



# INERTIAL SENSE

autonomous navigation solutions

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

Tactical Grade Inertial Systems

+RTK +Dual GNSS

### 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.



**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

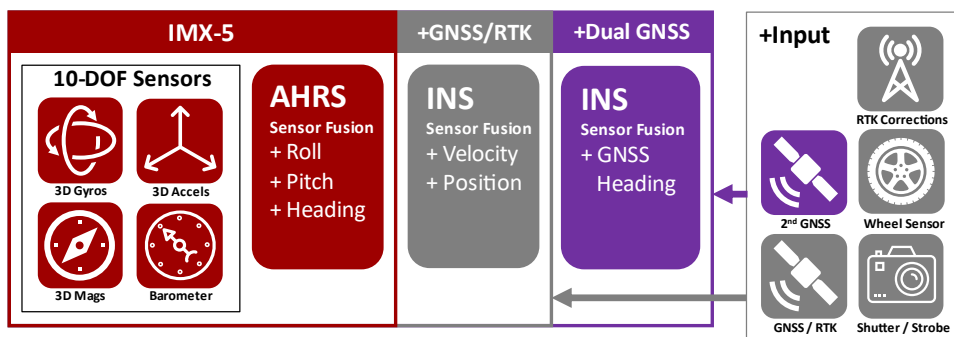
GNSS: Multi-Band L1/L2/E5

### Features

- **Tactical Grade IMU**
  - Gyro: 1.5 °/hr Bias Instability, 0.16 °/vhr ARW
  - Accel: 19 µg Bias Instability, 0.02 m/s/vhr VRW
- **0.04° Dynamic Roll/Pitch**
- **0.13° Dynamic Heading**
- **Surface Mount Reflowable (PCB Module)**
- Up to 1KHz IMU Output Data Rate
- External GNSS 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

### Applications

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





## Specifications

Performance (AHRS, INS, RUG-3)	Typ
INS Dynamic Roll/Pitch** (RMS)	0.04°
Static Roll/Pitch (RMS)	0.1°
INS Dynamic Heading** (RMS)	0.13°
Static Heading w/Dual Compass* (RMS)	0.4°
Static Heading w/magnetometer (RMS)	0.5°

\*1 m baseline distance between GNSS antennas.

\*\*With GNSS input and periodic motion >0.8 m/s<sup>2</sup> 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 / INS*)	1 KHz / 62*Hz
IMU signal latency	4 ms

\*INS output data rate will increase to 100Hz in a future firmware update.

Absolute Maximum Ratings	MAX
Acceleration	10,000 g
Operating Temperature	-40 to 105 °C
Barometer	-40 to 85 °C
Storage Temperature	-40 to 125 °C
Overpressure	600 kPa
ESD rating	± 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	0.16 °/Vhr	0.02 m/s/Vhr		
Non-linearity	0.02 % FSR	0.02 % FSR		
Noise Density	5 mdps/VHz	60 μg/VHz		Pa/VHz
Bias Error over -40C to 85C	0.3 °/s RMS	3,7 mg RMS		
Max Output Rate	1 KHz	1 KHz	100 Hz	50 Hz
Bandwidth	250 Hz	218 Hz	50 Hz	5 Hz
Alignment Error	0.03°	0.03°	0.05°	
Resonant Freq.	2.6/2.17 KHz	20 KHz		
Sampling Rate	8 KHz	4 KHz	300 Hz	200 Hz
Resolution	*0.0076 °/sec	*122 μg	0.3 μT	0.03 Pa
				(2 cm)

\*1KHz resolution after oversampling

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



Development Kits available on our website.

Electrical (IMX-5)	Min	Typ	Max	Units
Power Draw				
μIMU @ 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			120	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
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)	4.0		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)	Units
Size	15.6 x 12.5 x 2.9
Weight	0.8

Mechanical (RUG-3)	Units	Conditions
Size	30.5 x 25.4 x 9.9	RUG-3
	30.5 x 25.4 x 14.8	RUG-3-RTK/Dual
IP Rating	40	No liquid protection
Mounting Tab	30.836	
Hole Spacing		
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	3 Mbps
RS232	500 Kbps
Strobe Inputs / Outputs	4 / 1

