



# High Performance Advanced MEMS Inertial Measurement Units

## IMU-P "S"



- Designed for Platforms Stabilization & Pointing
- ITAR free (ECCN 7A994 - No License Required)
- 0.5 deg/hr Gyro Bias in-run stability
- 0.06 deg/√hr Angular Random Walk
- $\pm 40$  g accelerometers dynamic range
- 5  $\mu$ g Accelerometers Bias in-run stability
- 0.015 m/s/√hr Velocity Random Walk
- 0.05 deg Pitch & Roll accuracy
- Optional input from external GNSS
- Affordable price

Datasheet



The **Inertial Labs Inertial Measurement Unit (IMU-P)** is an Advanced MEMS sensor-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 get accurately determined for both motionless and dynamic applications. The Inertial Labs IMU-P is a breakthrough, fully integrated inertial solution that combines the latest MEMS sensors technology.



Fully calibrated, temperature compensated, and mathematically aligned to an orthogonal coordinate system, IMU demonstrates less than 0.5 deg/hr gyroscopes and 0.01 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** models can get aiding data from an external source of GNSS and then output a full spectrum of INS data (Positions, Attitude, Velocity, and Time).

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

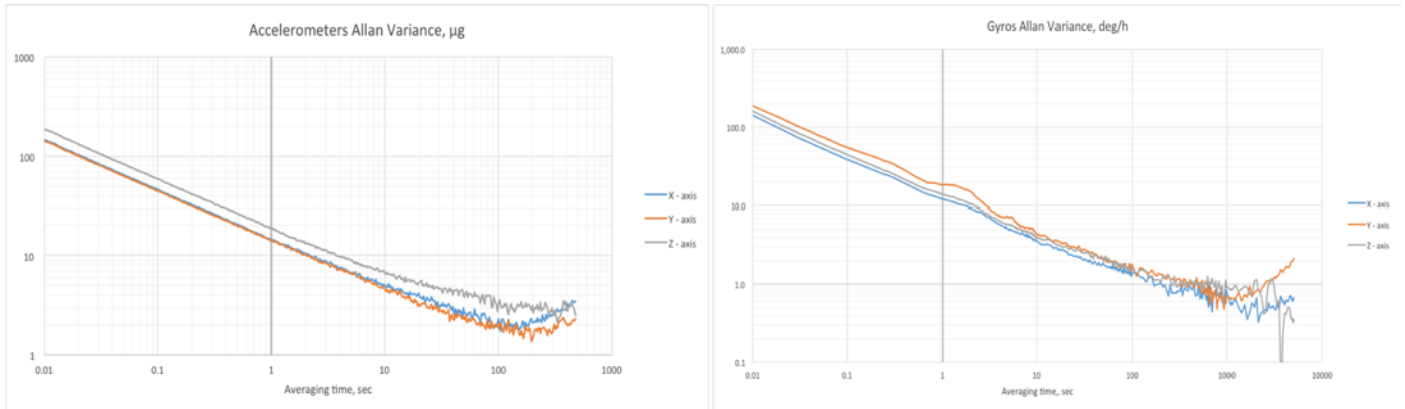
- ❖ Antenna and Line of Sight Stabilization Systems
- ❖ Passenger's trains acceleration / deceleration and jerking systems
- ❖ Motion Reference Units (MRU)
- ❖ Motion Control Sensors (MCS)
- ❖ Gimbals, EOC/IR, platforms orientation and stabilization
- ❖ GPS-Aided Inertial Navigation Systems (INS)
- ❖ 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 S"
<b>GYROSCOPES</b>	
Gyroscopes Bias in-run stability	0.5 deg/hr
Gyroscopes Bias residual error	35 deg/hr
Gyroscopes Angular Random Walk	0.06 deg/√hr
<b>ACCELEROMETERS (±8 g range)</b>	
Accelerometers Bias in-run stability	0.005 mg
Accelerometers Bias residual error	0.5 mg
Accelerometers Velocity Random Walk	0.015 m/sec/√hr
<b>PITCH &amp; ROLL</b>	
Pitch & Roll static accuracy, RMS	0.05 deg
Pitch & Roll dynamic accuracy, RMS	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

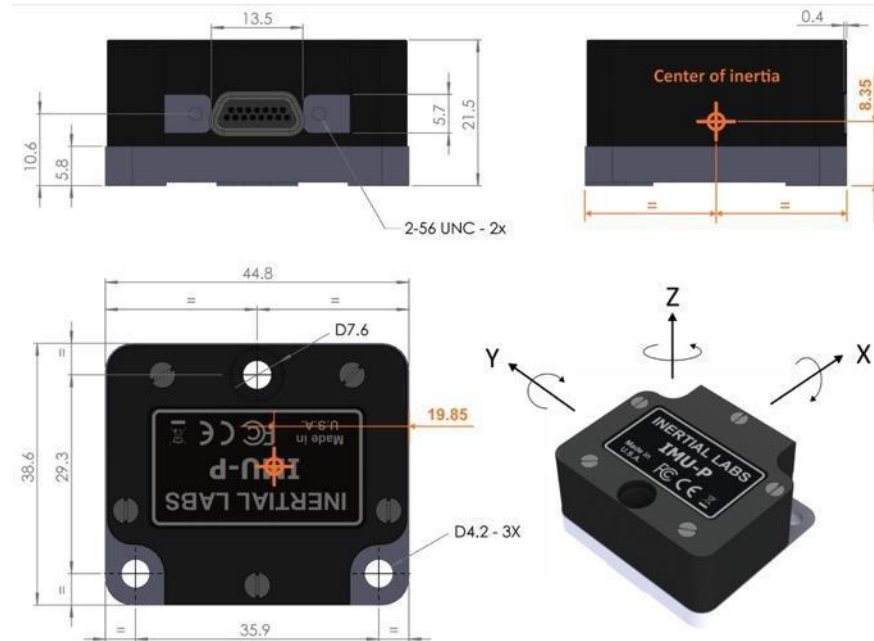
Parameter	Units	IMU-P TACTICAL "S"			IMU-P INDUSTRIAL "S"		
							
Output signals		Accelerations, Angular rates, Pitch, Roll, Relative Heading, Temperature Synchronization output					
Available colors of enclosure		Black, Desert Tan or Green					
Data update rate	Hz	4000 Hz			4000 Hz		
Start-up time	sec	< 1			< 1		
Full Accuracy Data (Warm-up Time)	sec	<5 (max)			<5 (max)		
Gyroscopes		IMU-P Tactical "S"			IMU-P Industrial "S"		
Measurement range	deg/sec	±4000			±4000		
Latency	ms	1			1		
Bandwidth (-3dB)	Hz	500			500		
Data update rate	Hz	4000			4000		
Bias in-run stability (Allan Variance, RMS)	deg/hr	0.5			2		
Bias repeatability (turn-on to turn-on, RMS)	deg/hr	15			25		
Bias instability (over temperature range, RMS)	deg/hr	35			50		
SF accuracy (over temperature range)	ppm	300			1000		
Noise. Angular Random Walk (ARW)	deg/√hr	0.06			0.1		
Non-linearity	ppm	200			250		
Axis misalignment	mrad	0.15			0.25		
Accelerometers		IMU-P Tactical "S"			IMU-P Industrial "S"		
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	ppm	150	150	150	340	800	1000
Axis misalignment	mrad	0.15	0.15	0.15	0.2	0.3	0.3
Inclinometer		IMU-P Tactical "S"			IMU-P Industrial "S"		
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 "S"			IMU-P Industrial "S"		
Mechanical shock	g, s	40, 0.011 half-sine pulse			40, 0.011 half-sine pulse		
Vibration	g, Hz	7, 20 – 2000			7, 20 – 2000		
Environmental Protection	-	IP67			IP67		
Operating temperature	deg C	-40 to +85			-40 to +85		
Storage temperature	deg C	-50 to +90			-50 to +90		
Low pressure	Pa, min	1750, 30			1750, 30		
Humidity	%	up to 95			up to 95		
MTBF (G <sub>M</sub> @+65degC, operational)	hours	100,000			100,000		
Life time (operational)	years	10			10		
Life time (storage)	years	17			17		
Electrical		IMU-P Tactical "S"			IMU-P Industrial "S"		
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-485			RS-422/RS-232/RS-485		
Output data format	-	Binary, ASCII, STIM-300 output format			Binary, ASCII, STIM-300 output format		
EMC/EMI/ESD	-	STD-461G			STD-461G		
Mechanical		IMU-P Tactical "S"			IMU-P Industrial "S"		
Size	mm	39 x 45 x 22			39 x 45 x 22		
Weight	gram	70			70		
Custom enclosure and connector	custom	Available			Available		

### Additional output parameters in case of input from external GNSS aiding\* data:

Parameters with GNSS aiding data		IMU-P Tactical "S"	IMU-P Industrial "S"
Horizontal Positions (GPS denied, land vehicles, % of Distance Traveled)	%, DT	0.2	0.75
Output parameters		Horizontal & Vertical Positions (LAT, LONG); Heading, Pitch, Roll, Velocity, PPS time, IMU data	
Horizontal Positions (GNSS enable), RMS		1.5 (SP, L1) / 1.2 (SP, L1/L2) / 0.6 (SBAS) / 0.4 (DGPS) / 0.01 (RTK)	
Vertical Positions (GNSS enable), RMS		1.5 (SP) / 0.02 (RTK)	
Velocity accuracy, RMS	m/sec	0.03	0.03
Heading (dynamic, aiding data from single GNSS antenna receiver)	deg	0.2	0.2
Heading (dynamic & static, aiding data from dual GNSS antenna receiver)	deg	0.08 (2 meters baseline)	0.08 (2 meters baseline)
Heading (dynamic, GNSS denied), RMS	deg/sec	0.008	0.01
Pitch & Roll (dynamic, GNSS enable), RMS	deg	0.03	0.05
Pitch & Roll (dynamic, GNSS denied), RMS	deg	0.08	0.08

\* According Inertial labs ICD (Interface Control Document)

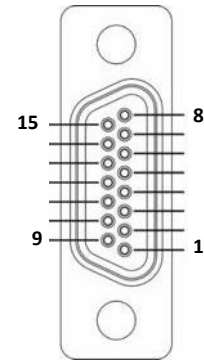
### IMU-P mechanical interface description



#### 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



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	Rx232	RS-232
13	Tx232	RS-232
14	NC	Do not connect
15	GND	Supply and signal ground

### IMU-P part number description

IMU-P	-	G4000	-	A8	-	TGA	-	C1	-	B	-	V1S	.1
				A15						G		V2S	.2
				A40						D			.3
													.12
													.13

Model	IMU-P	Inertial Measurement Unit, Professional version
Gyroscopes dynamic range	G4000	±4000 deg/sec measurement range
Accelerometers dynamic range	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
Color of enclosure	B	Black (default)
	G	Green (option)
	D	Desert tan (option)
Grade	V1S	Tactical grade, Model S: Stabilization
	V2S	Industrial grade
Interface	.1	RS-232
	.2	RS-422
	.3	RS-485
	.12	RS-232 and RS-422
	.13	RS-232 and RS-485