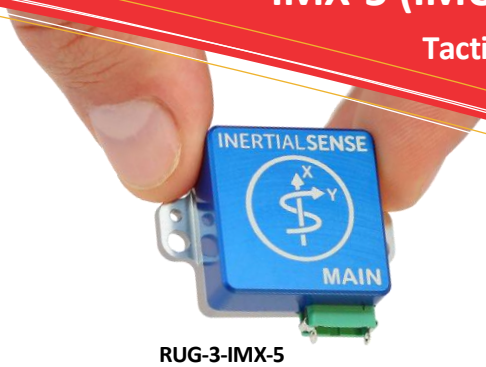
IMX-5 (IMU, AHRS, GNSS-INS)

Tactical Grade Inertial Systems
+RTK +Dual GNSS

INERTIALSENSE
autonomous navigation solutions



RUG-3-IMX-5
Size: 30.5 x 25.4 x 9.9 mm
Weight: 10.5 g

IMX-5
Size: 15.6 x 12.5 x 2.9 mm
Weight: 0.8 g
INS: External GNSS Input

RUG-3-IMX-5-RTK/Dual
Size: 30.5 x 25.4 x 14.8 mm
Weight: 14 g
GNSS: Multi-Band L1/L2/E5

Overview

The **IMX-5**™ is a 10-DOF sensor module consisting of a tactical grade Inertial Measurement Unit (IMU), magnetometer, and barometer. Output includes angular rate, linear acceleration, magnetic vector, and barometric pressure and altitude. IMU calibration consists of bias, scale factor, cross-axis alignment, and temperature compensation. The IMX-5 includes Attitude Heading Reference System (**AHRS**) sensor fusion to estimate roll, pitch, and heading. Adding GNSS input to the IMX-5 enables onboard Inertial Navigation System (**INS**) sensor fusion for roll, pitch, heading, velocity, and position.

The **RUG-3-IMX-5**™ series adds a rugged aluminum enclosure and RS232, RS485, and CAN bus to the IMX-5.

The **RUG-3-IMX-5-RTK**™ includes a multi-frequency GNSS receiver with RTK precision position enabling INS sensor fusion for roll, pitch, heading, velocity, and position.

The **RUG-3-IMX-5-Dual**™ includes two multi-frequency GNSS receivers with RTK precision position and dual GNSS heading/compass.

The **Inertial Sense SDK** is an open-source software development kit for quick integration to configure and communicate with Inertial Sense products. The SDK includes data logger, math libraries, and interface for Linux, Windows, and embedded platforms.

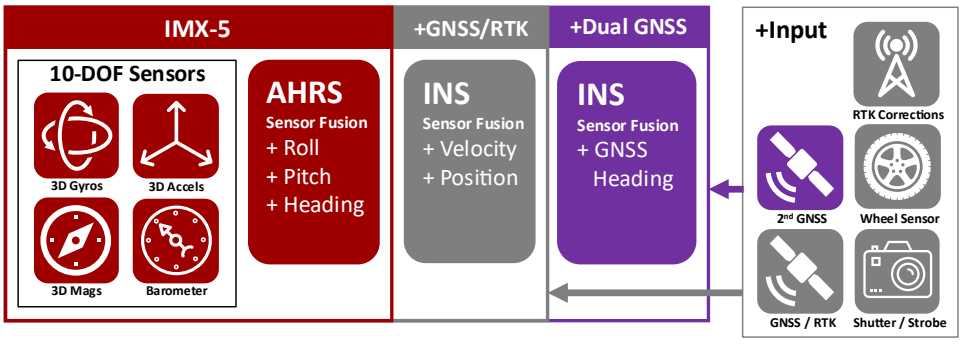
Features

- **Tactical Grade IMU**
  - **Gyro: 1.5 °/hr Bias Instability, 0.16 °/√hr ARW**
  - **Accel: 19 µg Bias Instability, 0.02 m/s/√hr VRW**
- **0.04° Dynamic Roll/Pitch**
- **0.13° Dynamic Heading**
- **Surface Mount Reflowable (PCB Module)**
- **Output Data Rates:**
  - **1000Hz IMU, 200Hz AHRS, 142Hz GNSS-INS**
- External GNSS Input Support (Multi-Band)
- Attitude (Roll, Pitch, Yaw, Quaternions), Velocity, and Position UTC Time Synchronized
- Triple Redundant IMUs Calibrated for Bias, Scale Factor, Cross-axis Alignment, and G-sensitivity
- -40°C to 85°C Sensor Temperature Calibration
- Binary and NMEA ASCII Protocol
- Barometric Pressure and Humidity
- Strobe In/Out Data Sync (Camera Shutter Event)
- Fast Integration with SDK and Example Software
- Data Logging (SDK and Application Software)
- RUG-3-IMX-5: RS232, RS485, CAN* bus

* Available in future firmware release.

Applications

- Drone Navigation
- Unmanned Vehicle Payloads
- Ground and Aerial Survey
- Automotive Navigation
- Stabilized Platforms
- Antenna and Camera Pointing
- First Responder and Trackers
- Robotics and Ground Vehicles
- Maritime



IMX-5 (IMU, AHRS, GNSS-INS)

Tactical Grade Inertial Systems
+RTK +Dual GNSS

INERTIALSENSE
autonomous navigation solutions

Specifications

Performance (AHRS, INS, RUG-3)	Typ	
INS Dynamic Roll/Pitch** (RMS)	0.04°	(GNSS-aided with motion excitation)
Static Roll/Pitch (RMS)	0.1°	
INS Dynamic Heading** (RMS)	0.13°	(GNSS velocity-derived)
Static Heading w/Dual Compass* (RMS)	0.4°	
Static Heading w/magnetometer (RMS)	1.0°	

*1 m baseline distance between GNSS antennas.
**With GNSS input and periodic motion >0.8 m/s^2 acceleration and >2 m/s velocity.

Performance (INS, RUG-3)	RUG-3	+RTK
Horizontal Position (w/ SBAS)	1.5 m CEP	1 cm + 1 PPM CEP
Velocity (GPS and INS)	0.03 m/s	
Angular Resolution	0.05°	
Operation Limits		
Velocity (external GNSS)	500 m/s	
Altitude (external GNSS)	50 Km	
Altitude (Barometric)	10 Km	
GNSS cold start time to fix	24 s	-

Performance	Typ
Startup Time	0.8 s
INS/AHRS Timestamp Accuracy (RMS)	1 us
Max Output Data Rate (IMU, AHRS, GNSS-INS)	1000, 200, 142 Hz
IMU signal latency @ 1KHz ODR	4 ms

Absolute Maximum Ratings	MAX
Acceleration	10,000 g
Ambient Operating Temperature	-40 to 85 °C
Junction Temperature	-40 to 105 °C
Storage Temperature	-40 to 125 °C
Overpressure	600 kPa
ESD rating (Human body model)	± 2 kV
Solder Reflow Temperature Max	245 °C
Solder Reflow Temperature Limit	217 °C liquidus: 40 – 60 s

Sensors	IMU - Gyros	IMU - Accels	Mags	Pressure
Operating Range	±4000 °/sec	±16 g	±2500 µT	30–125 kPa
In-Run Bias Stability	< 1.5 °/hr	< 19 µg		
Random Walk: ARW, VRW	0.16 °/√hr	0.02 m/s/√hr		
Non-linearity	0.02 % FSR	0.02 % FSR		
Noise Density	5 mdps/√Hz	60 µg/√Hz	20 nT/√Hz	0.18 Pa/√Hz
Bias Error over -40C to 85C	0.3 °/s RMS	3,7 mg RMS		
Max Output Rate	1 KHz	1 KHz	50 Hz	50 Hz
Bandwidth	539 Hz	416 Hz	50 Hz	5 Hz
Alignment Error	0.03°	0.03°	0.05°	
Resonant Frequency	20 KHz	2.6/2.17 KHz		
Sampling Rate	8 KHz	4 KHz	300 Hz	200 Hz
Resolution	*0.0076 °/sec	*122 µg	0.3 µT	0.03 Pa
*1KHz resolution after oversampling				(2 cm)

Function	IMX™	+RTK	+Dual
Gyro & Accelerometer (IMU)	•	•	•
Magnetometer & Barometer	•	•	•
Roll, Pitch, Heading (AHRS)	•	•	•
Heading, Velocity, Position (INS)		•	•
GNSS Heading			•

Electrical (IMX-5)	Min	Typ	Max	Units
Power Draw				
IMU @ 1KHz		95	105	mW
w/ AHRS, INS @ 250Hz		100	110	mW
Supply Voltage (Vcc)	3.0	3.3	3.6	V
I/O Pin MAX Voltage Range	-0.5		3.6	V
Total Output Current, All Pins			100	mA
I/O Pin Output Current			20	mA
I/O Pin Input low-level	0.99			V
I/O Pin Input high-level	2.31	3.3	3.6	V
I/O Pin Output high-level		3.3		V
STROBE input frequency			1	KHz
STROBE output jitter		10		us
Rising Slope of VIN*	2.4			V/ms

*The supply rising slope must be higher than minimum rating for proper function.

Electrical (RUG-3)	Min	Typ	Max	Units
Supply Voltage (VIN)	4.5		20	V
RUG-3-IMX-5-RTK + Antenna				
Current Draw @ 5V, 250Hz*		185		mA
Power Consumption @250Hz*		927		mW
Power Consumption @100Hz*				mW
Power Consumption – Dual		1470		mW

*Navigation filter update rate.

Mechanical (IMX-5)	Typ	Units
Size	15.6 x 12.5 x 2.9	mm
Weight	0.8	grams
Effective Thermal Resistance (Θeff)	19	°C/W
Thermal Resistance (ΘJA, ΘJB, ΘJC)	53, 34.5, 2.0	°C/W

Mechanical (RUG-3)		Units	Conditions
Size	30.5 x 25.4 x 9.9	mm	RUG-3
	30.5 x 25.4 x 14.8		RUG-3-RTK/Dual
IP Rating	40		No liquid protection
Mounting Tab Hole Spacing	30.836	mm	
Weight	14.0	grams	
Connectors	Main: Harwin# G125-MV11205L1P, GPS 1/2: MMCX		

Communications & I/O	
IMX-5 Interface	USB, UART x3, SPI
RUG-3 Interface	USB, UART x2, RS232, RS485, CAN*, SPI
Max Baud Rate:	
SPI	10 Mbps
UART, RS422, RS485	10 Mbps
RS232	500 Kbps
Strobe Inputs / Outputs	4 / 1

* Available in future firmware release.

Development Kits available on our website.