Inertial Labs
Single and Dual Antenna GPS-Aided Inertial Navigation Systems
INS

www.inertiallabs.com
The **Inertial Labs Single and Dual Antenna GPS-Aided Inertial Navigation System** – **INS** is a new generation of fully-integrated, combined GPS, GLONASS, GALILEO, QZSS, BEIDOU and L-Band navigation and high-performance strapdown system, that determines position, velocity and absolute orientation (Heading, Pitch and Roll) for any device on which it is mounted. Horizontal and Vertical Position, Velocity and Orientation are determined with high accuracy for both motionless and dynamic applications.

The Inertial Labs **INS** utilizes advanced single and dual antenna GNSS receiver, barometer, 3-axes each of calibrated in full operational temperature range precision Fluxgate magnetometers, Accelerometers and Gyroscopes to provide accurate Position, Velocity, Heading, Pitch and Roll of the device under measure. **INS** contains Inertial Labs new on-board sensors fusion filter, state of the art navigation and guidance algorithms and calibration software.

### Key Features and Functionality

- Affordable price
- Excellent accuracy in GPS-Denied environments (up to 0.05 % DT)
- Tactical-grade IMU + Fluxgate compass + Aiding data
- Support: ROS, LabVIEW, Waypoint Inertial Explorer, QINSy
- GPS, GLONASS, GALILEO, BEIDOU, SBAS, DGPS, RTK supported signals
- Tactical-grade IMU (1 deg/hr gyroscopes and 5 micro g accelerometers Bias in-run stability)
- Fluxgate gyro-compensated compass to maintain free-inertial Heading (INS-P model)
- Single and Dual antenna GNSS receivers
- Compatibility with LiDARs (Velodyne, RIEGL, FARO) and optical cameras
- Odometer, Wheel sensor, Airspeed sensor, Wind sensor, Doppler shift from locator aiding data
- 1 cm + 1 ppm RTK Horizontal Position Accuracy or 2.5 cm TerraStar-C PRO Horizontal Position Accuracy
- 0.05 deg GNSS Heading and <0.4 deg Free-inertial Heading accuracy (3 sigma)
- Advanced, extendable, embedded Kalman Filter based sensor fusion algorithms
- State-of-the-art algorithms for different dynamic motions of Vessels, Ships, Helicopters, UAV, UUV, UGV, AGV, ROV, Gimbals and Land Vehicles
- Implemented ZUPT, GNSS tracking angle features
- Full temperature calibration, Environmentally sealed (IP67), compact design, MIL-STD-810G/DO-160E

### Models & Features

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<tr>
<td>INS-D</td>
<td>Dual Antenna</td>
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<tr>
<td>INS-DL</td>
<td>Dual Antenna</td>
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**INS-B**

Ideal solution for remote sensing (UAV, LiDAR, Optical Camera, Point Clouds)

**INS-P**

High performance in long-term GPS-Denied environment

**INS-D**

High precision Heading Tactical-grade IMU SP/SBAS/DGPS/RTK

**INS-DL**

High precision Heading Industrial-grade IMU 1 cm RTK position

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**IMU**

**General**

- **Input signals**
  - Marine application: DVL (Doppler Velocity Log)
  - Land application: Odometer, Wheel sensor, Encoder, DMI
  - Aerial application: Wind sensor, Air Speed Sensor, Doppler shift from locator (for long-term GPS denied)
  - All: External Stand Alone Magnetic Compass (SMMC/AHRS)

- **Main features**
  - Ideal solution for remote sensing (with LiDAR, Optical Camera)
  - High performance in long-term GPS-Denied environment
  - High precision Heading, Tactical-grade IMU
  - Affordable price

**Compatible with**

- Pishawk Autopilot; Embention Autopilot; COBHAM AVIATOR UAV 200

**Environments**

- Storage temperature
  - Range: -55 to +85°C
- Temporal position accuracy:
  - GPS L1/L2: 1 cm RTK position
  - TerraStar (GPS L1, L2, BDS B1/B2, GAL E1, E5, QZSS L1/L2, DEWS, RTK)

**Power Consumption**

- DC ± 9 to 36 V

**Size**

- 120 x 50 x 53 mm

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Units</th>
<th>IMU-B</th>
<th>IMU-C</th>
<th>IMU-D</th>
<th>IMU-O</th>
<th>IMU-DL</th>
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Inertial Labs GPS-Aided INS key sensors (IMU) performance

![Graphs showing IMU performance metrics](image)

Inertial Labs GPS-Aided INS key applications

![Applications images](image)
**INS part numbers structure**

<table>
<thead>
<tr>
<th>Model</th>
<th>Gyro</th>
<th>Accl</th>
<th>Calibration</th>
<th>Connector &amp; Enclosure</th>
<th>Encoder support</th>
<th>Color</th>
<th>Data Logger</th>
<th>GNSS receiver</th>
<th>Version</th>
<th>Interface</th>
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<tbody>
<tr>
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<td>G450</td>
<td>A8</td>
<td>TGA</td>
<td>C1 (obsolete)</td>
<td>E (option)</td>
<td>B (default)</td>
<td>S64 (default)</td>
<td>O615 - obsolete</td>
<td>V0</td>
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<td>VD4</td>
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<td>Example: INS-B-G450-A8-TGA-C3-E-B-S64-O719-V0.1</td>
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- INS-B: Basic Model of GPS-Aided Inertial Navigation System
- INS-P: Professional Model of GPS-Aided Inertial Navigation System
- INS-D: Dual Antenna GPS-Aided Inertial Navigation System
- INS-DL: Dual Antenna GPS-Aided Inertial Navigation System

- **INS-B**:
  - G450: Gyroscopes measurement range = ±450 deg/sec
  - G950: Gyroscopes measurement range = ±950 deg/sec
  - G2000: Gyroscopes measurement range = ±2000 deg/sec
  - G16: Accelerometers measurement range = ±8 g
  - A15: Accelerometers measurement range ±15 g
  - A40: Accelerometers measurement range ±40 g

- **INS-P**: TGA: Gyroscopes and Accelerometers

- **INS-D**:
  - TMGA: Magnetometers, Gyroscopes and Accelerometers (INS-P and INS-D only)
  - C1: 12 pins connector (RS-232) - OBSOLETE
  - C3: 24 pins connector (RS-232, RS-422, CAN, Ethernet interfaces)
  - C31: 24 pins connector (RS-232, 2 x RS-422, CAN interfaces)
  - C32: 24 pins connector (RS-232, RS-422, CAN, Ethernet interfaces) with modified PPS (preserve PPS configurable polarity): Active high – 5v (1’). Active low – 0v (0’)
  - C5: 24 pins connector, flanges and alignment pins
  - C71: two 19 pins connectors, MIL-STD1275 protection
  - E: encoder support
  - B: Black Color (default)
  - D: Desert Color (Desert tan, color code 33446 (tan 686A) per FED STD-595, Change Notice 1.)
  - G: Green
  - W: White
  - S8: 8GB embedded Data Logger (optional)
  - S64: 64GB embedded Data Logger (optional)
  - O615: Novatel OEM615 single antenna GNSS receiver (INS-B and INS-P only) - OBSOLETE
  - O617D: Novatel OEM617D dual antenna GNSS receiver (INS-D only) - OBSOLETE
  - O718: Novatel OEM718D dual antenna GNSS receiver (INS-D, for China only)
  - O719: Novatel OEM719 single antenna GNSS receiver (INS-B and INS-P only)
  - O7720: Novatel OEM7720 dual antenna GNSS receiver (INS-D only)
  - P327: Hemisphere P327 single antenna GNSS receiver (INS-B and INS-P only)
  - B482: Inertial Labs B482 dual antenna GNSS receiver (INS-DL only)
  - V0: GPS L1, SBAS, DGPS, 20 Hz positions (INS-B and INS-P only)
  - V1: GPS L1, SBAS, DGPS, 50 Hz positions (INS-B and INS-P only)
  - V2: GPS L1, GLONSS, SBAS, DGPS, 20 Hz positions (INS-B and INS-P only)
  - V3: GPS L1/L2, SBAS, DGPS, 20 Hz positions (INS-B and INS-P only)
  - V4: GPS L1/L2, GLONSS L1/L2, SBAS, DGPS, 20 Hz positions (INS-B and INS-P only)
  - VR43: GPS L1/L2, GLONSS L1/L2, SBAS, DGPS, 20 Hz positions, 20 Hz measurements (INS-B and INS-P only)
  - VR5: GPS L1/L2, GLONSS L1/L2, SBAS, DGPS, RTK, 20 Hz positions, 20 Hz measurements (INS-B and INS-P only)
  - V8: GPS L1/L2/L5, GLONSS L1/L2, BeiDou B1/B2/B3, GALILEO E1/E5, SBAS; DGPS; 20 Hz measurements; 20 Hz positions RTK (INS-B and INS-P only)
  - V9: GPS L1/L2, Dual antenna Heading, SBAS, DGPS, 20 Hz positions (INS-D only)
  - VD42: GPS L1/L2, GLONSS L1/L2, Dual antenna Heading, SBAS, DGPS, RTK, 20 Hz measurements, 20 Hz positions (INS-D only)
  - VD43: GPS L1/L2, GLONSS L1/L2, Dual antenna Heading, SBAS, DGPS, 20 Hz positions (INS-D only)
  - VD9: GPS L1/L2, GLONSS L1/L2, BEIDOU B1/B2, GALILEO E1/E5, QZSS L1/L5, DGPS, RTK, Dual antenna Heading, DGPS, RTK, 20 Hz measurements, 20 Hz positions (INS-DL only)
  - VX.1: RS-232 interface
  - VX.2: RS-422 interface
  - VX.3: RS-485 interface (temporary is not available)
  - VX.4: CAN interface
  - VX.5: Ethernet interface
  - VX.11: two RS-232 interfaces
  - VX.22: two RS-422 interfaces
  - VX.145: RS-232, CAN and Ethernet interfaces (with optional encoder support)
  - VX.245: RS-422, CAN and Ethernet interfaces (w/o Encoder support)
Default: INS-D / INS-DL mechanical interface drawing

Optional: INS-D / INS-DL with alignment pins

Default: INS-B / INS-P mechanical interface drawing

Optional: INS-B / INS-P with alignment pins

Notes:
1. All dimensions are in millimeters.
2. All dimensions within this drawing are subject to change without notice. Customers should obtain final drawings before designing any interface hardware.
3. Interface connector type: Binder. Male receptacle, shielded, rear-mounting
4. GNSS antenna connector type: TNC - Female