# µIMU-5 (IMU, AHRS, GNSS-INS)

**Tactical Grade Inertial Systems**

**+RTK +Dual GNSS**

INERTIALSENSE
autonomous navigation solutions

**RUG-IMU-5**
Size: 25.4 x 25.4 x 11.2 mm
Weight: 10.5 g

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

**RUG-INS-5-RTK/Dual**
Size: 25.4 x 25.4 x 20.0 mm
Weight: 14 g
GNSS: Multi-Band L1/L2/E5

## Overview

The **µIMU-5**™ is a 10-DOF sensor module consisting of a triple redundant Inertial Measurement Unit (IMU), magnetometer, and barometer. Data output includes angular rate and linear acceleration. IMU calibration consists of bias, scale factor, cross-axis alignment, g-sensitivity, and temperature compensation.

The µIMU-5 includes Attitude Heading Reference System (**AHRS**) sensor fusion to estimate roll, pitch, and heading. Adding GNSS input to the µIMU-5 enables the onboard Inertial Navigation System (**INS**) sensor fusion to estimate roll, pitch, heading, velocity, and position.

The **RUG-INS-5-RTK**™ combines a multi-frequency GNSS receiver with the µIMU-5 enabling the Inertial Navigation System (INS) sensor fusion to estimate roll, pitch, heading, velocity, and position.

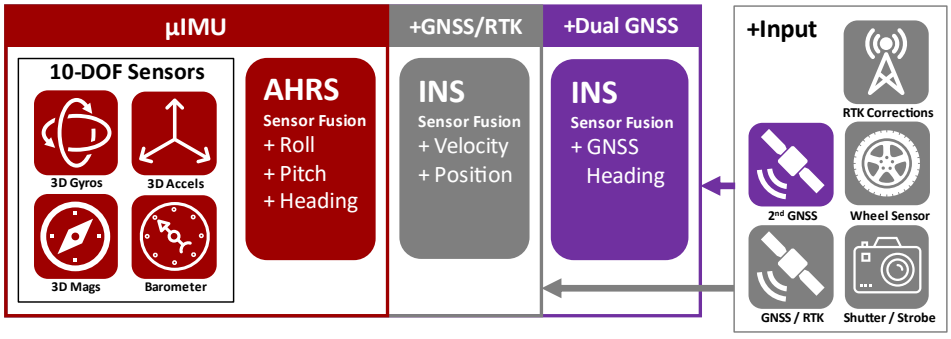
The **RUG-INS-5-Dual**™ combines two multi-frequency GNSS receivers and the µIMU-5 onboard sensor fusion. Dual GNSS heading can be determined in environments that are challenging for a magnetometer.

## 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

## Features

- **Tactical Grade IMU**
- **Gyro: 2.0 °/hr Bias Instability, 0.2 °/√hr ARW**
- **Accel: 20 µg Bias Instability, 0.04 m/s/√hr VRW**
- **0.03° Roll/Pitch, 0.1° Dynamic Heading**
- **Surface Mount Reflowable (PCB Module)**
- Up to 1KHz IMU and INS 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)



# µIMU-5 (IMU, AHRS, GNSS-INS)

## Tactical Grade Inertial Systems
## +RTK +Dual GNSS

## Specifications

| Performance (AHRS, INS, RUG) | Typ |
|---|---|
| Dynamic Roll/Pitch** (RMS) | 0.03° |
| Static Heading w/magnetometer (RMS) | 2.0° |
| Static Heading w/Dual Compass* (RMS) | 0.4° |
| INS Dynamic Heading** (RMS) | 0.1° |

*1 m baseline distance between GNSS antennas.
**Using external GNSS with motion.

| Performance (INS, RUG) | RUG | +RTK |
|---|---|---|
| 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 (external GNSS) | 50 Km | |
| Altitude (Barometric) | 10 Km | |

| Performance | Typ |
|---|---|
| Startup Time | 0.8 sec |
| INS/AHRS Timestamp Accuracy (RMS) | 1 us |
| Max Output Data Rate (IMU and INS) | 1 KHz |
| IMU signal latency | 4 ms |

*Used external GNSS receiver.

| Absolute Maximum Ratings | MAX | |
|---|---|---|
| Acceleration | 10,000 g | |
| Storage Temperature | -45 to 85 °C | Barometer limitation |
| Overpressure | 600 kPa | |
| ESD rating | ± 2 kV | Human body model |
| 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 | < 2.0 °/hr | < 20 µg | | |
| Random Walk | 0.2 °/√hr | 0.04 m/s/√hr | | |
| Non-linearity | 0.02 % FSR | 0.02 % FSR | | |
| Noise Density | 5 mdps/√Hz | 60 µg/√Hz | | Pa/√Hz |
| 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° | |
| 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 | µIMU™ | +RTK | +Dual |
|---|---|---|---|
| Gyro & Accelerometer (IMU) | • | • | • |
| Magnetometer & Barometer | • | • | • |
| Roll, Pitch, Heading (AHRS) | • | • | • |
| Heading, Velocity, Position (INS) | | • | • |
| GNSS Heading | | | • |

| Electrical (µIMU-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) | Min | Typ | Max | Units |
|---|---|---|---|---|
| Supply Voltage (VIN) | 4.0 | | 20 | V |
| RUG-INS-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 (µIMU-5) | | Units |
|---|---|---|
| Size | 15.6 x 12.5 x 2.9 | mm |
| Weight | 0.8 | grams |

| Mechanical (RUG) | | Units | Conditions |
|---|---|---|---|
| Size | 25.4 x 25.4 x 20.0<br>35.9 x 25.4 x 20.0 | mm | W/o mounting tabs<br>W/ mounting tabs |
| 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 | |
|---|---|
| Interface | UART x3, SPI |
| RUG Interface (IS-RUG) | USB, UART x3, RS232, RS485, CAN |
| Max Baud Rate: | |
| SPI | 10 Mbps |
| UART, RS422, RS485 | 3 Mbps |
| RS232 | 500 Kbps |
| Strobe Inputs / Outputs | 4 / 1 |

**Development Kits available on our website.**