

High Performance Advanced MEMS Industrial & Tactical Grade Inertial Measurement Units



IMU-P



- ITAR free (ECCN 7A994 - No License Required)
- Designed for stabilization (S) and guidance (A)
- Affordable price
- 1 deg/hr Gyro Bias in-run stability
- 0.08 deg/vhr Angular Random Walk
- ± 40 g accelerometers dynamic range
- 5 μ g Accelerometers Bias in-run stability
- 0.015 m/s/vhr Velocity Random Walk
- 0.05 deg Pitch & Roll accuracy



Datasheet
Rev. 2.6



**STANDARD
MIL-STD
810G**



The **Inertial Labs Inertial Measurement Unit (IMU-P)** is an Advanced MEMS sensors based, compact, self-contained strapdown, industrial and tactical grade Inertial Measurement Systems and Digital Tilt Sensor, that measures linear accelerations, angular rates, Pitch & Roll with three-axis high-grade MEMS accelerometers and three-axis tactical grade MEMS gyroscopes. Angular rates and accelerations are determined with high accuracy for both motionless and dynamic applications.



The **Inertial Labs IMU-P** is breakthrough, fully integrated inertial solutions that combine the latest MEMS sensors technology.

Fully calibrated, temperature compensated, mathematically aligned to an orthogonal coordinate system, IMU demonstrate less than 1 deg/hr gyroscopes and 0.005 mg accelerometers bias in-run stability with very low noise and high reliability.

Continuous Built-in Test (BIT), configurable communications protocols, electromagnetic interference (EMI) protection, and flexible input power requirements make the **Inertial Labs IMU-P** easy to use in a wide range of higher order integrated system applications.

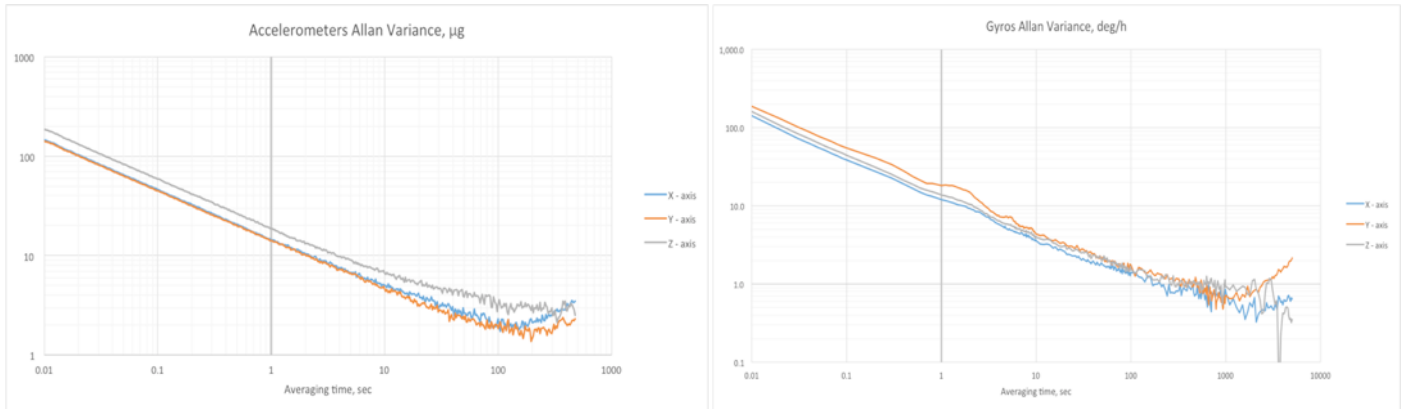
The **Inertial Labs IMU-P** was designed for applications, like:

- ❖ Antenna and Line of Sight Stabilization Systems
- ❖ Passengers trains acceleration / deceleration and jerking systems
- ❖ Motion Reference Units (MRU)
- ❖ Motion Control Sensors (MCS)
- ❖ Gimbals, EOC/IR, platforms orientation and stabilization
- ❖ GPS-Aided Inertial Navigation Systems (INS)
- ❖ Attitude and Heading Reference Systems (AHRS)
- ❖ Land vehicles navigation and motion analysis
- ❖ Buoy or Racing Boat Motion Monitoring
- ❖ UAV & AUV/ROV navigation and control



| Parameter | IMU-P "Tactical" Standard A | IMU-P "Tactical" Stabilization S | IMU-P "Industrial" |
|--|-----------------------------------|--|---------------------------------|
| GYROSCOPES (± 450 deg/sec range) | | | |
| Gyroscopes Bias in-run stability | 1 deg/hr | 2 deg/hr | 3 deg/hr |
| Gyroscopes Noise - Angular Random Walk | 0.2 deg/ $\sqrt{\text{hr}}$ | 0.08 deg/ $\sqrt{\text{hr}}$ | 0.3 deg/ $\sqrt{\text{hr}}$ |
| ACCELEROMETERS (± 8 g range) | | | |
| Accelerometers Bias in-run stability | 0.005 mg | 0.01 mg | 0.01 mg |
| Accelerometers Noise - Velocity Random Walk | 0.015 m/sec/ $\sqrt{\text{hr}}$ | 0.018 m/sec/ $\sqrt{\text{hr}}$ | 0.018 m/sec/ $\sqrt{\text{hr}}$ |
| PITCH & ROLL | | | |
| Pitch & Roll static accuracy, RMS | 0.05 deg | 0.05 deg | 0.05 deg |
| Pitch & Roll dynamic accuracy, RMS | 0.08 deg | 0.08 deg | 0.08 deg |

IMU-P Gyroscopes & Accelerometers Key Performance



Inertial Labs IMU-P key applications



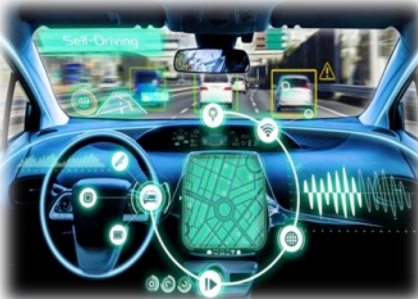
UAV, Loitering Munitions, Glide Bombs



Remote Weapon Stations, EOS stabilization



Aerospace



Autonomous vehicles



Land vehicles navigation systems



Remote sensing (mapping, photogrammetry)





Construction equipment motion control



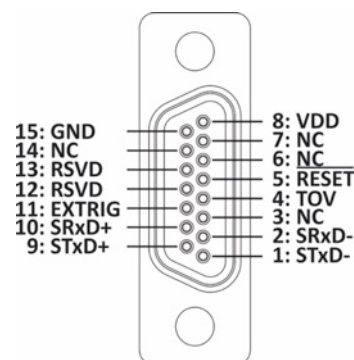
Antenna stabilization



Precision Agriculture

| Parameter | Units | IMU-P (TACTICAL) | | | IMU-P (INDUSTRIAL) | | |
|--|-----------|--|-------|-----------------|---|-------|------|
| | |  | | |  | | |
| Output signals | | Accelerations, Angular rates, Pitch, Roll, Relative Heading, Temperature, Synchronization output | | | | | |
| Available colors of enclosure | | Black, Desert Tan or Green | | | | | |
| Data update rate | Hz | 2000 Hz | | | 2000 Hz | | |
| Start-up time | sec | < 1 | | | < 1 | | |
| Full Accuracy Data (Warm-up Time) | sec | <5 (max) | | | <5 (max) | | |
| Gyroscopes | | IMU-P (Tactical) | | | IMU-P | | |
| | | Standard A | | Stabilization S | Industrial | | |
| Measurement range | deg/sec | ±450; ±950 | | ±450; ±950 | ±450; ±950 | | |
| Bandwidth (-3dB) | Hz | 260 | | 260 | 260 | | |
| Data update rate | Hz | 2000 | | 2000 | 2000 | | |
| Bias in-run stability (Allan Variance, RMS) | deg/hr | 1 | | 2 | 3 | | |
| Bias repeatability (turn-on to turn-on, RMS) | deg/hr | 15 | | 20 | 30 | | |
| Bias instability (over temperature range, RMS) | deg/hr | 30 | | 35 | 50 | | |
| SF accuracy (over temperature range) | % | 0.1 | | 0.3 | 0.4 | | |
| Noise. Angular Random Walk (ARW) | deg/√hr | 0.2 | | 0.08 | 0.3 | | |
| Non-linearity | ppm | 100 | | 200 | 200 | | |
| Axis misalignment | mrad | 0.15 | | 0.15 | 0.15 | | |
| Accelerometers | | IMU-P (Tactical) | | | IMU-P (Industrial) | | |
| Measurement range | g | ±8 | ±15 | ±40 | ±8 | ±15 | ±40 |
| Bandwidth (-3dB) | Hz | 260 | 260 | 260 | 260 | 260 | 260 |
| Bias in-run stability (RMS, Allan Variance) | mg | 0.005 | 0.02 | 0.03 | 0.01 | 0.03 | 0.05 |
| Bias instability (in temperature range*, RMS) | mg | 0.5 | 0.7 | 1.2 | 0.7 | 1.1 | 1.5 |
| Bias one-year repeatability | mg | 1.0 | 1.3 | 1.5 | 1.5 | 2.0 | 2.5 |
| SF accuracy (over temperature range) | ppm | 150 | 300 | 500 | 500 | 700 | 850 |
| SF one-year repeatability | ppm | 500 | 1300 | 1500 | 800 | 1400 | 1700 |
| Noise. Velocity Random Walk (VRW) | m/sec/√hr | 0.015 | 0.035 | 0.045 | 0.02 | 0.045 | 0.06 |
| Non-linearity | % | 0.015 | 0.015 | 0.015 | 0.034 | 0.08 | 0.1 |
| Axis misalignment | mrad | 0.1 | 0.1 | 0.15 | 0.05 | 0.05 | 0.05 |
| Inclinometer | | IMU-P (Tactical) | | | IMU-P (Industrial) | | |
| Measurement range, Pitch / Roll | deg | ±90 / ±180 | | | ±90 / ±180 | | |
| Resolution | deg | 0.01 | | | 0.01 | | |
| Static accuracy, RMS | deg | 0.05 | | | 0.05 | | |
| Dynamic accuracy, RMS | deg | 0.08 | | | 0.08 | | |
| Environment | | IMU-P (Tactical) | | | IMU-P (Tactical) | | |
| Mechanical shock (MIL-STD-810G) | g | 1500 | | | 1500 | | |
| Vibration (MIL-STD-810G) | g, Hz | 7, 5 – 2000 | | | 7, 5 – 2000 | | |
| Operating temperature | deg C | -40 to +85 | | | -40 to +85 | | |
| Storage temperature | deg C | -50 to +90 | | | -50 to +90 | | |
| MTBF (G _M @+65degC, operational) | hours | 100,000 | | | 100,000 | | |
| Electrical | | IMU-P (Tactical) | | | IMU-P (Industrial) | | |
| Supply voltage | V DC | 5 to 30 | | | 5 to 30 | | |
| Power consumption | Watts | 0.8 @ 5V | | | 0.8 @ 5V | | |
| Output Interface | - | RS-422/RS-232 | | | RS-422/RS-232 | | |
| Output data format | - | Binary, ASCII characters, STIM-300 output format | | | Binary, ASCII characters, STIM-300 output format | | |
| EMC/EMI/ESD | | MIL-STD-461F | | | MIL-STD-461F | | |
| Mechanical | | IMU-P (Tactical) | | | IMU-P (Industrial) | | |
| Size | mm | 39 x 45 x 22 | | | 39 x 45 x 22 | | |
| Weight | gram | 70 | | | 70 | | |
| IMU version using customized case & connector | custom | Available | | | Available | | |

IMU-P Electrical interface description



| Pin | Name | Description |
|-----|--------|--|
| 1 | STxD- | RS422 inverted output |
| 2 | SRxD- | RS422 inverted input |
| 3 | NC | Do not connect |
| 4 | TOV | Time of Validity output. Leave floating if not used. Open drain output pulled up to VDD via 10K. |
| 5 | RESET | Reset input. Leave floating if not used. Active low input, pulled up to VDD. |
| 6 | NC | Do not connect |
| 7 | NC | Do not connect |
| 8 | VDD | Power input |
| 9 | STxD+ | RS422 non-inverted output |
| 10 | SRxD+ | RS422 non-inverted input |
| 11 | EXTRIG | External trigger input. Pulled up to VDD via 10K, leave floating if not used. |
| 12 | RSVD | Reserved for (RS-232) |
| 13 | RSVD | Reserved for (RS-232) |
| 14 | NC | Do not connect |
| 15 | GND | Supply and signal ground |

- All dimensions are in millimeters
- All dimensions within this drawing are subject to change without notice
- Customers should obtain final drawings before designing any interface hardware
- Please contact Inertial Labs, Inc. if you need IMU-P to be delivered in a custom enclosure/case with customized connector and output data

| | | | | | | | | | | | | |
|------------|-------|---|------|---|-----|---|-----|---|----|---|-------|------|
| Tactical | IMU-P | - | G450 | - | A8 | - | TGA | - | C1 | - | V1A.X | VX.1 |
| Industrial | | | G950 | | A15 | | | | | | V1S.X | VX.2 |
| | | | | | A40 | | | | | | V2.X | |

| | | |
|--|-------|---|
| Model | IMU-P | Inertial Measurement Unit, Professional version |
| Gyroscopes dynamic range | G450 | ±450 deg/sec measurement range |
| | G950 | ±950 deg/sec measurement range |
| Accelerometers dynamic range & Bandwidth | A8 | ±8 g measurement range |
| | A15 | ±15 g measurement range |
| | A40 | ±40 g measurement range |
| Temperature calibration | TGA | Gyroscopes & Accelerometers are calibrated |
| Enclosure | C1 | Aluminum Enclosure |
| Grade | V1A.x | Tactical grade. Standard A: guidance & navigation |
| | V1S.x | Tactical grade. Stabilization S: stabilization & pointing |
| | V2.x | Industrial grade |
| Interface | Vx.1 | RS-232 |
| | Vx.2 | RS-422 |