µIMU-3, µAHRS-3, µINS-3

Calibrated Inertial Systems +RTK +Dual GNSS

INERTIALSENSE
autonomous navigation solutions

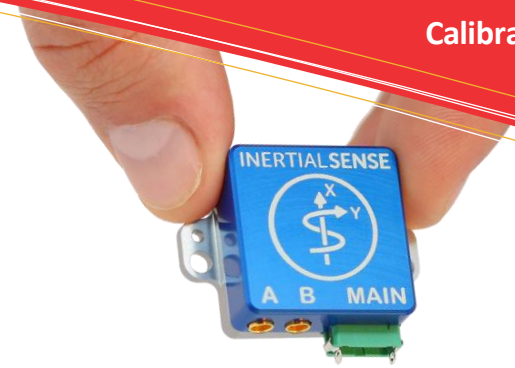
Overview

The **µIMU**™ is a 6-DOF sensor module consisting of a dual Inertial Measurement Unit (IMU). Data output includes angular rate and linear acceleration. IMU calibration includes bias, scale factor, cross-axis alignment, g-sensitivity, and temperature compensation.

The **µAHRS**™ is a 10-DOF Attitude Heading Reference System (AHRS) sensor module with IMU, magnetometer, barometer, and sensor fusion to estimate roll, pitch, and heading.

The **µINS**™ is a 10-DOF Inertial Navigation System (INS) sensor module with sensor fusion combining data from an external GNSS receiver and onboard sensors to estimate roll, pitch, heading, velocity, and position.

The **µINS Dual**™ is a 10-DOF Inertial Navigation System (INS) sensor module with sensor fusion combining data from two external GNSS receivers and onboard sensors. Dual GNSS heading can be determined in environments that are challenging for a magnetometer.



Rugged-1
Size: 25.4 x 25.4 x 11.2 mm
Weight: 10.5 g

PCB Module
Size: 16.3 x 12.6 x 4.6 mm
Weight: 1.3 g

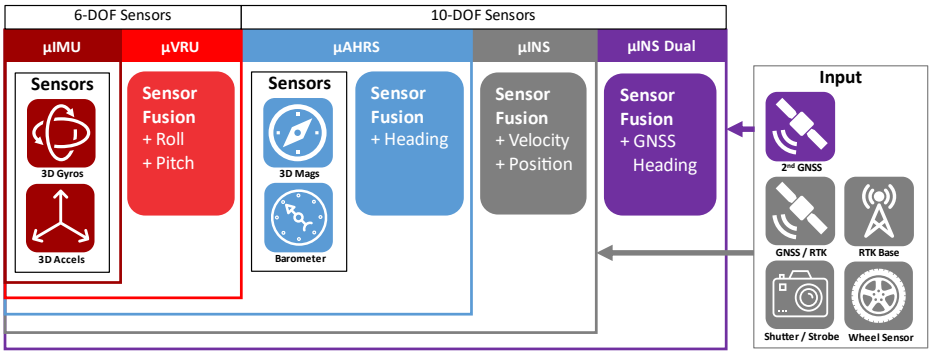
Rugged-2
Size: 25.4 x 25.4 x 20.0 mm
Weight: 14.5 g
GNSS: Multi-Band L1/L2/E5

Features

- Up to 1KHz IMU and INS Output Data Rate
- GNSS Multi-Band (L1/L2/G1/B1/B2/E1/E5)
- CAN Bus Interface
- Attitude (Roll, Pitch, Yaw, Quaternions), Velocity, and Position UTC Time Synchronized
- Dual Redundant IMUs Calibrated for Bias, Scale Factor, and Cross-Axis Alignment
- -40°C to 85°C Sensor Temperature Calibration
- On-Board u-Blox L1 GPS (GNSS) Receivers
- Onboard World Magnetic and Gravity Models
- 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)

Applications

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



Specifications

Performance (µINS, µAHRS, Rugged)	Typ
Roll/Pitch (RMS)	0.1°
Static Heading w/magnetometer (RMS)	2.0°
Static Heading w/Dual Compass* (RMS)	0.4°
µINS Dynamic Heading** (RMS)	0.3°

*1 m baseline distance between GNSS antennas.
**Requires GPS lock with periodic >0.8 m/s^2 acceleration and >2 m/s velocity.

Performance (µINS, Rugged)	PCB Module Typ	Rugged-2 ZED-F9P
Horizontal Position (w/ SBAS)	1.5 m CEP	1 cm + 1 PPM CEP
Velocity (GPS and INS)	0.05 m/s	
Angular Resolution	0.05°	
Operation Limits		
Velocity	500 m/s	
Altitude (GPS)	50 Km	
Altitude (Barometric)	10 Km	
Startup Time	0.8 sec	
GNSS Receiver Type	3 Concurrent Constellations 72-channel u-blox M8 engine GPS/QZSS L1 C/A, GLONASS L10F, BeiDou B11, Galileo E1B/C SBAS L1 C/A	4 Concurrent Constellations 184-channel u-blox F9 engine GPS L1C/A L2C, GLO L1OF L2OF, GAL E1B/C E5b, BDS B1I B2I, QZSS L1C/A L2C
GNSS Receiver Sensitivity	Tracking: -164 dBm, Hot: -156 dBm, Cold: -147 dBm	
GNSS Lock Time: Hot Start	1 sec	
GNSS Lock Time: Cold Start	30 sec	
GNSS Update Rate	5 Hz	
GNSS_PPS Time Sync. Pulse (10% duty cycle)	1 Hz	
GNSS_PPS Time Sync. Accuracy (RMS, 99%)	30, 60 ns	
INS/AHRS Timestamp Accuracy (RMS)	1 us	
Max Output Data Rate (IMU and INS)	1 KHz	
IMU signal latency	4 ms	

Absolute Maximum Ratings	MAX	
Acceleration	10,000 g	
Storage Temperature (µINS)	-45 to 85 °C	Barometer limitation
Overpressure	600 kPa	
ESD rating	± 2 kV	Human body model
Soldering Temperature	Hand Solder ONLY. Do NOT solder reflow.	

Sensors	IMU - Gyros	IMU - Accels	Mags	Pressure
Operating Range	±2000 °/sec	±16 g	±4800 µT	30–120 kPa
In-Run Bias Stability	< 10 °/hr	< 40 µg		
Random Walk	0.15 °/√hr	0.07 m/s/√hr		
Non-linearity	0.2 % FS	0.2 % FS		
Noise Density	0.01 °/s/√Hz	300 µg/√Hz		Pa/√Hz
Bias Error over -40C to 85C	0.7 °/s RMS	0.4 m/s^2 RMS		
Max Output Rate	1 KHz	1 KHz	100 Hz	50 Hz
Bandwidth	250 Hz	218 Hz	50 Hz	5 Hz
Alignment Error	0.05°	0.05°	0.05°	
Sampling Rate	8 KHz	4 KHz	100 Hz	250 Hz
Resolution	*0.0076 °/sec	*122 µg	0.6 µT	0.0016 kPa (13 cm)

*1KHz resolution after oversampling

Data Output	µIMU™	µAHRS™	µINS™
GPS, GPS Raw, UTC Time	•	•	•
IMU (Gyro & Accelerometer)	•	•	•
Magnetometer & Barometer	•	•	•
Attitude (Quaternions, Euler, DCM)		•	•
Inertial Velocity & Position			•

Electrical (PCB Module)	Min	Typ	Max	Units
Power Draw (w/o GPS ant.)				
µIMU @ 1KHz		340		mW
µINS, µAHRS @ 250Hz		412		mW
Supply Voltage (Vcc)	3.0	3.3	3.6	V
GNSS VBAT Voltage	1.4	3.3	3.6	V
GNSS VBAT Current @ 3.0V		15		µA
GNSS Antenna Supply w/o load (2.8V w/ 10mA load)*		2.9		V
GNSS Antenna Supply Current*			300	mA
GNSS Max RF Input Power			+15	dBm
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

*A 10 Ohm current limiting resistor sits in-line between voltage supply and antenna.
**The supply rising slope must be higher than minimum rating for proper function.

Electrical (Rugged)	Min	Typ	Max	Units
Supply Voltage (VIN)	4.0		20	V
Rugged-1 (w/ GNSS antennas)				
Power Consumption @250Hz*		625		mW
Power Consumption – Dual		1100		mW
Rugged-2 (w/ GNSS antennas)				
Power Consumption @250Hz*		710		mW
Power Consumption – Dual		1250		mW

*Navigation filter update rate.

Mechanical (PCB Module)		
µINS		Units
Size	16.3 x 12.6 x 4.6	mm
Weight	1.3	grams

Mechanical (Rugged)		Units	Conditions
Rugged-1 Size	25.4 x 25.4 x 11.2	mm	W/o mount tabs
Rugged-2 Size	25.4 x 25.4 x 20.0	mm	W/o mount tabs
Mount Tab Width	35.9	mm	
Mount Holes Spacing	30.836	mm	
IP Rating	40		No liquid protection
Rugged-1 Weight	10.5	grams	
Rugged-2 Weight	14.5	grams	
Connectors	Main: Harwin# G125-MV11205L1P, GPS 1/2: MMCX		

Communications	
Interface	UART, SPI
Rugged Interface	USB, UART, RS232, RS485, CAN
Max Baud Rate:	
CMOS, RS422, RS485	3 Mbps
RS232	500 Kbps

Development Kits available on our website.