRIG3	
17	GND	PXI_CLK10			GND	PXI_TRIG2	
16	GND	PXI_TRIG7	GND		PXI_TRIG0	PXI_TRIG1	
15	GND				GND		
14	NC						
13	NC						
12	NP	COM_DCS	+3.3V_DCS	+5V_DCS	-VCC_DCS	+VCC_DCS	
11	NP						
10	NC	COM_MU	+3.3V_MU	+5V_MU	-VCC_MU	+VCC_MU	
9	NC						
8	NC						
7	NC						
6	NC						
5	NC						
4	NC						
3	GND	RSA0	RRST#		GND	RSD0	
2	GND		RSDI	RSA1		RSCLK	
1	GND				GND	RCS#	

Figure 9-3: Pin assignment for connector X20

### 9.1.3 Connector X30

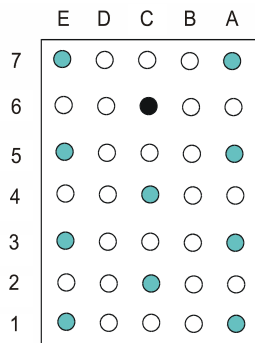


Figure 9-4: Connector X30 (mating side)

Table 9-2: X30 Pinning Schedule

Pin	E	D	C	B	A
7	IL2				IL1
6			GND		
5	ABc1				ABa1
4			ABb1		
3	ABc2				ABb2
2			ABa2		
1	ABd2				ABd1

### 9.1.4 Connector X1 (cPCI Bus Connector)

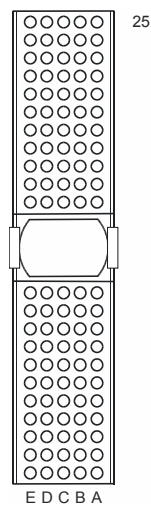


Figure 9-5: Connector X1 (mating side)

Pin	F	E	D	C	B	A		
25	GND	5V	3.3V	ENUM#	REQ64#	5V	X1	
24	GND	ACK64#	AD[0]	V(I/O)	5V	AD[1]		
23	GND	AD[2]	5V	AD[3]	AD[4]	3.3V		
22	GND	AD[5]	AD[6]	3.3V	GND	AD[7]		
21	GND	C/BE[0]#	M66EN	AD[8]	AD[9]	3.3V		
20	GND	AD[10]	AD[11]	V(I/O)	GND	AD[12]		
19	GND	AD[13]	GND	AD[14]	AD[15]	3.3V		
18	GND	C/BE[1]#	PAR	3.3V	GND	SERR#		
17	GND	PERR#	GND	IPMB_SDA	IPMB_SCL	3.3V		
16	GND	LOCK#	STOP#	V(I/O)	GND	DEVSEL#		
15	GND	TRDY#	BD_SEL#	IRDY#	FRAME#	3.3V		
12..14	Key Area							
11	GND	C/BE[2]#	GND	AD[16]	AD[17]	AD[18]		
10	GND	AD[19]	AD[20]	3.3V	GND	AD[21]		
9	GND	AD[22]	GND	AD[23]	IDSEL	C/BE[3]#		
8	GND	AD[24]	AD[25]	V(I/O)	GND	AD[26]		
7	GND	AD[27]	GND	AD[28]	AD[29]	AD[30]		
6	GND	AD[31]	CLK	3.3V	GND	REQ#		
5	GND	GNT#	GND	RST#	BSRSV	BSRSV		
4	GND	INTS	INTP	V(I/O)	HEALTHY#	IPMB_PWR		
3	GND	INTD#	5V	INTC#	INTB#	INTA#		
2	GND	TDI	TDO	TMS	5V	TCK		
1	GND	5V	+12V	TRST#	-12V	5V		

Figure 9-6: Pin assignment for connector X1

## 9.2 Interface description for R&S TS-PDC

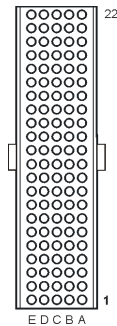


Figure 9-7: Connector X20 (R&S TS-PDC mating side)

Pin	Z	A	B	C	D	E	
22	GND						J20
21	GND		GND or NC *3)				
20	GND			+5V *1)	GND	+5V *1)	
19	GND		GND	+5V *1)			
18	GND				GND or NC *4)		
17	GND		GND	+5V *2)	+5V *2)		
16	GND			+5V *2)	GND		
15	GND		GND	+5V *2)	+5V *1)		
14	NC						
13	NC						
12	NP	+15V_1	-15V_1	+5V_1	+3.3V_1	COM_1	
11	NP						
10	NC	+15V_2	-15V_2	+5V_2	+3.3V_2	COM_2	
9	NC						
8	NC	COM_1	COM_1	COM_1	COM_1	COM_1	
7	NC						
6	NC	COM_2	COM_2	COM_2	COM_2	COM_2	
5	NC						
4	NC						
3	GND		GND		RRST#		
2	GND	RSCLK			RSDI		
1	GND	RCS#	GND			+5V *1)	
Pin	Z	A	B	C	D	E	

- \*1) TS-PDC Version 1.0 is supplied via these pins from +5V, for backplanes up to Version 3.x
- \*2) TS-PDC Version 1.1 or higher is supplied via these pins or pins from \*1)
- \*3) TS-PDC Version 1.3 or higher: This pin is not connected
- \*4) TS-PDC Version 1.4 or higher: This pin is not connected

Figure 9-8: Pin assignment for connector X20 (R&S TS-PDC)

## 10 Specifications

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**NOTICE**

The technical data of the Analog Stimulus Measurement Module R&S TS-PSAM 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.

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