

# DS.GAM.333

Digital 9-Axis IMU Sensor



Part No.: 670000615



**S·E·a** Science & Engineering  
Applications Datentechnik  
GmbH.

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# Getting Started

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## General



The safety ratings and specifications in this document are specific to the DS.GAM.333 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 DS.GAM.333 module please read this document and the Digital Sensor Toolkit 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 Digital Sensor Toolkit manual for details on programming and integration of the DS.GAM.333 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 DS.GAM.333 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

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To protect persons against any harm and the sensor from damage, the operation of the DS.GAM.333 sensor is only allowed according to the rules described in this document.

### Operator Protection



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



Use only isolated power supplies with a nominal voltage as stated in the *Specifications*, later in this manual.

### Safety Critical Applications



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



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

### Hazardous Locations



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



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



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

## Hazardous Voltages

A voltage is hazardous when higher than 25 V<sub>RMS</sub> or 60 VDC to earth ground according to IEC 60364-4-41 (SELV). If the sensor specifications allow to connect hazardous voltages to the sensor, take the following precautions, when connecting hazardous voltages to the sensor:



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 sensor.



The sensor must not be operated in high voltage areas.

## Prerequisites

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The DS.GAM.333 sensor is shipped with the following accessory:

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

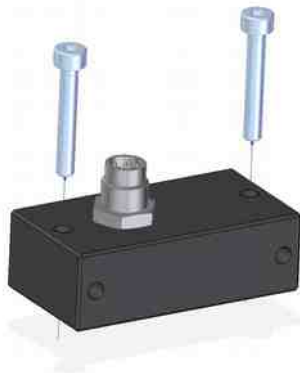
In order to operate the sensor the following components are required (not shipped with the sensor):

- Sensor Cable for Digital Sensors (DS), part no.: 61000144
- Processor-based computing unit (e.g. CompactRIO™ system from National Instruments™) with high-speed digital I/O lines (e.g. SEA 9210, part no.: 60000083)
- Power Supply (e.g. SEA 9210, part no.: 60000083)

## Mounting DS.GAM.333

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DS.GAM.333 is enclosed in a massive aluminium housing with two pairs of mounting holes allowing to mount the sensor in two orientations. The Fig. 1 shows an exemplary mounting orientation.



*Fig. 1: Mounting*

The mounting holes have a diameter of 3.2 mm, hence it is recommended to use M3 (3 mm) screws. For each orientation two screws are required for mounting. Please note, that screws are not enclosed with the sensor.



The sensor offers nine axis of measurement, for each physical quantity (acceleration, gyro, magnetometer) three orthogonal axis. The orientation of the axis is printed on the enclosure. Please consider the axis orientation before mounting the sensor. The mapping to the axis data in the software is as follows:

Hardware (Enclosure)	Software Driver		
X	-X_A (bin)	-X_G (bin)	-Y_M (bin)
Y	-Y_A (bin)	-Y_G (bin)	-X_M (bin)
Z	+Z_A(bin)	+Z_G (bin)	-Z_M (bin)

Tab. 1: Axis Mapping

Also refer to the fig. *Axis Mapping* for graphical representation<sup>1</sup>.

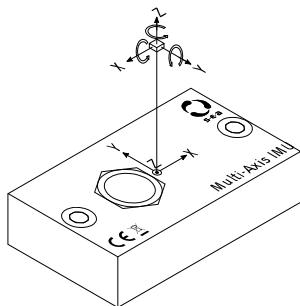


Fig. 2: Axis Mapping

<sup>1</sup> The rotation axis refer to gyro; magneto. axis are not shown to keep the fig. readable.

## Connecting DS.GAM.333

In order to operate the DS.GAM.333 it needs to be connected to a processor-based computing unit with suitable I/O and power supply (refer to the chapter *Prerequisites* early in this manual). For this purpose the DS.GAM.333 provides a single socket (type M8) for data communication and power supply. The pinout of this socket is shown in Fig. 3. The meaning of each pin is documented in Tab. 2 below.

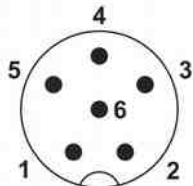


Fig. 3: Sensor M8 Socket Pinout

Pin	Meaning
1	CS – Chip select line
2	VCC – 3.3 VDC
3	SDO – Data out line (from sensor)
4	SDA – Data in line (to sensor)
5	SCL – Clock line
6	GND

Tab. 2: Sensor Socket Pinout

To integrate the sensor we strongly recommend to use the SEA 9210 *Multi-I/O* module (part no.: 60000083) along with the *Sensor Cable f. Digital Sensors (DS)* (part no.: 61000144), both separately available from S.E.A. In this setup just connect the connector end of the cable with the sensor and the open wire end with SEA 9210. The recommended<sup>1</sup> wire mapping is as follows:

<b>Cable Wire (61000144)</b>	<b>SEA 9210</b>
White (CS)	SO1
Brown (VCC)	SVSUP
Grey (SDO)	SIO
Black (SDA)	SO2
Blue (SCL)	SO0
Pink (GND)	SGND

*Tab. 3: Wire Mapping Sensor Cable – SEA 9210*

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<sup>1</sup> Other SOs, SIs channels can be used as well, however the line direction must match; the recommended lines are used in the examples.

## Specifications

The following specifications are typical for the operating temperature range unless otherwise noted.

Acceleration Characteristics		
Axis	3, individually utilizable	
Range (selectable)	G	$\pm 2 / \pm 4 / \pm 8 / \pm 16$
Resolution	Bit	16
Sensitivity Scale Factor	LSB/G	16,384 / 8,192 / 4,096 / 2,048
Output Frequency	Hz	0 to 260 <sup>1</sup>
Output Data Rate	Hz	1000
Gyroscope Characteristics		
Axis	3, individually utilizable	
Range (selectable)	$^{\circ}/s$	$\pm 250 / \pm 500 / \pm 1000 / \pm 2000$
Resolution	Bit	16
Sensitivity Scale Factor	LSB/ $^{\circ}s$	131 / 65.5 / 32.8 / 16.4

1 Low pass filter cut-off frequency



Output Frequency	Hz	0 to 250 <sup>1</sup>
Output Data Rate	Hz	1000
<b>Magnetometer Characteristics</b>		
Axis		3
Range	$\mu\text{T}$	$\pm 4800$
Resolution	Bit	14
Sensitivity Scale Factor	$\mu\text{T}/\text{LSB}$	0.6
Output Data Rate	Hz	8
<b>Power Requirements</b>		
Operating Voltage Range	V	2.4 to 3.6
Operating Current (at 2.5V)	mA	3.7 (max.)
<b>Physical Characteristics</b>		
Weight	g	30
Dimensions	mm	44 X 23 X 24.1
<b>Environmental Conditions</b>		

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1 Low pass filter cut-off frequency

Environment Type	Indoor only	
Ingress Protection	IP	67
Operating Temperature	°C	-40 to +85
Storage Temperature	°C	-40 to +85
Operating Humidity	% <sup>2</sup>	10 to 90
Shock Survivability	G	10000

Tab. 4: Specifications

## Electromagnetic Compatibility



This product is conform with the following European Union Directives:

- Directive 2004/108/EC (EMC)
- Directive 2006/95/EC (LVD)

## Maintenance

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Only use a clean and dry towel to wipe the DS.GAM.333. The DS.GAM.333 is not water resistant and should not be operated in humid environments.

The DS.GAM.333 does not contain components, which have to be maintained.



Opening the DS.GAM.333 will destroy the heat conductors and will void warranty.

## Contact and Support

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### 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](mailto:techsupport@sea-gmbh.com)
3. phone: + 49 2241 12737 – 0
4. fax: + 49 2241 12737 – 14

