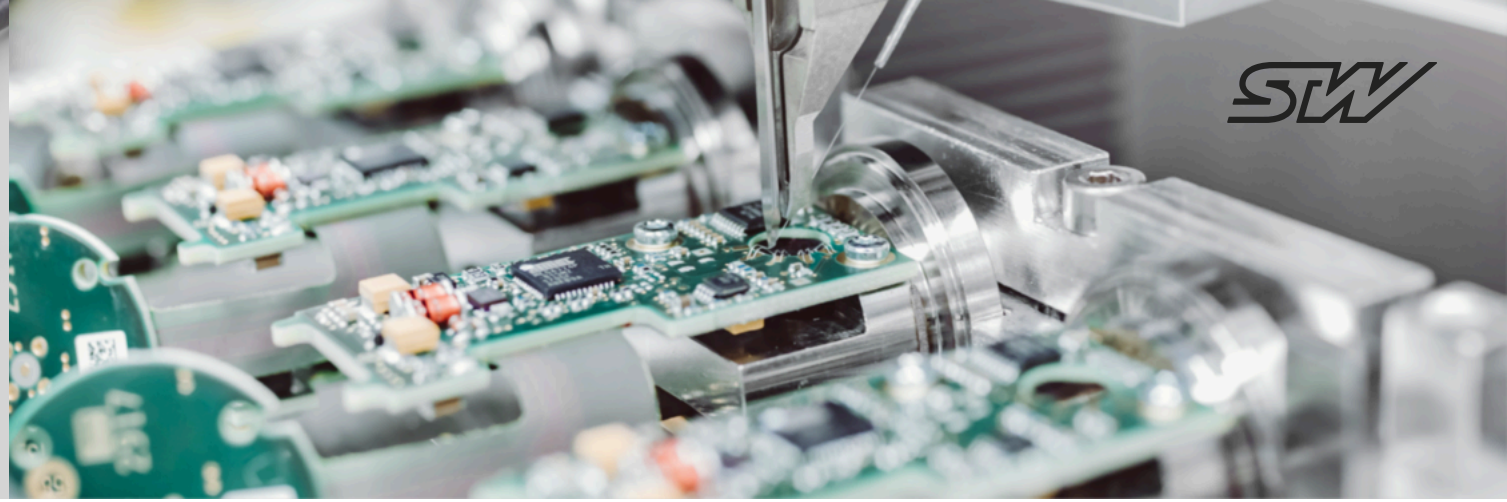


# **SMX.**igs-e

Inclination and Gyro Sensors

## KEY FEATURES

- Inertial measurement unit (IMU)
- Measurement of acceleration in 3 axes
- Measurement of angular velocity in 3 axes
- Measurement of the inclination of one axis or two axes
- Compact and robust design for use in harsh environments
- Internal adjustable digital signal filters, e.g. Kalman filter
- Integrated into STW's openSYDE software platform
- With ECE type approval

## TECHNICAL DATA

- Acceleration measurement range ±2 g
- Gyroscope measurement range ±1000°/s
- Configurable inclination measurement range ±90° or 360°
- Temperature range -40 °C to +85 °C
- Configurable interfaces: CAN, CANopen or SAE J1939
- Status LED
- Protection class IP6K5/IPX7/IPX9K

**Sensor-Technik Wiedemann GmbH**

Am Bärenwald 6
87600 Kaufbeuren
+49 8341 9505-0
info.stw@wiedemann-group.com
www.stw-mm.com

# TECHNICAL DATA

## Sensor

| Parameter | SMX.igs-e |
|---|---|
| Acceleration measuring range | ±2 g |
| Acceleration resolution | 1 µg |
| Gyroscope measuring range | ±1000°/s |
| Gyroscope resolution | 0.001°/s |
| Angle measuring range (configurable) | ±90° or 360° |
| Angle resolution | 0.01° |
| Angle accuracy | static ±0.3°<br>dynamic ±0.5° |
| Temperature coefficient | 0.01°/K |
| Filter options (configurable) | Butterworth filter 8th order<br>Critical damped filter 8th order<br>Kalman filter |

## CAN Interface

| Feature | Properties |
|---|---|
| Output signal | CAN, bit rate 100 ... 1000 kBit/s |
| Interface (configurable) | CAN, CANopen or SAE J1939 |
| Electrical protection | Short circuit protected (signal on GND/VCC) |
| Two-Colour-Status LED | Green / Red |

## Power Supply

| Feature | Properties |
|---|---|
| Voltage supply (power supply pin VCC) | 8 ... 36 V DC |
| | Supply lines inverse-polarity protected |
| Current Consumption | 50 mA @12 V DC |

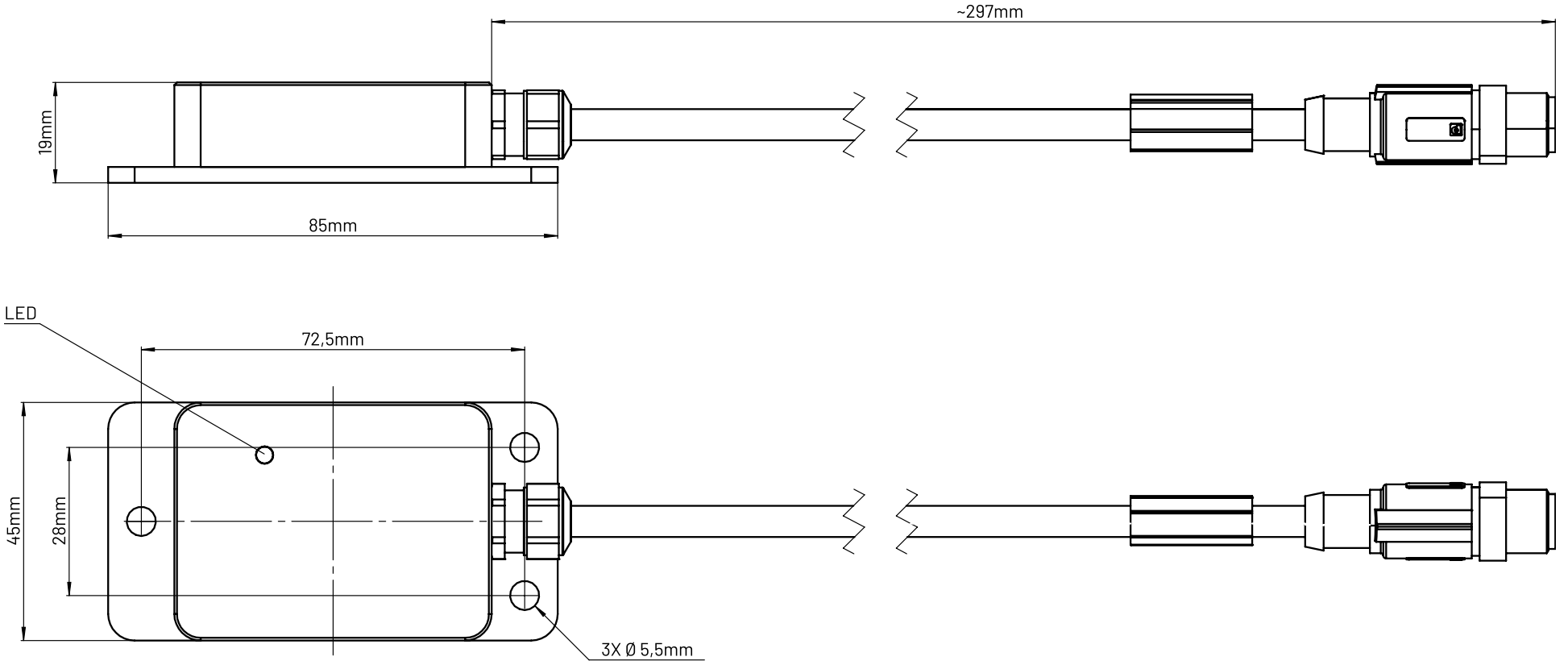
## Housing

| Feature | Properties |
|---|---|
| Housing material | Anodized aluminum |
| Degree of protection | IP6K5/IPX7/IPX9K |
| Electrical connection | Cable with 5 pole M12 plug, A coded |
| Dimensions (L x W x H) | 85 x 45 x 19 mm |
| Cable length | 300 mm |
| Weight | Approx. 130 g |
| Operating temperature | -40 °C ... +85 °C / -40 °F ... +185 °F |
| Storage temperature | -40 °C ... +85 °C / -40 °F ... +185 °F |

## Functional Safety

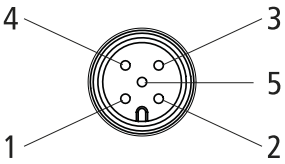
| Standard | Description |
|---|---|
| SN 29500 | MTTF = 381.25 years |

# TECHNICAL DRAWING



# PIN ASSIGNMENT

**Pin Assignment 5 Pin M12 Connector**




| Pin | Name | Description |
|---|---|---|
| 1 | CAN_SHLD | Shield |
| 2 | VCC | Power supply, 8 ... 36 V DC |
| 3 | GND | Common Ground |
| 4 | CAN_H | CAN High |
| 5 | CAN_L | CAN Low |

# QUALIFICATION

**Compliance Information**

| Standard | | Description | Parameter |
|---|---|---|---|
| ISO/IEC 17050-1 | CE | Conformity | See Declaration of Conformity |
| KBA (Kraft-fahrt-Bundesamt) | E1 | Certification | According UN ECE Regulation No. 10 No. 10R06/01 9376 00 |

# DETAILED QUALIFICATION

**Electromagnetic and Electrical Tests - EMC (CE Conformity)**

| Standard | Test Description | Test Parameter |
|---|---|---|
| DIN EN 61326-1:2013-07<br>DIN EN 55016-2-1:2014 + A1:2017 | Emissions - Electrical equipment for measurement, control and laboratory use | 150 kHz to 30 MHz<br>conducted emission |
| DIN EN 61326-1:2013-07<br>DIN EN 55016-2-3:2017 | Emissions - Electrical equipment for measurement, control and laboratory use | 30 MHz to 1000 MHz<br>radiated emission,<br>10 m |
| DIN EN 61326-1:2013-07<br>DIN EN 61000-4-2:2009 | Immunity - Electrical equipment for measurement, control and laboratory use -<br>Electrostatic discharge immunity test | 330 Ω / 150 pF<br>Contact discharge ±4 kV<br>Air discharge ±2, ±4, ±8 kV |
| DIN EN 61326-1:2013-07<br>DIN EN 61000-4-3:2006 + A1:2008 + A2:2010 | Immunity - Electrical equipment for measurement, control and laboratory use -<br>Radiated, radio-frequency, electromagnetic field immunity test | 80 MHz to 1.0 GHz →<br>10 V/m<br>1.0 GHz to 6.0 GHz →<br>3 V/m<br>3 m, horizontal and vertical<br>AM 80 %, 1 kHz |
| DIN EN 61326-1:2013-07<br>DIN EN 61000-4-4:2012 | Immunity - Electrical equipment for measurement, control and laboratory use - Electrical fast transient / burst immunity test | Supply lines ±2 kV<br>data lines ±1 kV<br>waveform: 5/50 ns tr/th<br>repetition frequency<br>100 kHz |
| DIN EN 61326-1:2013-07<br>DIN EN 61000-4-5:2014 + A1:2017 | Immunity - Electrical equipment for measurement, control and laboratory use -<br>Surge immunity test | Supply lines (symmetrical) ±0.5, ±1 kV<br>Supply lines (asymmetrical) ±0.5, ±1, ±2 kV |

**Electromagnetic and Electrical Tests - EMC (CE Conformity)**

| Standard | Test Description | Test Parameter |
|---|---|---|
| DIN EN 61326-1:2013-07<br>DIN EN 61000-4-6: 2014 | Immunity - Electrical equipment for measurement, control and laboratory use -<br>Immunity to conducted disturbances,<br>induced by radio-frequency fields | 150 kHz to 80 MHz, 3 V<br>80 % AM, sine at 1 kHz<br>150 Ω source impedance |

# DETAILED QUALIFICATION

**Electromagnetic and Electrical Tests - EMC (E1)**

| Standard | Test Description | Test Parameter |
|---|---|---|
| UN ECE R10<br>DIN EN 55025:2003-11, IEC/ CISPR 25:2002 | Emissions - Radiated emissions from components - ALSE method | 30 MHz to 1 GHz |
| UN ECE R10<br>ISO 11452-2:2004,<br>ISO 11452-5:2002-04 | Immunity - For components to electromagnetic Energy | ALSE - 1 GHz - 2 GHz, 30 V/m<br>Stripline - 20 MHz - 1 GHz, 60 V/m |
| ISO 7637-2:2004 | Emissions - Voltage transient emissions | 12 V: +75/-100 V |
| ISO 7637-2:2004 | Emissions - Voltage transient emissions | 24 V: +150/-450 V |
| UN ECE R10<br>ISO 7637-2:2004-09 | Immunity - Electrical transient conduction along supply lines only (12V and 24V System) - Level 3 | Pulse 1 (24 V) -450 V, 5000 pulses<br>Pulse 2a (24 V) +37 V, 5000 pulses<br>Pulse 2a (12 V) +37 V, 5000 pulses<br>Pulse 2b (24 V), +20 V, 10 pulses<br>Pulse 2b (12 V), +10 V, 10 pulses<br>Pulse 3a (24 V), -150 V, 1 h<br>Pulse 3b (24 V), +150 V, 1 h<br>Pulse 4 (24 V), -12 V, 1 pulse<br>Pulse 4 (12 V), -6 V, 1 pulse |

**Electromagnetic and Electrical Tests - EMC (E1)**

| Standard | Test Description | Test Parameter |
|---|---|---|
| ISO 16750-2:2012-11 | Immunity - Environmental conditions and testing for electrical and electronic equipment — Part 2: Electrical loads (12V System) | Load Dump - Test B<br>35 V, 400 ms, 2 Ω,<br>10 pulses |
| ISO 7637-3:2016-07 | Immunity - Electrical transient transmission by capacitive and inductive coupling via lines other than supply lines (24V System) - Level 4 | CCC<br>Pulse 3a: -150 V, 10 min.<br>Pulse 3b: +150 V, 10 min.<br>ICC<br>Pulse Slow-: -150 V, 10 min.<br>Pulse Slow+: +150 V, 10 min. |
| ISO 10605:2008-07 | Immunity - ESD component test method -Powered-up test | 330 Ω/330 pF, 330 Ω/150 pF, 2 kΩ/330 pF, 2 kΩ/150 pF<br>Contact discharge: ±2, ±4, ±6, ±8 kV<br>Air discharge: ±2, ±4, ±8, ±15 kV<br>Indirect contact discharge: ±2, ±4, ±8 kV |
| ISO 10605:2008-07 | Immunity - ESD component test method - Packaging and Handling test (unpowered test) | 330 Ω/150 pF<br>Contact discharge on pins and contacts: ±2, ±4 kV<br>Air discharge on surfaces: ±2, ±4, ±8 kV |

# DETAILED QUALIFICATION

**FCC 47 CFR Part15**

| Standard | Test Description | Test Parameter |
|---|---|---|
| FCC Part15 class B: 2017<br>ANSI C63.4: 2014 | Emissions - Conducted emission from power port | Frequency: 150 kHz - 30 MHz |
| FCC Part15 class B: 2017<br>ANSI C63.4: 2014 | Emissions - Radiated emission | Frequency: 30 MHz - 1 GHz, 10 m |

**Environmental Qualification**

| Standard | Test Description | Test Parameter |
|---|---|---|
| ISO 16750-4:2010-04 | Tests at constant temperature: Low temperature - storage | -40 °C for 24 h |
| ISO 16750-4:2010-04 | Tests at constant temperature: High temperature - storage | +85 °C for 48 h |
| ISO 16750-4:2010-04 | Tests at constant temperature: Low temperature - operation | -40 °C for 24 h |
| ISO 16750-4:2010-04 | Tests at constant temperature: High temperature - operation | +85 °C for 96 h |
| CLAAS - CN 05 0215-1:2017-01-01 | Tests at constant temperature: High temperature - operation | +85 °C for 240 h |
| ISO 16750-4:2010-04 | Temperature step test | +20 °C to Tmin to Tmax, 5 °C steps<br>Duration: 16 h (-40 °C to +85 °C)<br>Perform functional tests when DUT has reached the new temperature |
| ISO 16750-4:2010-04<br>IEC 60068-2-14 | Temperature cycling test - Rapid change of Temperature | Test Na<br>100 cycles, -40 °C to +85 °C<br>Transfer time < 5 s<br>Dwell time: 60 min.<br>Duration: 8 days 8 h |
| ISO 16750-4:2010-04<br>DIN EN 60068-2-14 | Temperature cycling test - specified change rate of Temperature | Test Nb<br>30 cycles, -40 °C to +85 °C<br>Duration 240 h |

# DETAILED QUALIFICATION

**Environmental Qualification**

| Standard | Test Description | Test Parameter |
|---|---|---|
| ISO 16750-4:2010-04 | Ice water shock test - Splash water test | Test Fluid: de-ionized water<br>Chamber Temperature: +85 °C<br>Water Temperature: 0 to +4 °C<br>Water Flow: (3 to 4 l)/3 sec (splash duration)<br>Cycle Duration: 66 min<br>Number of cycles: 100<br>Total Duration 110 h<br>In operation during splash |
| ISO 16750-4:2010-04<br>and CLAAS - CN 05 0215-1:2017-01-01<br>IEC 60068-2-11 | Salt spray test - Leakage and function | Test Ka<br>8 h salt spray and 16 h without spray<br>minimum 6 cycles á 24 h<br>In operation between fourth and fifth hour of each cycle |
| ISO 16750-4:2010-04<br>DIN EN 60068-2-52: 2018-08 | Salt spray test - Corrosion test | Severity 4<br>Duration: 14 days |
| ISO 16750-4:2010<br>IEC 60068-2-38 | Humid heat - Test 2:<br>Composite temperature / humidity cyclic test | Test Z/AD<br>10 cycles, upper temperature +65 °C<br>93% relative humidity,<br>5 cycles with frost phase (-10 °C)<br>Duration: 11 days<br>In operation when the maximum cycle temperature is reached |

**Environmental Qualification**

| Standard | Test Description | Test Parameter |
|---|---|---|
| ISO 16750-4: 2010-04<br>IEC 60068-2-30: 2005 | Humid heat - Test 3:<br>Dewing test | Test Db<br>Lower temperature: +25 °C<br>Upper temperature: +80 °C<br>5 cycles and 98% relative humidity<br>In operation |
| ISO 16750-4: 2010-04<br>DIN EN 60068-2-78:2014-02 | Damp heat, steady-state test | Severity: (40 ±2) °C and (85 ±3) % relative humidity<br>Not in operation for 20 days 23 h<br>In operation for the last hour<br>Duration: 21 days |
| ISO 16750-1:2018-11 | Life-time<br>Temperature cycling test - Rapid change of Temperature (Weibull) | Annex B<br>Test duration: 10 days<br>Min. temperature: -40 °C<br>Max. temperature: +85 °C<br>Holding time: 45 min.<br>Cycles: 166<br>Not in operation |
| ISO 16750-3:2012-12 Test VII<br>IEC 60068-2-64:2008, Test Fh<br>IEC 60068-2-14:2009, Test Nb | Vibration (random and broadband) with temperature superimposition | 10 - 2000 hz, 32 h/axis, 3 axes,<br>random and broadband vibration<br>Temperature superimposition:<br>-40 °C to +85 °C, 4 cycles per axis |

# DETAILED QUALIFICATION

**Environmental Qualification**

| Standard | Test Description | Test Parameter |
|---|---|---|
| ISO 16750-3:2012-12<br>DIN EN 60068-2-27 | Mechanical shock | Acceleration: 50 g, half sine<br>Time: 6 ms<br>10 Shocks/direction,<br>6 directions |
| ISO 16750-3: 2012<br>IEC 60068-2-31:2008 | Free fall | 3 devices, 2 falls every device on the opposite side of the housing<br>drop height: 1 m to concrete ground or steel plate |

**Environmental Qualification**

| Standard | Test Description | Test Parameter |
|---|---|---|
| ISO 16750-5:2010 | Chemical resistance | Code D: Mounting on the exterior<br>Agents: Urea and windscreen washer fluid<br>After test: drying at +85 °C, 22 h and 2 h respectively<br>Agents: Cavity protection, protective lacquer, protective lacquer remover, cold cleaning agent and ammonium containing cleaner<br>After test: drying at +25 °C, 22 h<br>Agents: car wash chemicals, glass cleaner, wheel cleaner, denatured alcohol and runway de-icer<br>After test: drying at +25 °C, 2 h<br>Application method: Protective lacquer and glass cleaner - spraying<br>All other agents - brushing |
| ISO 16750-4:2010<br>ISO 20653:2013 | IP Protection grade | IP6K5 / IPX7 / IPX9K |