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/√hr Angular Random Walk
- ±40 g accelerometers dynamic range
- 5 µg Accelerometers Bias in-run stability
- 0.015 m/s/√hr Velocity Random Walk
- 0.05 deg Pitch & Roll accuracy

Inertial Labs
Attitude is Everything

Datasheet
Rev. 2.5

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.
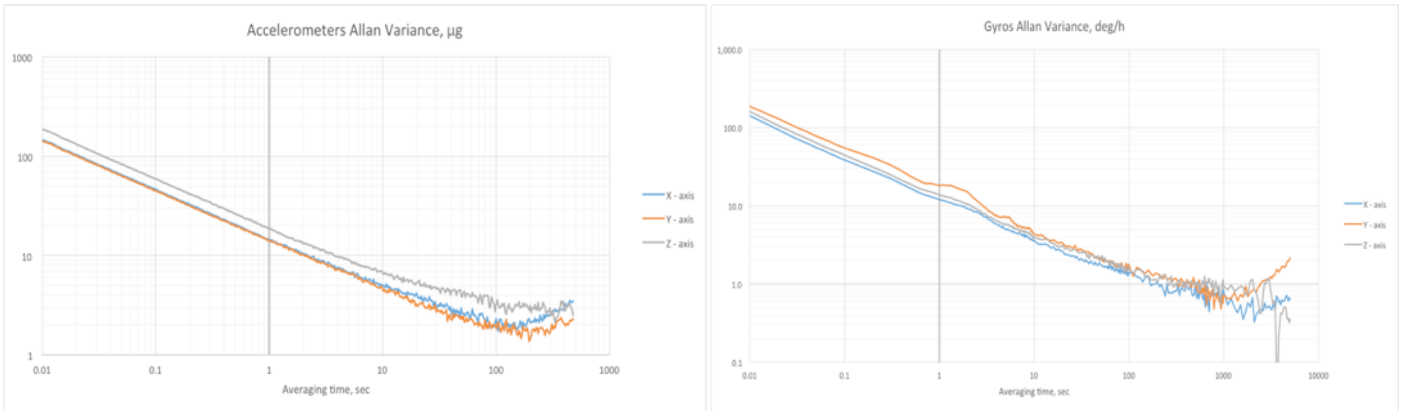
The **Inertial Labs IMU-P** was designed for applications, like:
- ❖ Antenna and Line of Sight Stabilization Systems
- ❖ Passengers trains acceleration / deceleration and jerking systems
- ❖ Motion Reference Units (MRU)
- ❖ Motion Control Sensors (MCS)
- ❖ Gimbals, EOC/IR, platforms orientation and stabilization
- ❖ 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
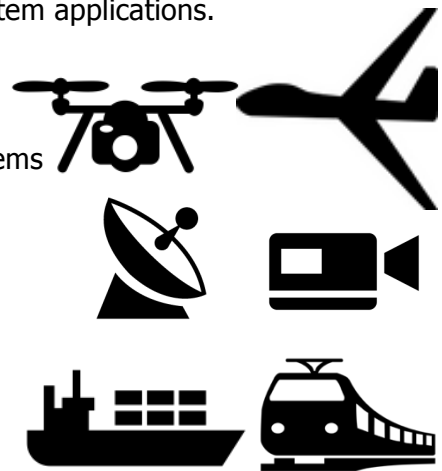
Parameter	IMU-P "Tactical" Standard A	IMU-P "Tactical" Stabilization S	IMU-P "Industrial"
GYROSCOPES (±450 deg/sec range)			
Gyroscopes Bias in-run stability	1 deg/hr	2 deg/hr	3 deg/hr
Gyroscopes Noise - Angular Random Walk	0.2 deg/√hr	0.08 deg/√hr	0.3 deg/√hr
ACCELEROMETERS (±8 g range)			
Accelerometers Bias in-run stability	0.005 mg	0.01 mg	0.01 mg
Accelerometers Noise - Velocity Random Walk	0.015 m/sec/√hr	0.018 m/sec/√hr	0.018 m/sec/√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

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IMU-P Gyroscopes & Accelerometers Key Performance

Inertial Labs IMU-P key applications

UAV, Loitering Munitions, Glide Bombs

Remote Weapon Stations, EOS stabilization

Aerospace
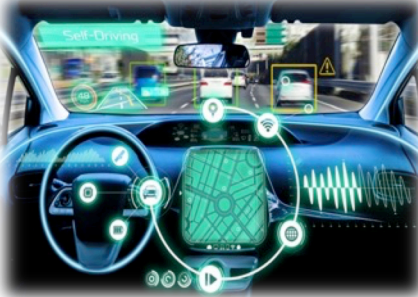
Autonomous vehicles

Land vehicles navigation systems

Remote sensing (mapping, photogrammetry)

Construction equipment motion control

Antenna stabilization

Precision Agriculture

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IMU-P Specifications

Parameter	Units	IMU-P (TACTICAL)			IMU-P (INDUSTRIAL)		
Output signals		Accelerations, Angular rates, Pitch, Roll, Relative Heading, Temperature, Synchronization output					
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		

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IMU-P mechanical interface description

Notes:
- 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

IMU-P Electrical interface description


```
15: GND        8: VDD
14: NC         7: NC
13: RSVD       6: NC
12: RSVD       5: RESET
11: EXTRIG     4: TOV
10: SRxD+      3: NC
9: STxD+       2: SRxD-
               1: STxD-
```

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

IMU-P part number description

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

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