



### Overview

The  $\mu$ IMU™ is a miniature calibrated sensor module consisting of an Inertial Measurement Unit (IMU), magnetometer, barometer, and onboard L1 GPS (GNSS) receiver. Data out includes angular rate, linear acceleration, magnetic field, barometric altitude, and GPS.

The  $\mu$ AHRS™ is an Attitude Heading Reference System (AHRS) that includes all functionality of the  $\mu$ IMU™ and fuses IMU and magnetometer data to estimate roll, pitch, and heading.

The  $\mu$ INS+RTK™ is a GPS (GNSS) aided Inertial Navigation System (GPS-INS) module that includes all functionality of the  $\mu$ AHRS™ and provides orientation, velocity, and position. Sensor data from MEMs gyros, accelerometers, magnetometers, barometric pressure, and GPS/GNSS is fused to provide optimal estimation.

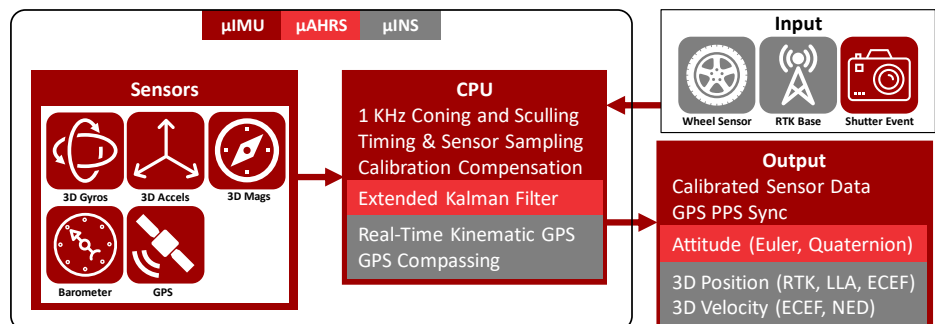
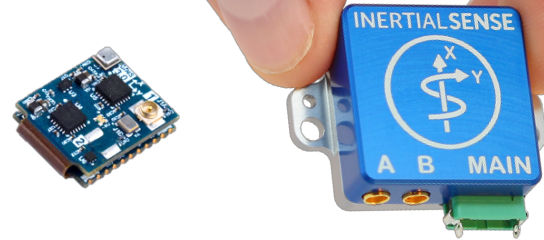
The  $\mu$ INS Dual™ is a GPS (GNSS) aided Inertial Navigation System (GPS-INS) module that includes all functionality of the  $\mu$ AHRS™ and provides orientation, velocity, and position. By utilizing Dual GPS antennas, accurate heading can be determined in environments that are challenging for a magnetometer.

### Applications

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

### Features

- **NEW** – Rugged Enclosure
- **NEW** – Precision RTK GNSS
- **NEW** – Dual GNSS Compassing
- Up to 1KHz IMU, 500Hz INS Update Rate
- 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) Receiver(s)
- 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)





## Specifications

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

\*Position is stationary. \*\*Requires GPS lock with periodic >0.8 m/s<sup>2</sup> acceleration and >2 m/s velocity.

Performance	Typ	RTK-GPS
Horizontal Position (w/ SBAS)	2.5 m (2.0 m)	3 cm
Vertical Position	2.5 m	5 cm
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	
GPS Lock Time		
Hot Start	1 sec	10 sec
Cold Start	30 sec	2-4 min
GNSS Receiver Sensitivity		
Tracking & Navigation	-164 dBm	
Cold Start	-147 dBm	
Hot Start	-156 dBm	
GPS Update Rate	5 Hz	
Max Output Data Rate (IMU, INS)	1 KHz, 500 Hz	
GPS_PPS Time Sync. Pulse (10% duty cycle)	1 Hz	
RMS Accuracy	30 ns	
99% Accuracy	60 ns	
IMU signal latency	4 ms	
Humidity Sensor Relative Accuracy	±3 %	

Absolute Maximum Ratings	MAX
Acceleration	10,000 g
Storage Temperature (μINS)	-45 to 85 °C
Overpressure	600 kPa
ESD rating	± 2 kV
Soldering Temperature	Human body model
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
Bias Repeatability	< 0.2 °/sec	< 5 mg		
In-Run Bias Stability	< 10 °/hr	< 40 μg		
Random Walk	0.15 °/Vhr	0.07 m/s/Vhr		
Non-linearity	< 0.1 % FS	< 0.5 % FS		
Noise Density	0.01 °/s/VHz	300 μg/VHz		Pa/VHz
Bias Error over -40C to 85C	0.7 °/s RMS	0.4 m/s <sup>2</sup> 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
*1KHz resolution after oversampling				(13 cm)

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

Electrical (μINS, μAHRS, μIMU)	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
GPS VBAT Voltage	1.4	3.3	3.6	V
GPS VBAT Current @ 3.0V		15		μA
GPS Antenna Supply w/o load		2.9		V
(2.8V w/ 10mA load)*				
GPS Antenna Supply Current*			300	mA
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 pulse duration	1			ms
STROBE pulse period	5			ms
Rising Slope of VIN**	2.4			V/ms

\*A 10 Ohm current limiting resistor sits inline between voltage supply and antenna.

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

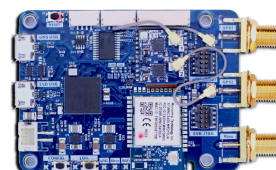
Electrical (μINS with Rugged/EVB)	Min	Typ	Max	Units
Supply Voltage (VIN)	4.0		20	V
μINS with Rugged or EVB				
Current Draw @ 5V, 250Hz*		125		mA
Power Consumption @250Hz*		625		mW
Power Consumption @100Hz*		575		mW
Power Consumption – Dual		1100		mW
*Navigation filter update rate.				

Mechanical (μINS, μAHRS, μIMU)		Units
Size	16.5 x 12.6 x 4.6	mm
Weight	1.3	grams

Mechanical (Rugged μINS)		Units	Conditions
Size	25.4 x 25.4 x 11.2 35.9 x 25.4 x 11.2	mm	W/o mounting tabs W/ mounting tabs
Distance Between Mounting Tab Holes	30.836	mm	
Weight	10.5	grams	
Connectors	Main: Harwin# G125-MV11205L1P, GPS A/B: MMCX		

Communications	
Interface	TTL, SPI
Rugged Interface (IS-RUG-1.x)	USB, TTL, RS232, RS485, CAN*
Max Baud Rate:	
TTL, RS422, RS485	3 Mbps
RS232	500 Kbps

\*Available in future firmware update.



Development Kits  
available on our  
website.

