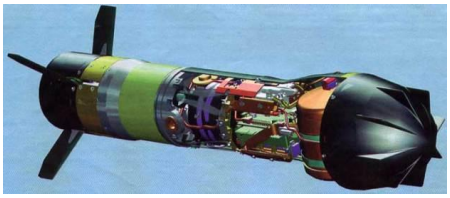
KebNi Inertial Sensing

Stockholm-based KebNi AB (publ) serves commercial and government customers globally. KebNi has extensive experience in inertial sensor systems (branded as AIMS) as well as satellite antenna solutions and is the leading Swedish developer and provider of IMU (Inertial Measurement Units) and INS (Inertial Navigation Systems) solutions.

TECHNICAL ADVANTAGE
Flexibility and cost efficiency is ensured by the slim organization. Highly skilled engineers design and deliver tailored solutions solving client needs of various types in various environments. Performance and reliability are ensured by high-spec sensors, advanced sensor fusion algorithms, modern code-generated software, modular hardware design, advanced calibration processes and extensive testing.

TRUSTWORTHY
Renowned and recurring customers confirm the performance and long-term reliability of products that are proven in battle and operated in harsh environments for years and years. The trustworthiness and solid experience in advanced sensor solutions is exemplified by below use-cases.






Predictive analysis	*Maintenance prediction on e.g. Volvo A30E-based BAE Systems' Archer*
Autonomous vehicles	*Navigation for e.g. Epiroc's autonomous underground loaders*
Rough environment	*Onboard sensors for e.g. next-gen Saab NLAW missile*
Top-level racing	*Tuning solution for e.g. prestigious Formula 1 team*
Satellite communication	*Control systems for e.g. stabilized military antennas*
Space navigation	*Navigation support for e.g. Mars rover*

SUPPORTS YOUR BUSINESS
Scalable capacity as production is outsourced, enabling offshore production as/when needed to support end-user purchasing offset requirements. This is further eased as all products are ITAR free and has no export restrictions.

FOR MORE INFORMATION
Contact Erik Winther, Head of Sales KebNi Inertial Sensing, via telephone +46 721814050 or email erik.winther@kebni.com.

A2 December 2021

KebNi **SensAItion** product family

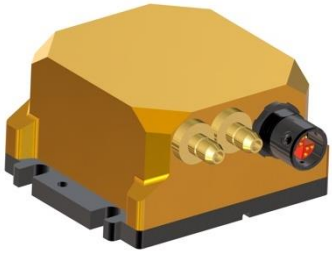
KebNi SensAItion is the ideal multisensor IMU/INS platform for the automotive industry, autonomous vehicles as well as other land, marine and air applications.

RACING HERITAGE
Under brand name AIMS, KebNi has helped prestigious racing brands in Formula 1 and Superbike win gold medals year after year.

KebNi has experience in (Inertial Measurement Units) and INS (Inertial Navigation Systems) solutions for navigation guidance of vehicles operating deep underground, on land, and as far up as on Mars' surface.

Based on the extensive racing and navigation experience, KebNi is currently finalizing the next-generation multisensor platform: SensAItion.

TAILORED FOR AUTONOMY
SensAItion is uniquely niched to satisfy tomorrow's requirements of the automotive industry, both in terms of specifications, price and regulatory compliance. SensAItion meets ISO-26262 Road vehicles, Functional safety. The AI-based sensor fusion algorithms are prepared for aiding inputs, including odometer/wheel rotation speed sensor.



KebNi SensAItion
Rugged INS version

FLEXIBLE FORM FACTOR
SensAItion is available both as IP68 rugged version for complete environmental protection and internal power supply filtering or as OEM version for tightly integration in the customer solution.

FULL INS-CAPABILITY
The modular hardware design allows for optional inclusion of supplementary sensors and computations. SensAItion is designed with full INS-capability though optional inclusion of one or two internal GNSS receivers. Supplementary internal and aiding sensors along with the advanced sensor fusion technology enables top performance at all times and conditions.

TOP PERFORMANCE AND RELIABILITY

- ✓ High-spec sensors
- ✓ Advanced sensor fusion algorithms
- ✓ Modern code-generated software
- ✓ Modular hardware design
- ✓ Advanced calibration process
- ✓ Extensive testing

SCALABLE PRODUCTION
The production capacity is fully scalable as product assembly is outsourced. Further, as the products are ITAR free and has no export restrictions, production can be located overseas on request.
Final development work is ongoing. Deliveries are scheduled to commence in early 2022.

Technical Data: **SensAItion** IMU and AHRS versions

Technical data is preliminary and may change without notice

PRODUCT OVERVIEW

KebNi SensAItion Inertial Measurement Unit (IMU) and Attitude and Heading Reference System (AHRS) is a miniature high performance IMU including inertial sensors, magnetometer and barometric pressure sensor. All units are individually calibrated for sensor errors over the full temperature range using advanced real time compensation algorithms and calibration process.

The product is available with IMU or AHRS functionality level. The IMU version provides fully compensated sensor data with high data rate. The AHRS version also provides attitude and heading data using KebNi's advanced onboard sensor fusion software and Kalman filter. The AHRS supports external GNSS aiding for increased performance during dynamic conditions. The onboard Kalman filter estimates and compensates for sensor bias and scale factor errors in real time.

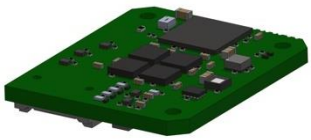
The product is available as rugged version for complete environmental protection and internal power supply filtering or as OEM version for tightly integration in the customer solution.

GENERAL SPECIFICATIONS

Sensors	Accelerometer, Gyro, Inclinometer, Magnetometer, Pressure Sensor
Aiding Sensors	GNSS (AHRS version only)
Operating Temperature	-40°C to +70°C
Vibration and Shock	ETSI EN 300 019-2-5
Functional Safety	ISO 26262

INTERFACE SPECIFICATIONS

Connector (Rugged)	12-pin miniature circular push-pull
Data (Rugged)	CAN 2.0 A/B, RS-232
Electrical (Rugged)	9 - 32 VDC
Connector (OEM)	20-pin micro board mounted
Data Interface (OEM)	CAN 2.0A/B, RS-232, SPI, I2C
Electrical (OEM)	3.6 - 5.5 VDC
Data Rate	Up to 4 kHz (IMU), Up to 1 kHz (AHRS)
Serial Protocol	Binary, NMEA
Sync	Sync-in, Sync-out



OEM version

AHRS SPECIFICATIONS

Roll/Pitch	0.1°
Heading (Magnetic)	1.0°
Heading (GNSS)	0.2° (during movement)

INERTIAL SENSOR SPECIFICATIONS

	Accelerometer	Inclinometer	Gyro
Range	8/16 g	2 g	250/500/1000 °/s
Bandwidth	Up to 500 Hz	Up to 100 Hz	Up to 500 Hz
In-run Bias Stability	≤20 µg	≤10 µg	≤2 °/h
Bias Error	2 mg 1σ	1 mg 1σ	0.1 °/s 1σ
Noise Density	0.1 mg/√Hz typ.	0.1 mg/√Hz typ.	0.0025 °/s/√Hz typ.
Cross-Axis Sensitivity	≤0.05°	≤0.05°	≤0.05°

MAGNETOMETER SPECIFICATIONS

Range	Up to 16 Gauss
Bandwidth	TBD
Noise	3.2 mGauss RMS typ.
Cross-Axis Sensitivity	≤0.1°

PRESSURE SENSOR SPECIFICATIONS

Range	260 - 1260 hPa
Bandwidth	TBD
Resolution	0.025 Pa
Accuracy	10/100 Pa Relative/Absolute

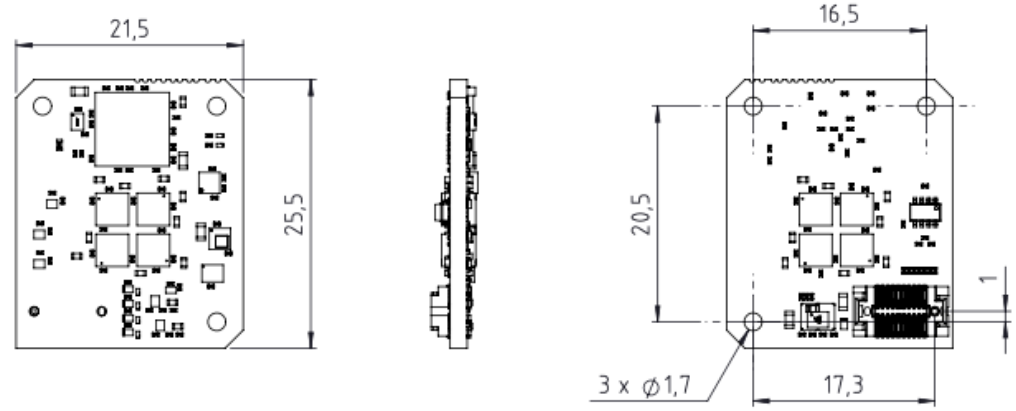
MECHANICAL SPECIFICATIONS

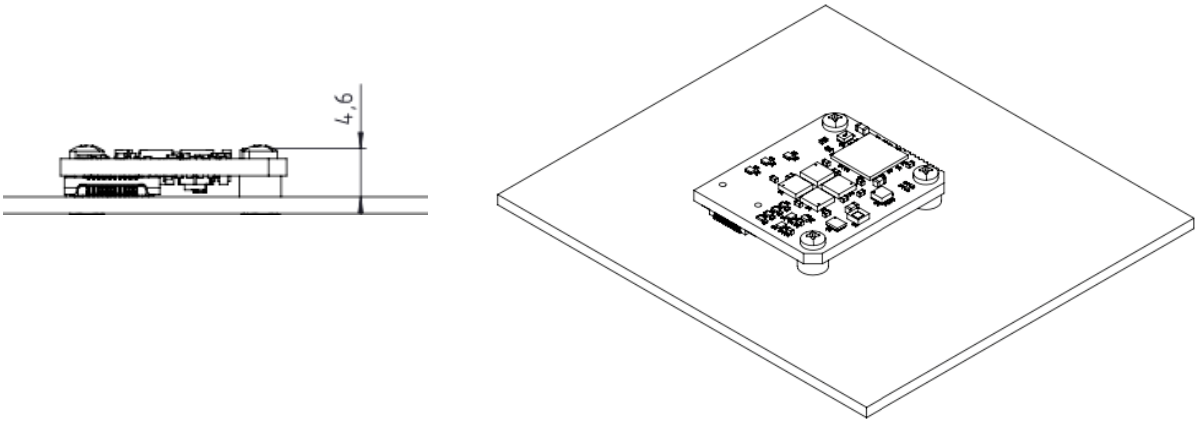
Housing (Rugged)	Aluminium, sealed IP68
Dimensions (Rugged)	TBD
Dimensions (OEM)	26 x 22 x 5 mm

PRODUCT DRAWING RUGGED VERSION

TBD

PRODUCT DRAWING OEM VERSION





Technical Data: **SensAItion** INS version

Technical data is preliminary and may change without notice

PRODUCT OVERVIEW

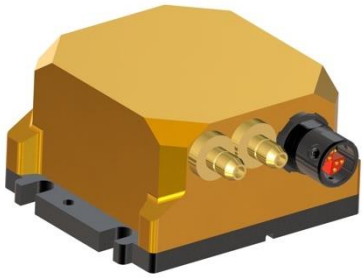
KebNi SensAItion Inertial Navigation System (INS) is a miniature high performance multi sensor navigation system including inertial sensors, dual high precision GNSS receivers, magnetometer and barometric pressure sensor. All units are individually calibrated for sensor errors over the full temperature range using advanced real time compensation algorithms and calibration process.

The INS provides robust and reliable position, velocity, attitude and heading data using KebNi's advanced onboard sensor fusion software and Kalman filter. The dual GNSS receiver configuration ensures accurate heading data during both static and dynamic conditions and eliminates issues with magnetic disturbance. The unit supports external odometer aiding for increased performance for e.g. land vehicle applications. The unit also supports RTK aiding for centimetre accuracy. The onboard Kalman filter estimates and compensates for sensor bias and scale factor errors in real time.

The product is available as rugged version for complete environmental protection including internal power supply filtering, or as OEM version for tight integration.

GENERAL SPECIFICATIONS

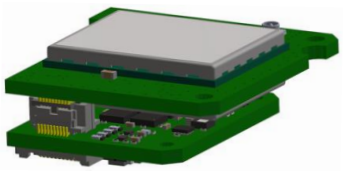
Sensors	Accelerometer, Gyro, Inclinometer, Dual GNSS, Magnetometer, Pressure Sensor
Aiding Sensors	Odometer, RTK
Operating Temperature	-40°C to +70°C
Vibration and Shock	ETSI EN 300 019-2-5
Functional Safety	ISO 26262



Rugged version

INTERFACE SPECIFICATIONS

Connector (Rugged)	12-pin miniature circular push-pull, dual SMB GNSS antenna ports
Data (Rugged)	CAN 2.0 A/B, RS-232
Electrical (Rugged)	9 - 32 VDC
Connector (OEM)	20-pin micro
Data Interface (OEM)	CAN 2.0A/B, RS-232, SPI, I2C
Electrical (OEM)	3.6 - 5.5 VDC
Data Rate	Up to 1 kHz (INS), Up to 4 kHz (raw data)
Serial Protocol	Binary, NMEA
Sync	Sync-in, Sync-out



OEM version

INS SPECIFICATIONS

Roll/Pitch	0.1°
Heading	0.2° (dual antenna 2 m)
Velocity	0.05 m/s
Navigation	1.0 m SBAS, 0.01 m RTK

INERTIAL SENSOR SPECIFICATIONS

Sensor type	Accelerometer	Inclinometer	Gyro
Range	8/16 g	2 g	250/500/1000 °/s
Bandwidth	Up to 500 Hz	Up to 100 Hz	Up to 500 Hz
In-run Bias Stability	≤20 µg	≤10 µg	≤2 °/h
Bias Error	2 mg 1σ	1 mg 1σ	0.1 °/s 1σ
Noise Density	0.1 mg/√Hz typ.	0.1 mg/√Hz typ.	0.0025 °/s/√Hz typ.
Cross-Axis Sensitivity	≤0.05°	≤0.05°	≤0.05°

MAGNETOMETER SPECIFICATIONS

Range	Up to 16 Gauss
Bandwidth	TBD
Noise	3.2 mGauss RMS typ.
Cross-Axis Sensitivity	≤0.1°

PRESSURE SENSOR SPECIFICATIONS

Range	260 - 1260 hPa
Bandwidth	TBD
Resolution	0.025 Pa
Accuracy	10/100 Pa Relative/Absolute

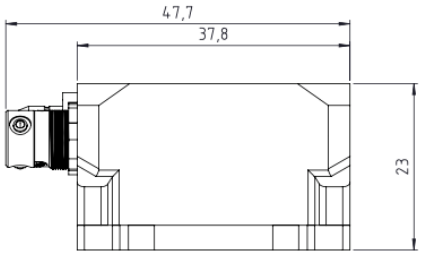
GNSS RECIEVER SPECIFICATIONS

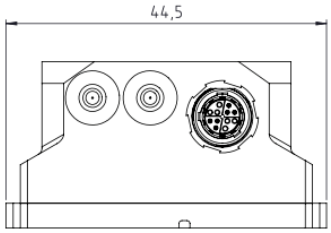
Receiver Type	184 channel, GPS L1C/A L2C, GLO L1OF L2OF, GAL E1B/C E5b, BDS B1I B2I, QZSS L1C/A L1S L2C, SBAS L1C/A
Update Rate	Up to 20 Hz
Cold Start / Hot Start	<25 s / <2 s

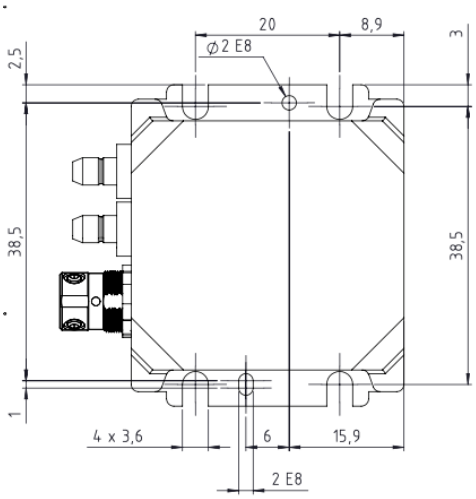
MECHANICAL SPECIFICATIONS

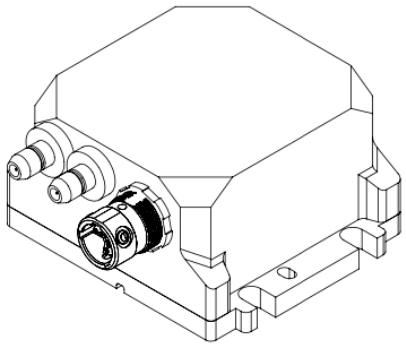
Housing (Rugged)	Aluminium, sealed IP68
Dimensions (Rugged)	45 x 38 x 23 mm
Dimensions (OEM)	31 x 30 x 12 mm

PRODUCT DRAWING RUGGED VERSION









PRODUCT DRAWING OEM VERSION