

## Getting Started



## GPS Module

**R&S<sup>®</sup> TSMX-PPS2**

1515.7120.02



**Dear Customer,**

throughout this manual, the GPS Module R&S® TSMX-PPS2 is abbreviated as R&S TSMX-PPS2.

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

Trade names are trademarks of the owners.

# 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 supply voltage
	Caution when handling heavy equipment	⏻	Standby indication
	Danger of electric shock	— — —	Direct current (DC)

## Basic Safety Instructions

Symbol	Meaning	Symbol	Meaning
	Warning! Hot surface		Alternating current (AC)
	Protective conductor terminal		Direct/alternating current (DC/AC)
	Ground		Device fully protected by double (reinforced) insulation
	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 severity 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 AC supply network. If a different voltage is to be set, the power fuse of the product may have to be changed accordingly.
2. In the case of products of safety class I with movable power cord and connector, operation is permitted only on sockets with 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 AC supply network, or if the power switch is not suitable for this purpose, use the plug of the connecting cable to disconnect the product from the AC supply network. 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 IEC60950-1/EN60950-1 or IEC61010-1/EN 61010-1 standards that apply in each case.
11. Unless expressly permitted, never remove the cover or any part of the housing while the product is in operation. Doing so will expose circuits and components and can lead to injuries, fire or damage to the product.
12. If a product is to be permanently installed, the connection between the 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.


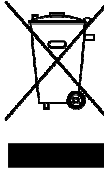

Tener en cuenta las informaciones de seguridad sirve para evitar en lo posible lesiones o daños por peligros de toda clase. Por eso es imprescindible leer detalladamente y comprender por completo las siguientes informaciones de seguridad antes de usar el producto, y respetarlas durante el uso del producto. 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 señalizar las áreas de trabajo en las que exista un riesgo elevado de exposición a radiaciones.
6. Tenga en cuenta que en caso de incendio pueden desprenderse del producto sustancias tóxicas (gases, líquidos etc.) que pueden generar daños a la salud. Por eso, en caso de incendio deben usarse medidas adecuadas, como p. ej. máscaras antigás e indumentaria de protección.
7. 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 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  
[customersupport@rohde-schwarz.com](mailto:customersupport@rohde-schwarz.com)

### North America

Phone 1-888-TEST-RSA (1-888-837-8772)  
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
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## List of abbreviations

ADR	Automotive Dead Reckoning
DR	Dead Reckoning
PPS	Pulses per Second

# 1 Welcome to the R&S TSMX-PPS2

The R&S TSMX-PPS2 is a small, compact GPS receiver with high sensitivity and precision time pulse output. It is based on a  u-blox LEA 6 GPS chipset. The u-blox “Automotive Dead Reckoning” (ADR) feature provides 100% positioning even in tunnels.

It is especially designed for drive test systems based on R&S ROMES software in combination with R&S radio network analyzers where continuous position tracking and exact time synchronization of the utilized radio network analyzers is a requirement.



## 1.1 System Requirements

- PC with USB interface
- Operating System: Microsoft Windows 7, Windows XP
- USB driver / provided in the accessory CD-ROM

## 2 Device Tour

This section gives an overview of the control elements and the connectors of the R&S TSMX-PPS2. Each element/connector is briefly described and a reference is given to the chapters containing detailed information.

### 2.1 Top View - Status LEDs



Figure 2-1: Top panel view

1

#### "STATUS" – LEDs



##### 1 STATE

The STATE LED shows the power state of the device.

- **Green:** device is powered from the USB port
- **Yellow:** device is in STB state
- **Off:** the device is un-powered

##### 2 PPS

The PPS LED indicates the availability of the precision time pulse signal on the PPS OUT connector. It is also a quality indicator of the GPS position fix.

- **Green (blinking, 1 Hz):** the GPS module is in tracking mode and PPS pulse is output on the PPS OUT connector
- **Off:** GPS module is not in Tracking Mode resp. bad GPS health condition – no time pulse signal on the PPS OUT connector is available



## 2.2 Connectors - 1

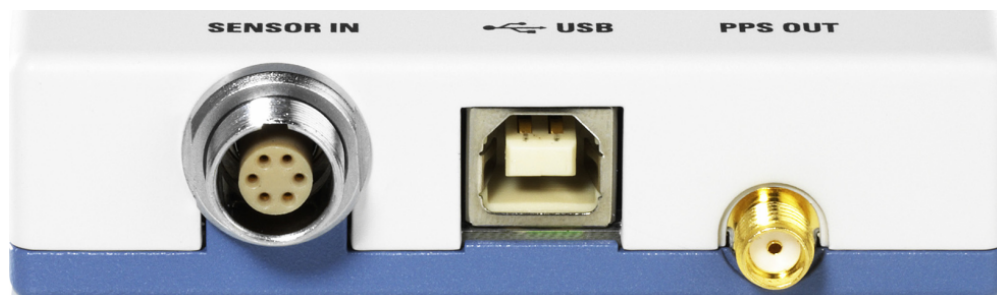
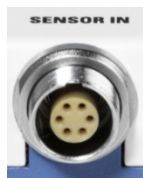


Figure 2-2: Front panel view

1

### SENSOR IN



ODU MINI-SNAP connector, 6 pins

Sensor interface for vehicle speed and direction signal (odometer). The supplied accessory sensor cable is used to bring these signals into the device. Sensor signals are only necessary if ADR should be supported.

2

### USB

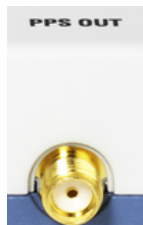


USB connector Type B

The USB port serves as power supply and as bi-directional data interface. Position data and device control data will be transferred via this interface.

3

### PPS OUT



SMA connector (female)

Output port for the precision time pulse signal.

Source Impedance: 100 R

Level: TTL / 3,3 V

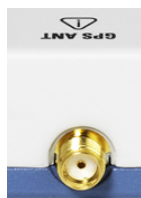
## 2.3 Connectors - 2



Figure 2-3: Rear panel view

1

### GPS ANT



SMA connector (female)

Bi-directional GPS antenna port.

- **Input:** GPS antenna signal (GPS antenna is part of the accessory package) see section "[Accessory List](#)" on page 42.

Impedance 50  $\Omega$

Recommended GPS antenna characteristics

Noise figure: < 3 dB

Max antenna gain: 50 dB (minus cable and interconnect losses)

**Output:** antenna bias voltage for active antennas. The antenna bias voltage is fed through the inner conductor.

Output voltage: 3.3 V

Max. Output Current: 50 mA

## 3 System Configurations

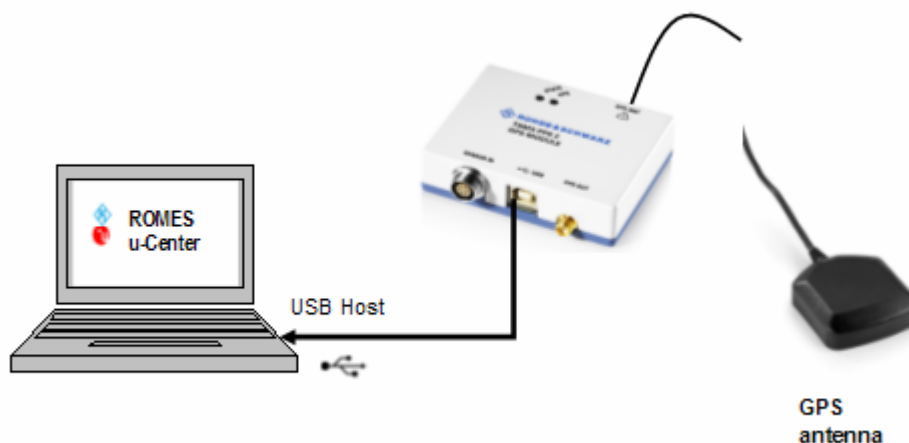
### 3.1 Standard Navigation

The R&S TSMX-PPS2 is used for GPS navigation in this configuration. The time synchronization output and the ADR feature are not used for this setup.

The active GPS antenna is connected to the antenna port. Data connection and power supply are provided from the host PC via USB.

The preferred host PC application is R&S ROMES. This software is not part of this package. For details about R&S ROMES software, please follow this link to the product homepage: <http://www.rohde-schwarz.com/product/ROMES.html>.

For test, evaluation and backup is the evaluation software “u-center” from u-blox included on the accompanying CD-ROM. But any other customer software capable of handling NMEA and/or the proprietary UBX protocol could be used to control the device and evaluate the GPS data.



*Figure 3-1: System Configuration - Standard Navigation*

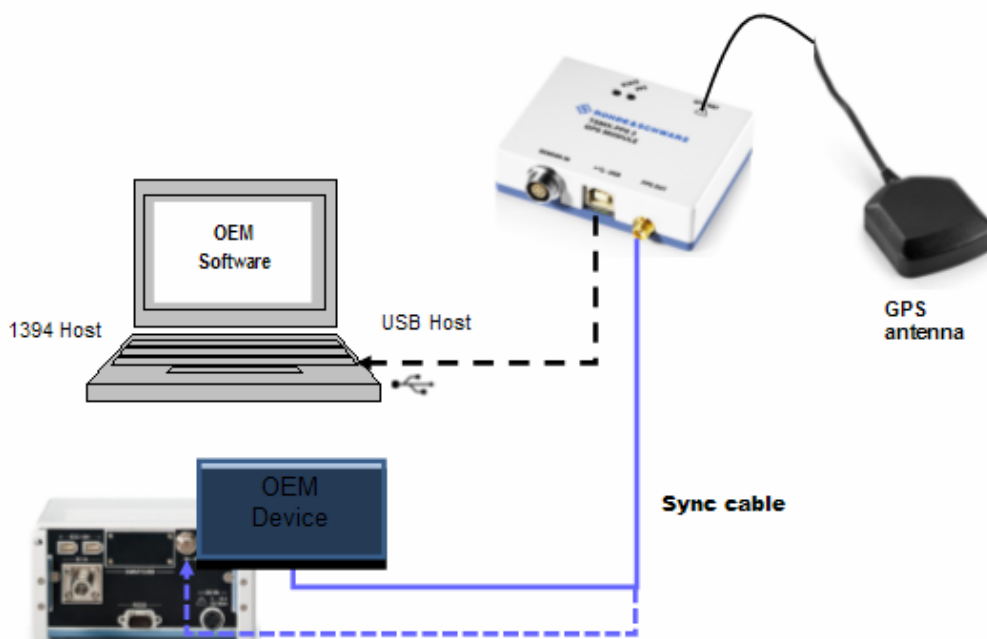
## 3.2 Time Synchronization

The R&S TSMX-PPS2 is used as a precision time reference in this configuration. The precision time pulse signal (PPS OUT) from the device is used to synchronize the R&S TSMU Radio Network Scanner family (see section "[Navigation & Time Synchronization](#)" on page 11) but can also be used as a reference in customer specific device setups.

In such a configuration the R&S TSMX-PPS2 is connected to the GPS antenna and calculates continuously the GPS position. The accessory sync cable is used to bring the trigger pulse from the PPS OUT port to the PULSE-IN connector of the R&S TSMU respectively to the trigger in signal of the OEM device. The device is powered and optionally controlled via USB.

Running PC software for R&S TSMX-PPS2 control is not mandatory in this mode as far as the default settings are convenient for the application. As long as the R&S TSMX-PPS2 can determine a GPS fix the precise PPS signal will be available.

Frequency, precision edge, pulse width and frequency could be altered and stored in the device using u-center software (see section "[Time Pulse Settings](#)" on page 34).



*Figure 3-2: System Configuration – Time Synchronization*

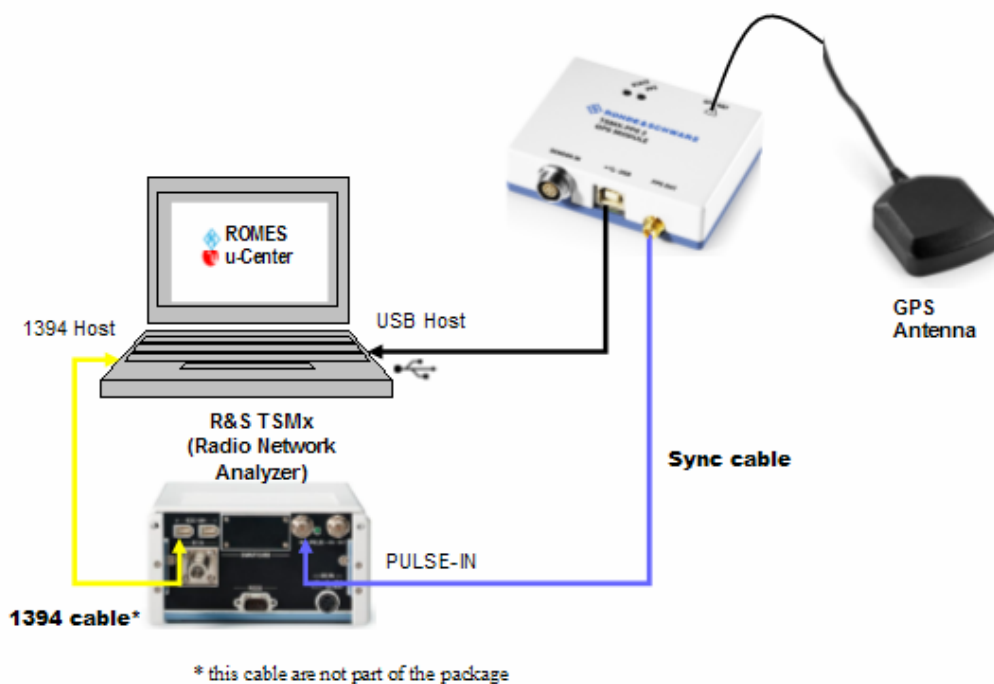
### 3.3 Navigation & Time Synchronization

The R&S TSMX-PPS2 is used for navigation and time synchronization in this configuration.

The connections for this setup are shown in [Figure 3-3](#).

This setup represents the basic mode of operation for the R&S TSMX-PPS2.

The active GPS antenna is connected to the antenna input. The USB port is used for navigation data and device configuration. This port is controlled by R&S ROMES software.



**Figure 3-3: System Configuration – GPS Navigation & Time Synchronization**

### 3.4 ADR Navigation

The Automotive Dead Reckoning feature (ADR) of the R&S TSMX-PPS2 provides 100 % navigation coverage even in tunnels or building canyons with bad or missing GPS coverage. ADR combines the calculated GPS position data with heading and distance data from additional sensors. When GPS satellites are out of sight, the last valid position is extrapolated using distance and angle information from a gyroscope and a speed/direction pulse input.

It is also possible to use the time synchronization output in this mode.

The gyroscope for heading information is already embedded in the R&S TSMX-PPS2. The distance signal and the direction information need to be derived from the vehicle tachometer pulses and direction indication and fed via the accessory sensor cable into the SENSOR IN port. Power supply and data connection are provided via the USB cable.

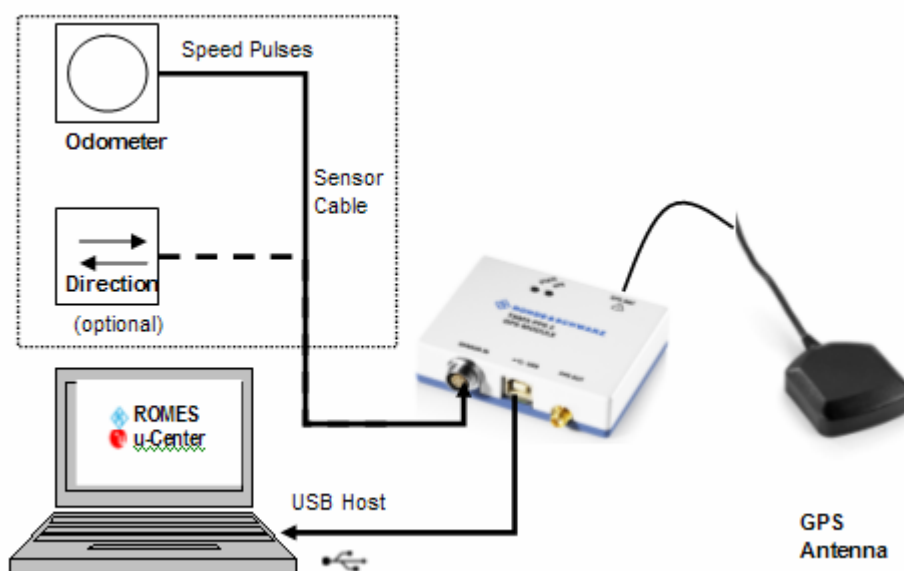


Figure 3-4: TSMX-PPS2 Operating Mode – Automotive Dead Reckoning

## 4 Getting Started

This section explains how to bring the R&S TSMX-PPS2 device into operation and shows the different mode of operations. It encloses connecting the device with the host PC.

It does not contain installation of application software, e.g. R&S ROMES software. Please refer to the related software manuals.

### 4.1 Unpacking and Checking

To remove the device from its packaging and check the equipment for completeness, proceed as follows:

- Remove the device and the various components from their packaging.
- Check the equipment for completeness using the delivery note and the "[Accessory List](#)" for the various items.
- Check the device for any damage. If there is damage, immediately contact the carrier who delivered the device. Make sure not to discard the box and packing material.



#### **Packing material**

Retain the original packing material. If the device needs to be transported or shipped at a later date, you can use the material to prevent control elements and connectors from being damaged.

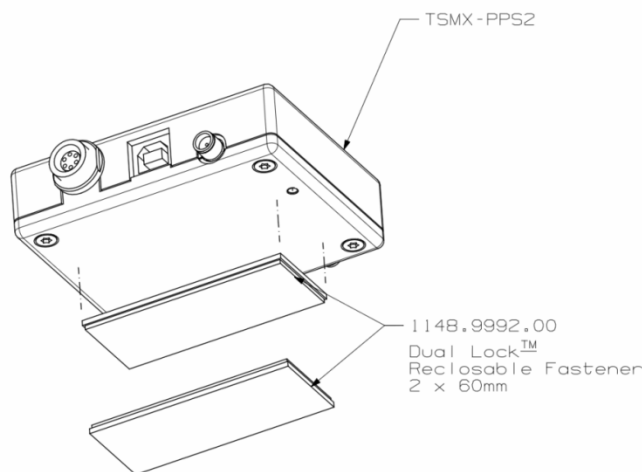
---

## 4.2 Preparations

The accessory re-closable Dual Lock Fastener®3M strip should be used for attaching the device. This strip has to be cut to fit along the bottom side of the housing as shown in [Figure 4-1](#). The counterpart of the Dual Lock Fastener®3M should be cut to have similar length.

Prior to applying 3M™ Dual Lock™ the bottom cover of the device should be cleaned with warm water and dishwashing liquid. A 50:50 mixture of isopropyl alcohol (IPA) and water may also be used.

- To obtain optimum adhesion the bonding surface must be well unified, clean and dry.
- Remove the backing plastic from the Dual Lock Fastener®3M without touching the adhesive strip. Align the tape to the desired position at the bottom side of the device and apply pressure to the tape. Firm application pressure develops better bond strength.
- Turn the R&S TSMX-PPS with the Dual Lock Fastener®3M facing upwards.
- Align the remaining strip and press both sides together until you hear an audible snap but don't remove the backing plastic. The unit is now ready to be placed in the vehicle according to the recommendations in the following section.



**Figure 4-1: Dual Lock Re-closable Fastener**



## 4.3 Placing Hardware

### 4.3.1 Placing the R&S TSMX-PPS2

**Standard Navigation (without ADR):** No strict mounting recommendations. The device could be positioned anywhere and in any direction (horizontally or vertically) inside the vehicle or the trunk.

**ADR Navigation:** Calculations for ADR are based on quite sensitive and three dimensional acceleration values. For that reason a strict horizontal mounting position (with printed, brighter chassis side up) which is fastened tightly with the vehicle chassis is absolutely important



#### Consider Mounting Requirements for ADR Navigation

Proper mounting position and tight connection with the vehicle chassis is absolutely necessary when operating the R&S TSMX-PPS2 in “Automotive Dead Reckoning” mode.

- Clean and dry the surface of the mounting position inside the vehicle in a similar way as done for bonding the Dual Lock Fastener®3M on the device.
- Remove the protection plastics and press the R&S TSMX-PPS firmly against to proper mounting position.
- Allow Dual Lock adhesive to cure for ten hours.

### 4.3.2 Positioning the Antenna

A magnetic mount antenna is part of the delivery. The antenna should be placed on a metallic part of the vehicle chassis with free line of sight to the sky.

**Without ADR:** For optimum performance, the antenna should be placed in the middle of the vehicle roof or trunk.

**ADR Support:** For an optimum ADR performance the placement of the antenna is important and depends on the type of vehicle. Please follow these recommendations:

- **Road Vehicle**
  - Antenna: should be placed above the middle of the rear (not steered) wheels.
  - TSMx-PSS2: should be placed in the front or middle part of the vehicle

- **Articulated Road Vehicle**
  - Antenna: should be placed above the middle of the rear (not steered) wheels of the anterior part of the vehicle.
  - TSMx-PPS2: should be placed in the front or middle part of the anterior part of the vehicle.
- **Rail Vehicle**
  - Antenna: should be placed in the middle of a wagon.
  - TSMx-PPS2: should be placed in the front or middle part of the same wagon.

## 4.4 Installing Software / Device Driver

Next step after having positioned the R&S TSMX-PPS2 inside the vehicle is to install the control software on the host PC side.

This has to be done prior to first connecting the R&S TSMX-PPS2 with a PC. Depending on the target software used (ROMES, u-Center etc.) the Windows device driver for the u-blox LEA-6R chipset has to be installed in addition.



### Hint

R&S TSMX-PPS2 requires u-blox device driver to be installed prior to first connection via USB cable.

---

Please follow the guidelines in this section.

### 4.4.1 R&S ROMES

The R&S ROMES software is not part of the R&S TSMX-PPS2 delivery.

Please refer to section "[Rohde & Schwarz Internet Pages](#)" on page 44 for a link to the related product homepage or contact your local R&S representative.



### Hint

The ROMES setup is not part of this package and needs to be installed separately.

---

#### **For users with an existing ROMES installation:**

The u-blox device driver installation is **not** part of the integral ROMES setup and need to be executed separately from the R&S ROMES DVD.

To get sure having installed the necessary Windows driver Rohde & Schwarz recommend to install the driver from the accompanying R&S TSMX-PPS2 CD-ROM (see next paragraph for instructions).

#### **For all other users:**

The device driver for Windows XP, Vista, 7, 8 can be found on the accompanying CD-ROM in the folder: [\Software\Drivers\](#)

For installation run the executable file: [ublox\\_A4\\_U5\\_USB\\_drvxxyy\\_install\\_UI.exe](#)

For release notes and to download of the latest device driver version also visit the u-center website. Please refer to section "[u-blox Internet Pages](#)" on page 44 for the link.

#### 4.4.2 u-center Evaluation

The u-Center setup is part of the accessory CD-ROM:

[..\software\Applications\](#)

The Windows device driver installation is part of the u-Center setup. So no dedicated device driver installation is necessary when using u-Center software.

For a link to the u-center website for release notes and news refer to section "[u-blox Internet Pages](#)" on page 44.

For instructions how to control the R&S TSMX-PPS2 via u-Center software, please refer to section "[u-blox Internet Pages](#)" on page 44.

#### 4.4.3 Microsoft Windows 7 USB Sensor/VCP Driver

The windows 7 operating system provides built-in support for sensor devices including location sensors, such as the R&S TSMX-PPS2 devices. This driver model is currently not supported by R&S ROMES software but may be used for an OEM integration of this GPS receiver.

For installation run the executable file: please refer to section "[u-blox Internet Pages](#)" on page 44.

For a link to the u-blox sensor driver please refer to section "[u-blox Internet Pages](#)" on page 44.

## 4.5 Connecting Cables



### Consider order of connection

When connecting the external cables it is strongly recommended to proceed in the same order as listed in the following section.

Interchanging the order could end in unexpected system behavior and in longer start times for a valid GPS position fix.

### 4.5.1 GPS antenna / GPS ANT

Connect the accessory active GPS antenna to the **GPS ANT** port.



### Antenna connection only in un-powered mode

Connect the GPS antenna before powering the device via USB.

As the R&S TSMX-PPS2 calibrates the noise floor of the RF antenna at power on delayed connection may result in a prolonged GPS acquisition time.

The R&S TSMX-PPS2 is designed for both active and passive antennas. This port provides an open circuit and short cut protection.

Due to better navigation performance, R&S generally recommends to use active antennas, especially the antenna shipped with the product.

For details on the accessory antenna characteristics, please refer to the u-blox datasheet for the **ANN-MS** antenna. Link to website in section "[u-blox Internet Pages](#)".

R&S recommends the following antenna characteristics for customers using their own antenna:

- Frequency: 1575 ±3 MHz
- Bandwidth: min. 10 MHz
- Polarization: RHCP
- Min Supply Voltage: ≥ 3.0 V
- Max current: 50 mA
- Impedance: 50 Ω
- Min Noise figure: 1.5 dB
- min VSWR: 2
- Min. Gain: 15 dB
- Max. gain: 50 dB (minus cable and interconnect losses)

### 4.5.2 Sensor cable / SENSOR IN



#### Sensor Signals for ADR (Automotive Dead Reckoning)

Connecting the sensor cable and providing the vehicle signals is mandatory for the ADR feature.

Operating the R&S TSMX-PPS2 in standard navigation mode should leave this port unconnected.

The sensor cable is part of the delivery. The plug has to be connected with the **SENSOR IN** port of the R&S TSMX-PPS2. The opposite side needs to be wired with the speed pulse and direction signal of the vehicle.



The sensor input at the R&S TSMX-PPS2 is electrically isolated via optical coupler.

Figure 4-2 Sensor Cable

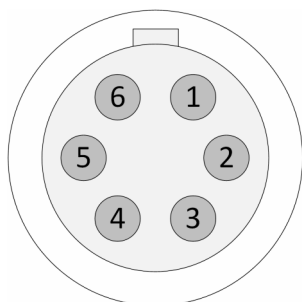


Figure 4-3 Frontal view on the pins of the Sensor Cable connector

Lead Color	Signal Description	Pin
Black	SPEED+	1
Brown	SPEED-	2
Red	DIR+	3
Orange	DIR-	4
-	Device Detection / GND	5
-	GND	6

Figure 4-4 Pin out Sensor Cable

#### 4.5.2.1 Speed Pulse Signal

This signal is mandatory for using the ADR function. The signal should fulfill the following recommendations:

- signal level range for high level:  $3.5\text{ V} < \text{Level} < 15\text{ V}$
- input frequency range:  $0\text{ Hz} < \text{Frequency} < 2\text{ kHz}$
- 0 Hz of the speed signal must be equal to a speed of 0 km/h
- speed signal should origin from the rear (not steered) wheel

The speed signal is normally available in the radio slot of the vehicle.

#### 4.5.2.2 Direction Signal

The direction signal is optional and only improves the results of the DR algorithm. As the forward/backward direction signal is not available in all vehicles, try to make use of the reverse gear light signal.

- Valid Signal Level Range for high level:  $3.5\text{ V} < \text{Level} < 15\text{ V}$
- $\text{Level} > 3,5\text{ V} \rightarrow$  backward direction

#### 4.5.3 Sync Cable

- The Sync Cable (SMA  $\rightarrow$  BNC) is part of the delivery (see ["Accessory List"](#)).

The precision time pulse is available on the PPS port and used for synchronizing external measurement equipment with the GPS time.

This port is normally connected to the trigger input of the R&S TSMU scanner (see [Figure 3-2](#)). If not used this port may be left open.

The time delay for the time pulse strongly depends on the connected load capacity on the PPS port and this is application specific. For synchronizing R&S TSMU radio network scanners this does not harm as only the relative relationship of the pulses is important.

Users with an absolute requirement for the pulse signal are able to configure a dedicated time shift using u-center software (see section ["Time Pulse Settings"](#)).

Load capacity	Typical delay (approximately)
15 pF	0.6 – 3.7 ns
30 pF or 50 pF	1 – 4.5 ns

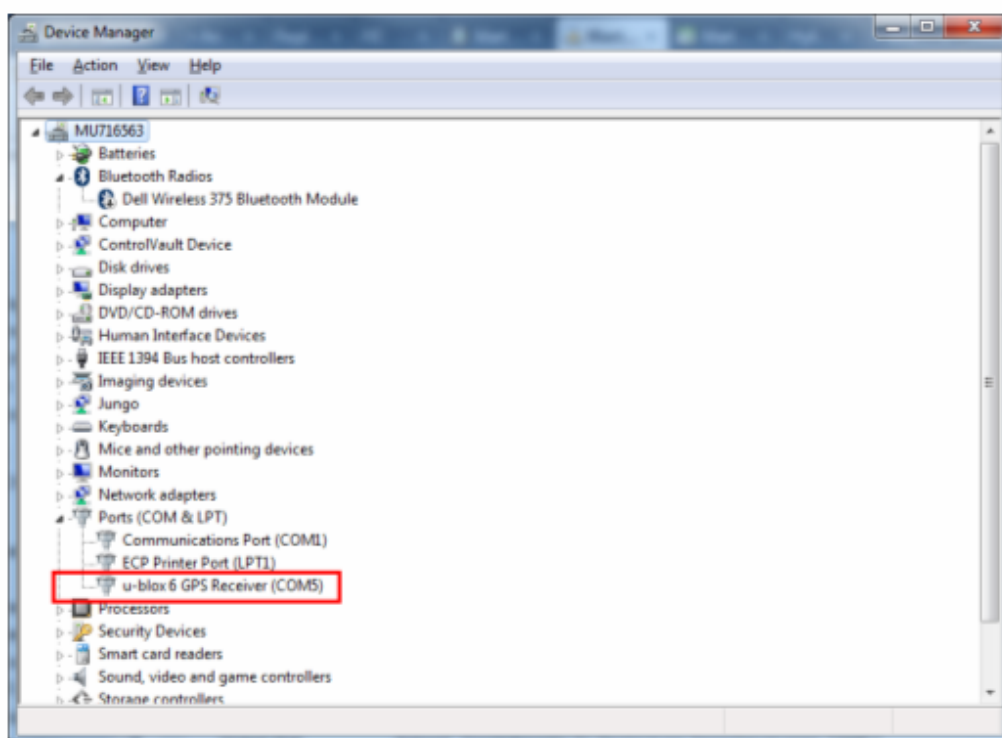
**Table 4-1: Typical delay of the PPS OUT pulse**

## 4.6 Powering On / Loading USB Driver

The R&S TSMX-PPS2 has no dedicated On/Off Switch and automatically changes into “Power On” state when connected to the USB port. The green “STATE” LED is on when powered (see section ["Top View - Status LEDs"](#)).

Windows will identify the R&S TSMX-PPS2 as a new device and load the pre-installed device driver. Please refer to section ["Installing Software / Device Drive"](#) how to install the USB driver.

After enumeration “u-blox 6 GPS Receiver” device is listed in the Windows device manager (see [Figure 4-5](#)). Please notice the assigned COM port number. This information will be needed in the next step when connecting software to the R&S TSMX-PPS2 (see section ["Connecting Device"](#) on page 23).



*Figure 4-5: Device Entry in the Windows Device Manager*



## 5 Starting Operation

### 5.1 Connecting Device

The R&S TSMX-PPS2 device is ready to be addressed via software as soon as the device driver is listed in the Windows device driver (see section "[Installing Software / Device Driver](#)" on page 17).

The device could be connected to software using its assigned virtual COM port. For default protocols and settings of the emulated COM port refer to section "[USB Port Settings](#)" on page 38. Please refer to the related software documentation how to setup and perform measurements with the R&S TSMX-PPS2 device.

**R&S ROMES Software:** see section "[Rohde & Schwarz Internet Pages](#)" for a product link

**u-center software:** see section "[Connecting R&S TSMX-PPS2](#)"

## 5.2 Initial Position Fix

The device automatically starts calculating for an initial GPS position fix. In GPS receivers one generally distinguishes between different start up modes. This depends on the available GPS information in the receiver at start up.

The following table gives an overview:

Start Up Mode	Pre-Condition	Remarks	ADR Calibration	TTFF <sup>1)</sup> [sec]
Cold Start	Un-powered for more than ~ 3 hours	- No information of satellite position (almanac/ephemerides) - No sensor calibration data	yes	< 32
Hot Start	Disconnected from USB power < 3 hours	- satellite ephemerides available - sensor calibration data available	no	< 3

**Table 5-1: Modes of Position Fix in R&S TSMX-PPS2**

- 1) TTFF: Time to First Fix (good GPS signal)

A valid GPS position fix with the transition into "Navigation State" is indicated by the amber **PPS** LED starting blinking (see section "[Top View - Status LEDs](#)" on page 6).



### ADR Navigation

R&S strongly recommends not moving the vehicle until a valid 2D/3D position fix had been reported from the R&S TSMX-PPS2 when using ADR.

Moving the vehicle earlier could last in inadequate sensor calibration and position localization errors.

The blinking frequency of the PPS LED is equivalent to the configured time pulse frequency setting (see section "[Time Pulse Settings](#)" on page 38). The precision time pulse is being output as soon as PPS LED starts blinking.



### Proper Antenna Position

The GPS antenna must have a good line of sight to the sky to enter "Navigation State" immediately.

## 5.3 ADR Calibration



### Attention

This section is important for operating the R&S TSMX-PPS2 in ADR mode with connected vehicle sensor signals (see section "[ADR Navigation](#)" on page 12).

Users running the R&S TSMX-PPS2 in standard navigation mode or time sync mode could skip this section and proceed to section "[Navigation Mode](#)" on page 29.

### 5.3.1 General

For optimum ADR performance the system needs to learn from the internal sensors (gyro & temperature) as well as from the provided vehicle signals (speed & direction).

The calibration process is initiated at the beginning of each drive as long as no calibration data set is available from a previous drive (see Cold Start in section "[Initial Position Fix](#)"). The calibration data set is kept in the volatile part of the memory and this is provided with a battery backup that lasts for roughly about for three hours. So any time the R&S TSMX-PPS is disconnected from power and this time period is expired the device will re-calibrate.

For the time the R&S TSMX-PPS2 executes sensor calibration it is in GPS-only mode and already provides navigation data. When calibration is finished to a certain degree it switches into combined mode and combines Dead Reckoning (DR) calculations and GPS and changes into "GPS + DR".

As the calibrations are based on real position data a good GPS reception is necessary.



### Requirements for ADR calibration phase

- ADR calibration process requires good GPS position fix
- The calibration should only be executed when driving forwards

The following parameters are being measured when calibrating:

- Sensitivity and zero point output of the internal Gyro
- Temperature drift of the Gyro
- Pulse ratio of the vehicle wheel ticks

The course calibration of the gyro and the resolution of the vehicle wheel ticks need to be executed when doing sensor calibration.

The fine calibration of the sensor signals is an ongoing process for the whole drive.

For details please refer to the following sections and to the corresponding u-blox documentation for the LEA-6R chipset. To get a link, please refer to section "[u-blox Internet Pages](#)".

#### Validity of Calibration Data

As the R&S TSMX-PPS2 is only equipped with a short time back-up buffer for this memory (backup time ~ 3 hours).

For that reason the device will run a new calibration every time the USB power was disconnected for longer than this period. Calibration of the sensor data will be kept.

### 5.3.2 Providing Vehicle Sensors Data

Even better the device knows to interpret the measurement data of the used sensors, the more precise and quicker is the calibration process. The sensitivity and offset of the embedded gyro is already programmed at factory for that purpose.

To speed up ADR calibration and to achieve proper function the system needs to know the parameters of the external vehicle sensors.

#### a) Polarity of the direction signal

This setting is mandatory and important when the sensor cable is connected.

Default setting: "1 – High=Backward"



#### Direction Signal Polarity

ADR positioning will not work or is incorrect if the polarity setting is erroneous.

---

#### b) Resolution of the speed pulses

Setting optional but could speed up calibration process. System is able to calculate resolution based on the driven GPS distance.

#### How to enter sensor data:

**ROMES:** The sensor data is normally needed to be provided when loading R&S TSMX-PPS2 driver. Please refer to the related ROMES documentation.

**u-center:** Please refer to section "[Verifying ADR Settings](#)" on page 33 how the enter.

### 5.3.3 Monitoring Calibration Status

The current state of the ADR calibration will be continuously reported from R&S ROMES software. Please refer to the R&S ROMES manual for details.

For requesting the status of the ADR calibration, please refer to section "[ADR Calibration Status](#)" on page 36.

There are different steps for calibration

- No calibration
- not yet calibrated      (*Calibrating*)
- coarsely calibrated      (*Coarse Calib*)
- finely calibrated      (*Fine Calib*)



#### Minimal calibration state for ADR

A sufficient ADR performance can be expected when at least coarse calibration has been achieved.

Fine calibration isn't mandatory for ADR assistance.

If the calibration status reaches "**Fine Calibration**" the user can expect very good ADR functionality and the device will use this feature to improve the accuracy respectively to bridge short times with poor or missing GPS reception.

#### How to see if ADR works properly?

**ROMES:** the ADR state will be reported in the GPS status view (see R&S ROMES documentation for details).

**u-Center:** whether ADR is used is displayed in the "Data View" of the u-center software

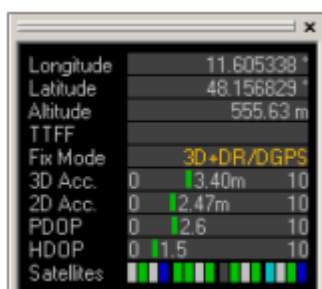


Figure 5-1: GPS status overview

If calibration does not start measurement see troubleshooting section "[ADR Calibration fails](#)" on page 41.

### 5.3.4 Deleting Calibration Data

A delete of the sensor calibration data is necessary under the following circumstances:

- when changing the measurement vehicle
- when exchanging vehicle sensors
- when the GPS provides insufficient localization data especially after tunnels or in situations with bad GPS coverage

**R&S ROMES** software will offer a dedicated action menu in the R&S TSMX-PPS2 software driver for deleting this data. Please refer to the R&S ROMES documentation how to initiate this.

For **u-center** software please refer to section "[Resetting Sensor Calibration](#)" on page 34.

## 5.4 Navigation Mode

The GPS module automatically enters navigation mode as soon as it determined the GPS position fix. Depending of the mode of operation (ADR or Standard Navigation) the GPS will be assisted from dead reckoning data when calibration is finished (see section "[Monitoring Calibration Status](#)" on page 27).

Following a list of the different navigation modes:

Navigation Mode	Remarks
No Fix	No position fix
2D Fix	Two-dimensional fix / at least 3 satellites
3D Fix	Three-dimensional fix / at least 4 satellites
DR	Dead Reckoning
DGPS	Differential GNSS

*Figure 5-2: Modes of navigation*

## 5.5 Powering Off

There is no dedicated switch to power off the R&S TSMX-PPS2. The device is turned off by removing the USB cable. The GPS almanac data and sensor calibration data is kept for a certain amount of time when disconnected from USB.



### Caution:

Make sure that you have disconnected from any software application interfacing the R&S TSMX-PPS2 device before removing the USB cable.

There is no "Stand-By" or "Power Safe" mode implemented for the R&S TSMX-PPS2.

## 6 Using u-center Software

The u-center software is part of the delivery. Please refer to section “[..\software\Applications\](#)” on the accompanying CD-ROM for the setup and the user guide or visit the u-blox website (see section “[u-blox Internet Pages](#)” on page 44).

This software can be used for test, evaluation and maintenance of the R&S TSMX-PPS2.



### Using R&S ROMES Software

Generally, there is no requirement to use u-center software for device configuration when using R&S ROMES software. The R&S TSMX-PPS2 will be fully supported and configured via R&S ROMES software.

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This free of charge demo software from u-blox gives the user the possibility to evaluate the various features of this GPS receiver. Additionally, it gives the user the possibility to change and store receiver settings permanently.



### Attention

Using u-Center software enables the user to change receiver settings permanently.

This may lead to un-predictable behavior and incompatibilities with R&S ROMES software. Under such conditions the R&S TSMX-PPS2 may be brought back to factory settings unless it may be used with R&S software again

---

For this software is used to bring the R&S TSMX-PPS2 back into factory default configuration. For a detailed description how to restore factory setting (see section “[Recover GPS Factory Settings](#)” on page 37).



## 6.1 Setting Preferences

Some preferences of u-center software need to be adapted in order to get full access und functionality of the ADR configuration and replay control of exported R&S TSMX-PPS2 data. For this reason, please open the preferences in the tools menu and enter the settings in the following subsections.

**ublox u-center:**  
→ Tools → Preferences → Program Options: `-sfd -cdk`

### 6.1.1 Program Options

In order to get full ADR access:

**Program Options:** `-sfd -cdk`

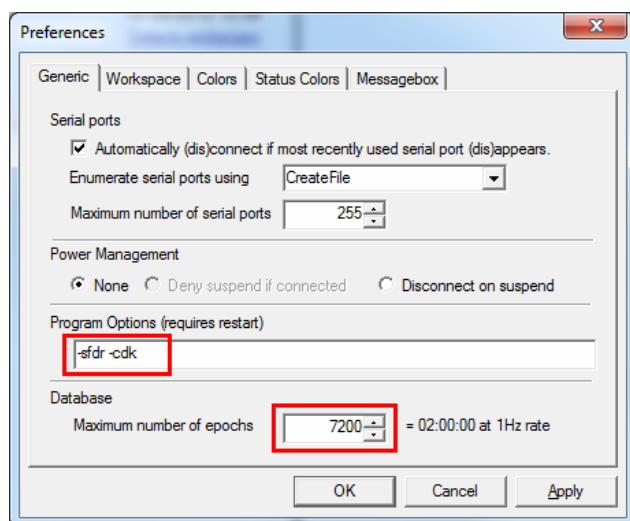


Figure 6-1: u-center preferences

### 6.1.2 Database

If u-center software is used to export stored data to Google Earth the **maximum number of epochs** should be set to a sufficient time value (see Figure 6-1).

If this time value is too small, the export of position data to Google Earth is limited in time and may not display all data.

This value could be changed when data recording is stopped but before export of data.

## 6.2 Connecting R&S TSMX-PPS2

If the R&S TSMX-PPS2 is powered and the device driver loaded in Windows (see section "Powering On / Loading USB Driver" on page 22) it could be connected in u-center software by selecting the emulated COM port.



Figure 6-2: Connect to the R&S TSMX-PPS2 in u-center



### Close other software applications when using u-center

The R&S TSMX-PPS2 software interface does not allow any other software application to interface the device at the same time.


So, be sure having closed possible connections in R&S ROMES software or any other software application when connecting to u-center.


## 6.3 Configuration View

The "Configuration Message View" could be used to change the configuration for the R&S TSMX-PPS2.

### u-center:

→ Select menu "View" → Configuration View → Displays the list of configuration messages...

Select the UBX message of interest in this view and press the  button to retrieve the current configuration.

For changing any setting select the corresponding UBX message and adapt the parameters in the message window. The new parameters will be sent to the receiver when pressing the  button.

The following sections list some of the important configuration commands for R&S TSMX-PPS2.

### 6.3.1 Verifying ADR Settings

Select "EKF" message in "Configuration View"

**u-center:**

→ Select menu "View" → Configuration View → EKF Settings

- 1) **Gyro**  
Keep the default setting (see section "ADR Sensor Settings" on page 39).
- 2) **Temperature**  
Keep the default setting (see section "ADR Sensor Settings" on page 39).
- 3) **Pulses**  
The pulse ratio of the connected wheel sensor could be entered here. But this value will be calculated during calibration.
- 4) **Direction Pulse**  
Change the polarity of direction signal if necessary.

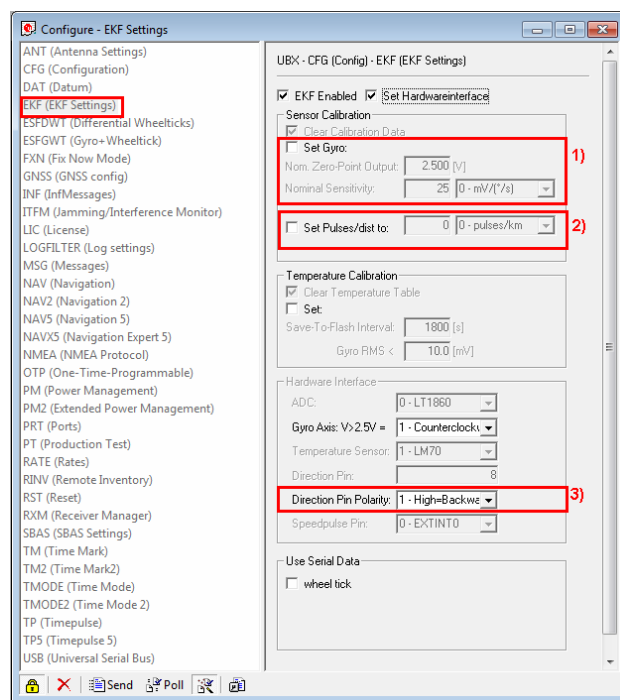



Figure 6-3: UBX Configuration Message "EKF"- Sensor Settings

For changing any parameter select the corresponding "Set" tick to enter the new value. The new parameters will be sent to the receiver when pressing the  Send button.

To keep settings after re-powering the device, it is necessary to save the configuration in the flash (see section "Saving User Configurations" on page 36).

### 6.3.2 Resetting Sensor Calibration

Select "EKF" message in the "Configuration View"

**u-blox u-center:**  
 → Select menu "View" → Configuration View → EFK → Tick at "Clear Calibration Data" → Click on "Send" in the left lower corner

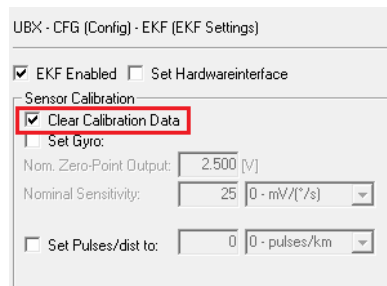


Figure 6-4: UBX Configuration Message "EKF"- Reset Sensor Settings

### 6.3.3 Time Pulse Settings

Select "TP" message in the "Configuration View"

**u-blox u-center:**  
 → Select menu "View" → Configuration View → TP (Timepulse)

Configurable parameters:

- Pulse Mode:** defining edge for precision (rising or falling)
- Pulse Period:** output frequency of time pulse
- Pulse Length:** pulse length of the time pulse
- Time Source:** reference for the time pulse (GPS time, UTC, etc.)

For default settings please refer to section "Time Pulse Settings".

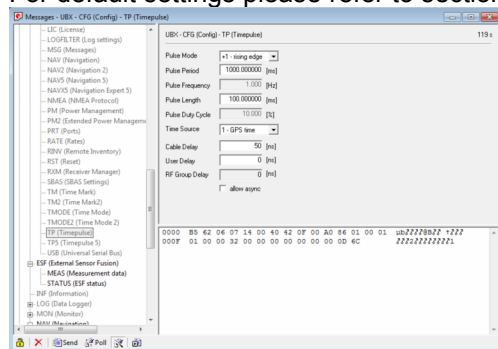


Figure 6-5: UBX Configuration Message "TP"- Time Pulse Settings


To keep settings after re-powering the device, it is necessary to save the configuration in the flash (see section "Saving User Configurations" on page 36).

## 6.4 Message View

The “Message View” could be used to request certain status messages of the R&S TSMX-PPS2.

**u-blox u-center:**

→ Select menu “View” → Message View → Open “UBX” on the left tree view → Displays the list of available messages...

Select the UBX message of interest in this view and press the  button to request the specific information.

The following sections list some of the important messages for the R&S TSMX-PPS2.

### 6.4.1 Sensor Measurement Data

Select “ESF-MEAS” message in the “Configuration View”

**u-blox u-center:**

→ Select menu “View” → Configuration View → ESF (External Sensor Fusion) → MEAS (Measurement data)

This message visualizes the measurement data for the various sensors and gives an impression of sensor signals are being detected.

- Single Tick:** Accumulated pulses of the wheel trigger
- Gyro Z:** Acceleration in z-axis
- Gyro Temperature:** Measurement of the internal temperature sensor

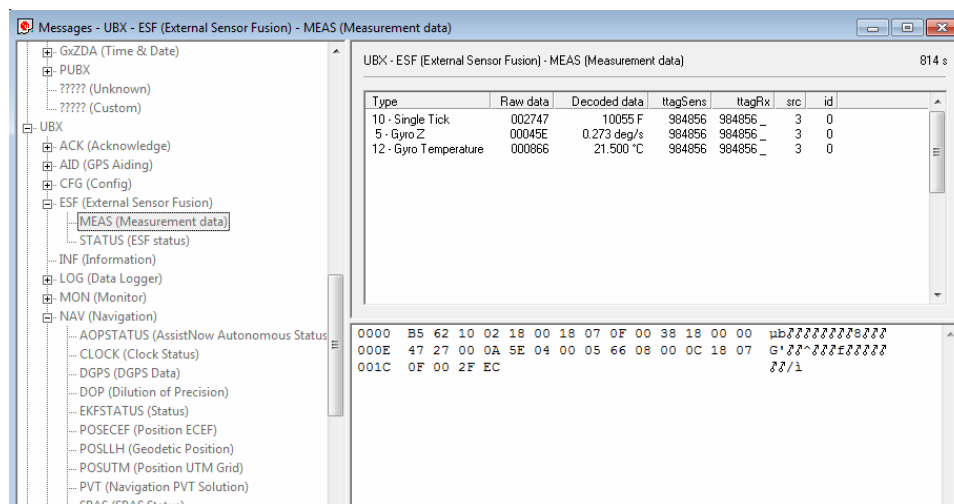


Figure 6-6: UBX Message “NAV EKFSTATUS”- Status

### 6.4.2 ADR Calibration Status

Select "ESF-STATUS" message in the "Configuration View"

**u-blox u-center:**

→ Select menu "View" → Configuration View → ESF (External Sensor Fusion) → STATUS (ESF status)

This message gives a quick overview of the calibration state for the different sensors (temperature, wheel tick and gyro) and the usage of the different sensors for ADR.

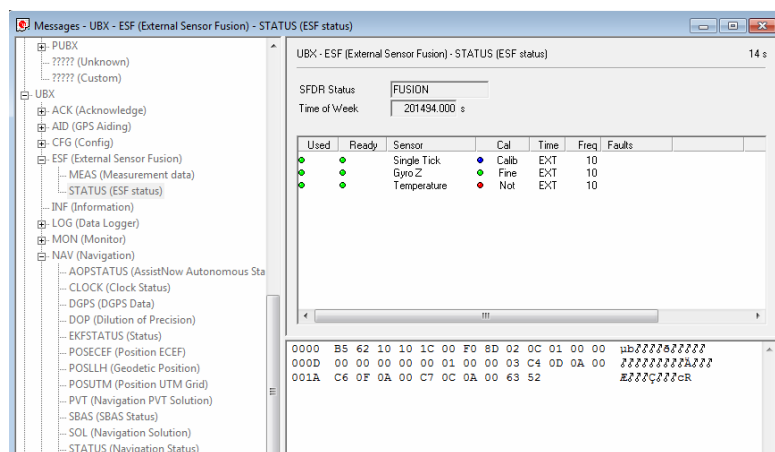


Figure 6-7 UBX Message "ESF-STATUS"- External Sensor Fusion

For details about the various parameters of the please refer to the UBX Protocol Receiver Description → ESF-STATUS (see section "u-blox Internet Pages" on page 44 for a link).

This documentation is also included on the accessory CD-ROM ([..\documents\Manuals\ u-blox6\\_ReceiverDescriptionProtocolSpec.pdf](#))

## 6.5 Saving User Configurations

The u-center software can be used to store user defined device settings in a file. This file can be used later to configure other devices.

**u-blox u-center:**

→ Tools → GPS Configuration...  
 → click on GPS >> FILE  
 → select file and destination to store configuration and press Save

## 6.6 Recover GPS Factory Settings

Under certain circumstances it is necessary to bring the R&S TSMX-PPS2 device back to factory setting. This could be done using the “GPS configuration” tool from u-center software.

The factory configuration of the R&S TSMX-PPS2 is part of the CD-ROM.

[..\software\Default Configuration\TSMX-PPS2\\_DefaultConfig.txt](#)

For restoring the original device configuration, proceed as follows:



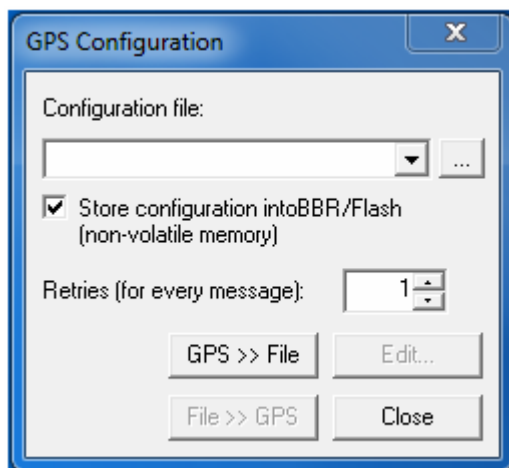
**u-center:**

→ Tools → GPS Configuration...

→ select configuration file

→ set tick to store configuration file into BBR/Flash

→ click on File >> GPS



**Figure 6-8:** GPS configuration window to reload and store GPS settings

## 7 Default Settings

The R&S TSMX-PPS2 is being shipped with a factory configuration and is ready to use. By means of the u-center demo application or by any customer application, it is possible that these default settings are being re-configured in a way that the GPS receiver won't work properly anymore.

In order to overcome this, the device factory settings are part of the accessory CD-ROM. This could be reloaded into the device by means of the u-center application (see section "[Recover GPS Factory Settings](#)" on page 37).

### 7.1 USB Port Settings

Regarding the **USB interface** specifications the receiver default settings are:

- Interface: USB
- Protocols in: UBX + NMEA + RTCM
- Protocols out: UBX + NMEA
- Baud rate COM Port: 9600

### 7.2 Time Pulse Settings

- Precision of Signal: at 99 % of time < 60 ns; RMS = 30 ns  
(Under good GPS signal conditions)
- Precision Edge (Mode): rising / falling / disabled (default: Rising Edge)
- Pulse Period/Freq.: adjustable 0.25 Hz to 1 kHz (default: 1 Hz)
- Pulse Length: adjustable; > 100 ns (default 100 ms)
- Time Source: UTC time / GPS time / Local time (default GPS time)
- Cable Delay: adjustable; default: 50 ns
- User Delay: adjustable; default: 0 ns  
(Positive delay results in earlier pulse)

For details about possible configurations of the time pulse please refer to the UBX Protocol Receiver Description → Time pulse (see section "[u-blox Internet Pages](#)" on page 44 for a link).

This documentation is also included on the accessory CD-ROM  
(..\documents\Manuals\ u-blox6\_ReceiverDescriptionProtocolSpec.pdf)



## 7.3 Protocol Settings

The listed protocols are per default updated and transmitted:

### NMEA

- GPGGA (Global Positioning System Fix Data)
- GPGLL (Geographic Position – Latitude/Longitude)
- GPGSA (GNSS DOP and Active Satellites)
- GPGSV (GNSS Satellites in View)
- GPRMC (Recommended Minimum Specific GNSS Data)
- GPVTG (Course Over Ground and Ground Speed)

### UBX

- ESF\MEAS (Sensor Measurement Data)
- ESF\STATUS (Sensor Status)
- NAV\EKFSTATUS (Dead Reckoning Overview)

## 7.4 ADR Sensor Settings

The following parameters are programmed from R&S ROMES software any time the R&S TSMX-PPS2 device is loaded as hardware device. R&S ROMES uses the EKF message of the UBX protocol.

### Sensor Calibration

- Nom. Zero-Point Output: 2.500 [V]
- Nominal Sensitivity: 25 [mV/(deg/s)]

### Temperature Calibration

- Save-To-Flash Interval: 180 [s]
- Gyro RMS: 1.0 [mV]

### Hardware Interface

- Gyro Axis:  $V > 2.5 V =$  1 – counter clock
- Direction Pin Polarity: 1 – High = Backwards

Direction Pin Polarity	Interpretation of input level in the device
0	High = Forward, Low = Backward
1 (default)	High = Backward, Low = Forward

**Table 7-1: Interpretation of direction signal**

## 8 Troubleshooting

### 8.1 Device does not power on

The device has not changed into "Power On" state (STATE LED doesn't lit green) after being connected to the host PC:

1. Check USB cable connection
2. Check if USB port is working well on the PC/Laptop/Tablet
3. Nothing helps → contact your local R&S service

### 8.2 Device not selectable in software

The virtual COM for the R&S TSMX-PPS2 (u-blox 6 GPS Receiver) might not being listed in the Windows Device Manager.

1. Check if the USB device driver had been installed correctly. Depending on the type of software application this has to be executed as a separate step:
  - a. **u-center:** no special measures are necessary for device driver installation. This is integral part of the u-center setup.
  - b. **R&S ROMES:** device driver for u-blox LEA-6R module need to be installed separately previous to starting software application. The device driver is included in the CD-ROM ([..\software\Drivers\ublox\\_USB\\_driver.exe](#)).
  - c. **OEM application:** the software originator is responsible for adding this into the dedicated setup
2. Check the device driver version.

If necessary, install the latest driver version for LEA-6 chipsets from the u-blox homepage. Please refer to section "[u-blox Internet Pages](#)" on page 44 for a link).

### 8.3 No GPS position fix

1. Check if GPS antenna is connected correctly.
2. Check if GPS antenna has free line of sight to the sky.
3. Signal is too poor or no signal → change to location with brighter sky view.
4. Check the GPS receiver configuration. If necessary reset to factory settings. (see section "[Recover GPS Factory Settings](#)" on page 37).
5. For ADR users: Reset sensor calibration and restart calibration (see section "[Deleting Calibration Data](#)" on page 28).

## 8.4 No Time Pulse (PPS)

1. Check your PPS cable connections
2. Check the position fix mode of your device. It has to be at least "2D" or "3D" position. In this case the PPS LED has to blink.
  - a) If displayed "**No Fix**", change your location to a place with brighter and better sky view.
  - b) If Fix Mode is "**2D**" or even "**3D**" and PPS LED is blinking and no PPS signal can be detected on the output, please send the device to your local R&S service.

## 8.5 ADR Calibration fails

1. Check with u-center software whether the external sensor signals (speed and direction) and the embedded gyroscope are being detected (see section "[Sensor Measurement Data](#)" on page 35).
  - If speed signal is missing check whether the Sensor Cable is plugged in and connected correctly to the vehicle signals (speed & direction). Maybe check the outputted signal with an oscilloscope.
  - If the gyroscope signal is missing please send the device to our support, because greater damage could be happened to the device
  - If all signals are displayed go on with next step
2. Try to restart the calibration by clearing the latest calibration data to get sure not to have any corrupted calibration data set (see section "[Resetting Sensor Calibration](#)" on page 34).
3. Execute sensor calibration and monitor calibration status (see section "[ADR Calibration Status](#)" on page 36). If it still fails, please proceed with next step.
4. Restore factory settings and repeat with step 3. If nothing helps please contact the local R&S service.

## 8.6 Checking extern sensor signals

1. Check with u-center software whether the external sensor signals (speed and direction) and the embedded gyroscope are being detected (see section ["Sensor Measurement Data"](#) on page 35).
  - If speed signal is missing check whether the Sensor Cable is plugged in and connected correctly to the vehicle signals (speed & direction). Maybe check the outputted signal with an oscilloscope. If the Sensor Cable is firmly fixed to the car and measuring of the signals is only possible on the Sensor Cable connector (the pin out could be find in section ["Sensor cable / SENSOR IN"](#) on page 20).

**Measuring direction:** Changing from forward to reverse gear has to be combined with a change of the signal level (for example as a rule from 0 V to 12 V, sometimes also reverse) between the DIRECTION+ and the DIRECTION- pins.

**Measuring speed:** When moving the vehicle, there should be a continuous square-wave, sinus- or a triangle-shaped signal (differs from car to car) with a frequency proportional to the driven speed between the SPEED+ and the SPEED- pins.
  - If the gyroscope signal is missing please send the device to our support, because greater damage could be happened to the device.
  - If all signals are displayed go on with next step.
2. Check position of installation.
  - The device has to be firmly fixed horizontal with the printed, brighter chassis side up to the car chassis in a way that the device could not move or turn (see section ["Placing the R&S TSMX-PPS2"](#) on page 15).
  - If the placement of the device is correct proceed with the next step.
3. Restore factory settings to exclude faulty settings (see section ["Recover GPS Factory Settings"](#) on page 37). In this regard consider that the configuration is stored into BBR/Flash (→ set corresponding tick in the u-blox GPS Configuration window!).
4. Check with u-center software whether the external sensor signals could now be detected.
  - If the signals are available proceed with sensor calibration (see section ["ADR Calibration Status"](#) on page 36)
  - If the signals are still not present please contact the local R&S service.

## 9 Accessory List

- |   |              |
|---|--------------|
| • Cable USB/A-USB/B 1.3 m               | 0041.9177.00 |
| • Active GPS Antenna 5 m                | 1503.3624.00 |
| • Cable Sensor 1.5 m                    | 1515.7213.00 |
| • CD with manual, software and drivers  | 1515.7165.08 |
| • Printed Getting Started Documentation | 1515.7236.02 |
| • Cable Sync (SMA/BNC)                  | 3522.0565.00 |

## 10 References & Links

All links listed in this document represent the state of release date and may be changed from u-blox without notice!

### 10.1 Rohde & Schwarz Internet Pages

**Rohde & Schwarz Homepage**

<http://www.rohde-schwarz.com>

**R&S TSMX-PPS2 Product Page**

<http://www.rohde-schwarz.com/product/TSMXPPS2.html>

**R&S ROMES Software Product Page**

<http://www.rohde-schwarz.com/product/ROMES.html>

### 10.2 u-blox Internet Pages

**u-blox Homepage**

<http://www.u-blox.com/index.php>

**LEA-6R Product Page**

<http://www.u-blox.com/en/gps-modules/u-blox-6-dead-reckoning-module/lea-6r.html>

**u-blox Gen 6 Resources Overview**

<http://www.u-blox.com/en/download/documents-a-resources/u-blox-6-gps-modules-resources.html>

**UBX Protocol Description**

[http://www.u-blox.com/images/downloads/Product\\_Docs/u-blox6\\_ReceiverDescriptionProtocolSpec\\_%28GPS.G6-SW-10018%29.pdf](http://www.u-blox.com/images/downloads/Product_Docs/u-blox6_ReceiverDescriptionProtocolSpec_%28GPS.G6-SW-10018%29.pdf)

**LEA-6R chipset**

<http://www.ublox.com/en/gps-modules/u-blox-6-dead-reckoning-module/lea-6r.html>

**u-center Online Manual**

[http://www.u-blox.com/images/downloads/Product\\_Docs/u-Center\\_User\\_Guide%28GPS-SW-08007%29.pdf](http://www.u-blox.com/images/downloads/Product_Docs/u-Center_User_Guide%28GPS-SW-08007%29.pdf)

**u-center Program Download**

<http://www.u-blox.com/en/evaluation-tools-a-software/u-center/u-center.html>

**Standard UBS driver**

<http://www.u-blox.com/en/drivers-a-middleware/usb-drivers/windows-vistaxp2000-driver.html>

**Windows sensor API driver**

<http://www.u-blox.com/en/drivers-a-middleware/usb-drivers/windows-7-driver.html>

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