Hardware Manual – Operation Instructions, Safety Guidelines and Specifications

SEA 9405

GPS Module for CompactRIO™

Part No.: 60000201

s·e·a Science & Engineering Applications Datentechnik GmbH

Doc. No.:
HB/SEA 9405 Hardware Manual/3.1.a/Feb-2019

Content

Getting Started

General

The safety ratings and specifications in this document are specific to the SEA 9405 module and may differ for other components in the system. To determine the safety ratings and specification of the entire system refer to each component in the system.

Before starting to work with the SEA 9405 module please read this document and the software manual carefully. If there are any questions about operating the module or if any term is not understood, please contact the vendor before using the module.

Ensure that you use the latest version of the manuals:
Check the Support/Downloads area on the S.E.A. website `http://www.sea-gmbh.com` for updates and get the latest version if available.

Refer to the software manual for details on programming and integration of the SEA 9405 module.

Refer to the appropriate National Instruments™ documentation for details on National Instruments hardware.

We believe that all information in this manual is accurate. The document has been carefully reviewed for technical accuracy. In the event of techni-

cal or typographical errors, we reserve the right to make changes to subsequent editions of this document without prior notice to holders of this edition. The reader should consult the vendor if errors are suspected.

End User License Agreement (EULA)

Before operating the SEA 9405 and the provided software you have to agree to the terms and conditions (EULA). This agreement is part of the software installation procedure. In addition, the terms and conditions are available through the LabVIEW menu after installation (Tools › SEA › `product name` › Legal Information). If you do NOT agree you can send back the hardware and software package within a period of two weeks after delivery. In this case S.E.A. will refund the product price and shipping costs.

Safety Guidelines

To protect persons against any harm and the module from damage, the operation of the SEA 9405 module is only allowed according to the rules described in this document.

Operator Protection

Hot or Cold Surface The metallic surface of the module might become hot or cold as well. Touching the surface may result in bodily injury.
Do not dismount the module from the chassis during operation. Wait until the module temperature has reached 20 °C.

Do not insert or remove the module from the system or connect/disconnect wires or connectors to/from the module unless power has been switched completely off. Make sure working in an ESD safe environment.

Do not open or disassemble the module or other hardware parts.
Guarantee is void if the seal is broken!

Use only isolated power supplies made for use with CompactRIO systems (typically with a voltage of 12 VDC).

Keep the module and the antennas at least 1 meter away from human bodies during operation.

Safety Critical Applications

The module is not failure tolerant and therefore not suitable for use in safety critical applications.

Do not use the module for medical applications or any live supporting apparatus.

Do not solely use the module for geoposition determination, when a failure can be a danger for the environment, material or can possibly harm humans.

Hazardous Locations

The module is suitable for use in non hazardous locations only. Keep the module always away from hazardous locations and explosive areas.

Protect the module from thunderstorm and lightning strikes or other electrical hazards.

Use the module only in dry areas. Do not operate the module in bath areas, kitchens etc., where water or vapor can be getting in contact with the module or cables.

Hazardous Voltages

A voltage is hazardous when higher than 25 V_{RMS} or 60 VDC to earth ground according to IEC 60364-4-41 (SELV). If the module specifications allow to connect hazardous voltages to the module, take the following precautions, when connecting hazardous voltages to the module:

Make sure that only qualified personnel wires hazardous voltage adhering to local electrical standards.

Do not mix hazardous voltage circuits and human-accessible circuits on the same module.

The module must not be operated in high voltage areas.

Prerequisites

The SEA 9405 module is shipped with the following accessory:

- Printed hardware manual with operating instructions, safety guidelines and specifications

In order to operate the module the following components are required (not shipped with the module):

- CompactRIO™ system from National Instruments™
- GPS antenna – mandatory for operation, compatible antennas for various purposes are available from S.E.A. shop at shop.sea-gmbh.com
- Software driver – available as a free download from the support area at www.sea-gmbh.com

The SEA 9405 module can currently be operated in the following CompactRIO™ systems:

- Reconfigurable Chassis (RIO chassis)
- Expansion Chassis: all types

  It is strictly recommended to use the module only in combination with accessories provided or recommended by S.E.A. to avoid incompatibility, malfunction or even damage of the components.

Connecting SEA 9405

The SEA 9405 is a GPS module for stationary and mobile usage. It provides position data for global localization on earth, as well as precise time base for timing and synchronization purposes.

The module is designed to be operated in a FPGA - based RIO chassis only. It can be operated in any slot. Multiple modules can be operated in parallel (independently) inside a single RIO chassis. The power is supplied through the backplane from the RIO chassis.

On the front side the module provides LEDs (1) to indicate the status of the module, as well as sockets (2), (3) to connect accessory, refer to Fig. 1. Additionally, on the imprinted side a DIP switch (4) is available to control behavior of the backup battery.

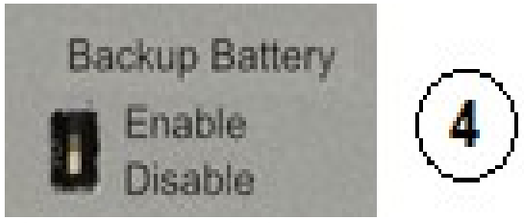

Fig. 2: DIP Switch

The subsequent sections describe each interface in more details.

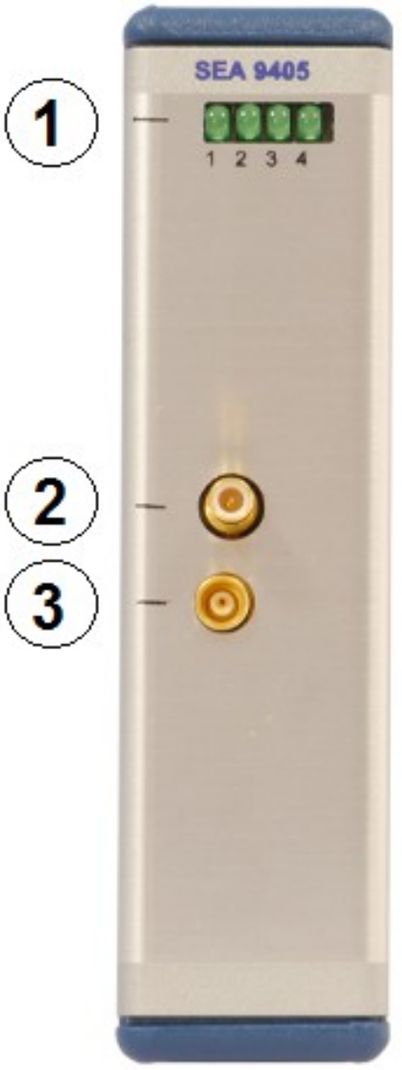

Fig. 1: Front Side

LEDs (1)

The LEDs on the front side indicate the status of the module. The meaning of each LED is described in the table below:

LED #	Meaning
1	unused
2	unused
3	Backplane Power - is steady on when power (through the back-plane connector) is present
4	GPS Status - flashes with Timepulse frequency when GPS re-ceives valid data.

Tab. 1: LEDs

All LEDs are OFF while *Sleep Mode* is active or FPGA is not running a code.

A short description on the LEDs can also be found on the imprinted side of the module housing.

Sync Output (2)

This SMB socket (male) delivers 5V-TTL-compatible Timepulse output signal (also known as Pulse-Per-Second or PPS). The Timepulse signal provides a short impulse (logical high level) at the beginning of each second.

The Sync Output signal, however, can be customized by redirect the original Timepulse signal to the FPGA, generate a custom signal and output this signal on the Sync Output socket.

GPS Antenna (3)

This MCX socket (female) allows to connect an external GPS antenna to the module. The usage of an adequate GPS antenna is mandatory to receive valid GPS data. Only active GPS antennas with a supply voltage of 3.3 V and a maximum current of 40 mA are allowed. Antennas with differing specifications may destroy the module.

Select adequate antennas carefully for the intended use case. Mount the antennas mechanically properly at the desired location. Connect only antennas which are proven to work with these modules. Refer to the S.E.A. web shop at http://www.sea-gmbh.com for compatible antenna types.

If a roof antenna is used, the antenna has to be dismounted when lightning strikes are likely to happen. The module and any antenna or cabling is NOT protected against lightning strikes or any over-voltage. Do NOT operate the module or antenna during thunderstorms, and keep the antenna away from any kind of elevation.

Backup Battery (4)

The backup battery provides the following features:

- Stores the last GPS almanac.

This feature significantly speeds up the availability of the first valid GPS data after a power-up, because the module does not need to collect the almanac again, which can take several seconds or minutes. This option requires that the location of the GPS antenna didn't changed significantly since the last switch-off.

The functionality of the DIP switch is explained below:

Switch	Meaning
Backup Battery	**Enable:** The battery is charged when the module is powered. The GPS almanac is saved while switched off. **Disable (default):** The battery is not charged when powered. The GPS almanac is not saved while switched off.

Tab. 2: DIP Switch

The battery is designed as a maintenance-free component and is hence not considered to be replaced during a module's lifetime. Therefore it is recommended to take some measures to extend the battery's lifetime:

The battery should not be discharged below a minimum limit to avoid its damage. Therefore do not store the module with enabled battery for long time periods. An acceptable store period is between 2 and 6 weeks depending on the battery condition and

the storage conditions (temperature, humidity...). As a general rule: a storage period of 4 weeks is achievable under normal environmental conditions, when the battery is fully charged before.

Sleep Mode

This module supports a low-power sleep mode. In sleep mode typically there is no communication with the module and the power consumption is minimized. The system thermal dissipation may decrease. Refer to the *Specifications* section for more information about power consumption and thermal dissipation. The sleep mode can be enabled by software.

Specifications

The following specifications are typical for the nominal temperature of 20 °C unless otherwise noted.

GPS Characteristics		
Number of Channels	50	
Frequency Band	GPS L1	
Cold Start Acceleration	Yes (Backup Battery)	
<u>Time-To-First-Fix</u> Cold Start, w/o Battery Cold Start w/ Battery	s	 26 3
Max. Update Rate	Hz	4
<u>Position Accuracy</u> Horizontal Vertical	m	 2.5[1] 10 to 40
Velocity Accuracy	m/s	0.1
Max. Altitude	m	2000
Max. Speed	km/h	500

1 CEP, 50%, 24 hour static, -130dBm, SEP: <3.5m

Timepulse Accuracy	ns	± 50
Timepulse Logic Low High	V	 0 to 0.3 0.7 to 5
Power Requirements[1]		
Operating Voltage (RIO chassis)	VDC	5
Operating Current Typical Sleep Mode	mA	 60[2] 4
Physical Characteristics		
Weight	g	ca. 175
Dimensions	mm	80 x 23 x 88
Environmental Conditions		
Operating Temperature	°C	-25 to +60
Storage Temperature	°C	-25 to +60

1 The exact power consumption is dependant on the active communication standard as well as the antenna and reception quality.

2 With active GPS-Patch antenna connected to the module.

Ingress Protection[1]		IP 30
Operating humidity	%[2]	10 to 90
Shock and Vibration		
<u>Operating Vibration</u> Random (IEC 60068-2-64) Sinusoidal (IEC 60068-2-6)	Hz	5 g_{rms}, 10 to 575 5 g, 10 to 575
<u>Operating Shock</u> (IEC 60068-2-27)		15 g, 11 ms half sine, 30 g, 11 ms half sine, 50 g, 3 ms half sine, (10 shocks at 6 orientations)

Tab. 3: Specifications

1 with connected power cable
2 RH, noncondensing

Certifications

For EMC compliance, it is only allowed to operate the SEA 9405 with original and shielded antenna cabling only. For further information about antennas and cabling please refer to our website: http://www.sea-gmbh.-com

This product meets the essential requirements of the following US directives:

- FCC 47 CFR Part 15B: Class B

This product meets the requirements of the **INDUSTRY OF CANADA RULES.**

CE

This product is conform with the following European Union directives (RE-D):

- 2014/30/EU (EMC)
- 2014/35/EU (Health & Safety)
- 2014/53/EU (Radio)

The conformity is assessed in accordance with the following standards (test pending):

- EN 301 489-1 v2.1.1 (EMC)
- EN 301 489-19 v2.1.1 (EMC)
- EN 62311:2008-09 (Health)
- EN 60950-1:2014-08 (Safety)
- EN 303 413 v1.1.0 (Radio, GPS)

Contact and Support

Address

S.E.A. Datentechnik GmbH
Muelheimer Strasse 7
53840 Troisdorf
Germany

Support channels

1. website: http://www.sea-gmbh.com
2. email: techsupport@sea-gmbh.com
3. phone: + 49 2241 12737 – 0
4. fax: + 49 2241 12737 – 14