High Performance Advanced MEMS 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
- up to ±90 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
- Optional input from external GNSS and INS data output

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Datasheet

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.

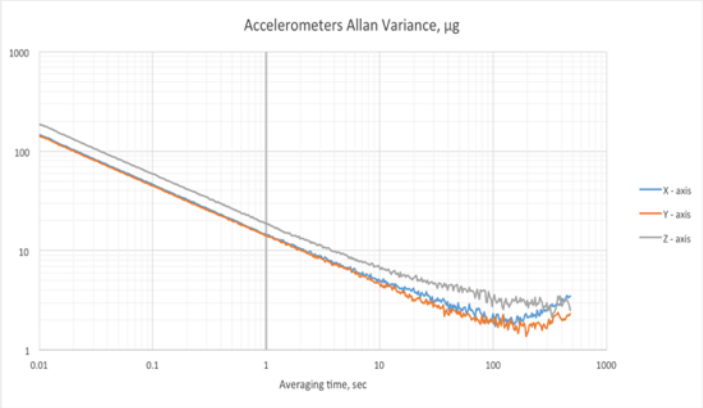
The **Inertial Labs IMU-P** models are able to get an aiding data from external source of GNSS and then to output full spectrum of INS data (Positions, Attitude, Velocity and Time).

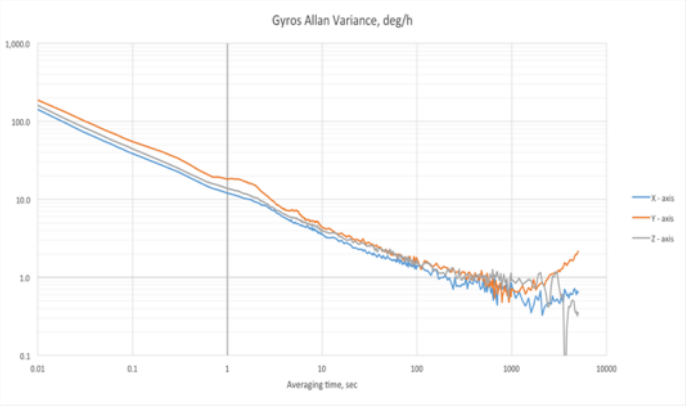
The **Inertial Labs IMU-P** was designed for applications, like:

- Antenna and Line of Sight Stabilization Systems
- 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 A"	IMU-P "Tactical S"	IMU-P "Industrial"	IMU-P "KERNEL"
GYROSCOPES				
Gyroscopes Bias in-run stability	1 deg/hr	2 deg/hr	3 deg/hr	2 deg/hr
Gyroscopes Bias residual error	30 deg/hr	35 deg/hr	50 deg/hr	72 deg/hr
Gyroscopes Angular Random Walk	0.2 deg/√hr	0.08 deg/√hr	0.3 deg/√hr	0.38 deg/√hr
ACCELEROMETERS (±8 g range)				
Accelerometers Bias in-run stability	0.005 mg	0.01 mg	0.01 mg	0.01 mg
Accelerometers Bias residual error	0.5 mg	0.5 mg	0.7 mg	0.7 mg
Accelerometers Velocity Random Walk	0.015 m/sec/√hr	0.018 m/sec/√hr	0.018 m/sec/√hr	0.02 m/sec/√hr
PITCH & ROLL				
Pitch & Roll static accuracy, RMS	0.05 deg	0.05 deg	0.05 deg	0.05 deg
Pitch & Roll dynamic accuracy, RMS	0.08 deg	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

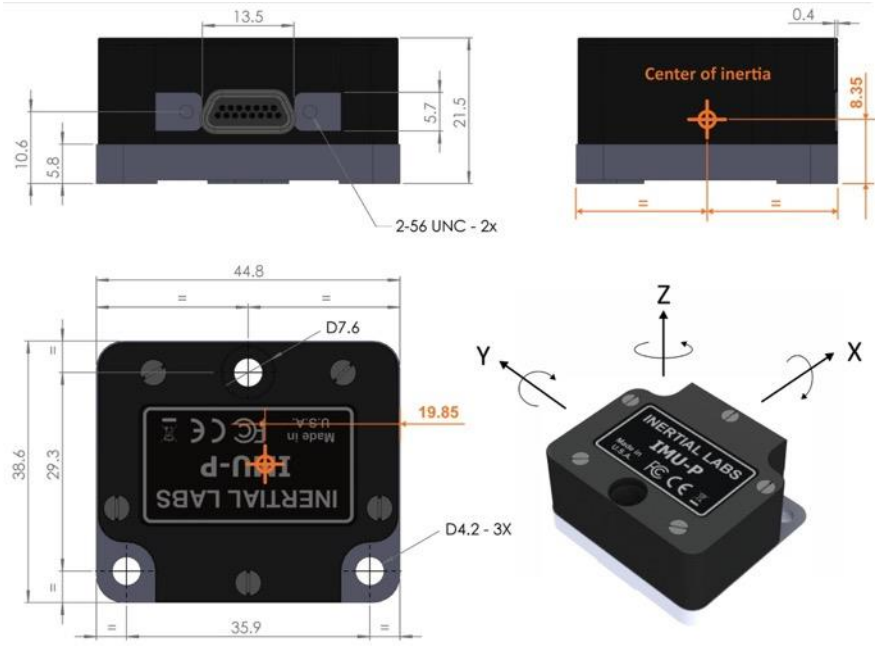
Parameter	Units	IMU-P TACTICAL				IMU-P INDUSTRIAL				IMU-P KERNEL			
													
Output signals		Accelerations, Angular rates, Pitch, Roll, Relative Heading, Temperature, Synchronization output											
Available colors of enclosure		Black, Desert Tan or Green											
Data update rate	Hz	2000 Hz				2000 Hz				2000 Hz			
Start-up time	sec	< 1				< 1				< 1			
Full Accuracy Data (Warm-up Time)	sec	<5 (max)				<5 (max)				<5 (max)			
Gyroscopes		**IMU-P (Tactical)**				**IMU-P**				**IMU-P**			
		Model A		**Model S**		**Industrial**				**KERNEL**			
Measurement range	deg/sec	±450 / ±950 / ±2000		±450		±450 / ±950 / ±2000				±2000			
Bandwidth (-3dB)	Hz	260		260		260				260			
Data update rate	Hz	2000		2000		2000				2000			
Bias in-run stability (Allan Variance, RMS)	deg/hr	1		2		3				2			
Bias repeatability (turn-on to turn-on, RMS)	deg/hr	15		20		30				20			
Bias instability (over temperature range, RMS)	deg/hr	30		35		50				72			
SF accuracy (over temperature range)	ppm	1000		3000		4000				1000			
Noise. Angular Random Walk (ARW)	deg/√hr	0.2		0.08		0.3				0.38			
Non-linearity	ppm	100		200		200				350			
Axis misalignment	mrad	0.15		0.15		0.3				0.15			
Accelerometers		**IMU-P (Tactical)**				**IMU-P (Industrial)**				**IMU-P KERNEL (1)**			
Measurement range	g	±8	±15	±40	±90	±8	±15	±40	±90	±8	±15	±40	±90
Bandwidth (-3dB)	Hz	260	260	260	260	260	260	260	260	260	260	260	260
Bias in-run stability (RMS, Allan Variance)	mg	0.005	0.02	0.03	1	0.01	0.03	0.05	1	0.01	0.03	0.05	1
Bias instability (in temperature range, RMS)	mg	0.5	0.7	1.2	200	0.7	1.1	1.5	200	0.7	1.1	1.5	200
Bias one-year repeatability	mg	1.0	1.3	1.5	200	1.5	2.0	2.5	200	1.5	2.0	2.5	200
SF accuracy (over temperature range)	ppm	150	300	500	2000	500	700	850	2000	500	700	850	2000
SF one-year repeatability	ppm	500	1300	1500	2000	800	1400	1700	2000	800	1400	1700	2000
Noise. Velocity Random Walk (VRW)	m/sec/√hr	0.015	0.035	0.045	15	0.02	0.045	0.06	15	0.02	0.045	0.06	15
Non-linearity	ppm	150	150	150	3000	340	800	1000	3000	340	800	1000	3000
Axis misalignment	mrad	0.15	0.15	0.15	0.3	0.2	0.3	0.3	0.3	0.15	0.15	0.2	0.3
Inclinometer		**IMU-P (Tactical)**				**IMU-P (Industrial)**				**IMU-P KERNEL**			
Measurement range, Pitch / Roll	deg	±90 / ±180				±90 / ±180				±90 / ±180			
Resolution	deg	0.01				0.01				0.01			
Static accuracy, RMS	deg	0.05				0.05				0.05			
Dynamic accuracy, RMS	deg	0.08				0.08				0.08			
Environment		**IMU-P (Tactical)**				**IMU-P (Industrial)**				**IMU-P KERNEL**			
Mechanical shock	g, s	40, 0.011 half-sine pulse				40, 0.011 half-sine pulse				40, 0.011 half-sine pulse			
Vibration	g, Hz	7, 20 – 2000				7, 20 – 2000				7, 20 – 2000			
Environmental Protection	-	IP67				IP67				IP67			
Operating temperature	deg C	-40 to +85				-40 to +85				-40 to +85			
Storage temperature	deg C	-50 to +90				-50 to +90				-50 to +90			
Low pressure	Pa, min	1750, 30				1750, 30				1750, 30			
Humidity	%	up to 95				up to 95				up to 95			
MTBF (G_M @+65degC, operational)	hours	100,000				100,000				100,000			
Life time (operational)	years	10				10				10			
Life time (storage)	years	17				17				17			
Electrical		**IMU-P (Tactical)**				**IMU-P (Industrial)**				**IMU-P KERNEL**			
Supply voltage	V DC	5 to 30				5 to 30				5 to 30			
Power consumption	Watts	0.8 @ 5V				0.8 @ 5V				0.8 @ 5V			
Output Interface	-	RS-422/RS-232/RS-485				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				Binary, ASCII, STIM-300 output format			
EMC/EMI/ESD		STD-461G				STD-461G				STD-461G			
Mechanical		**IMU-P (Tactical)**				**IMU-P (Industrial)**				**IMU-P KERNEL**			
Size	mm	39 x 45 x 22				39 x 45 x 22				39 x 45 x 22			
Weight	gram	70				70				70			
Custom enclosure and connector	custom	Available				Available				Available			

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

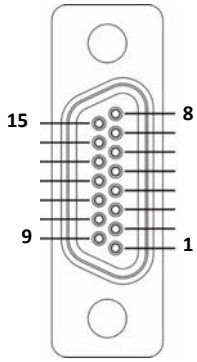
Parameters with GNSS aiding data		IMU-P (Tactical)	IMU-P (Industrial)	IMU-P KERNEL
Output parameters		Horizontal & Vertical Positions (LAT, LONG); Heading, Pitch, Roll, Velocity, PPS time, IMU data (angular rates, accelerations)		
Horizontal Positions (GNSS enable), RMS	meters	1.5 (SP, L1) / 1.2 (SP, L1/L2)/ 0.6 (SBAS) / 0.4 (DGPS) / 0.01 (RTK)		
Vertical Positions (GNSS enable), RMS	meters	1.5 (SP) / 0.02 (RTK)		
Horizontal Positions (GNSS denied, land vehicles, % of Distance Traveled), RMS	%, DT	0.2	0.75	1
Velocity accuracy, RMS	m/sec	0.03	0.03	0.03
Heading (dynamic, aiding data from single GNSS antenna receiver), RMS	deg	0.2	0.2	0.2
Heading (dynamic & static, aiding data from dual GNSS antenna receiver), RMS	deg	0.08 (2 meters baseline)	0.08 (2 meters baseline)	0.08 (2 meters baseline)
Heading (dynamic, GNSS denied), RMS	deg/sec	0.008	0.01	0.02
Pitch & Roll (dynamic, GNSS enable), RMS	deg	0.03	0.05	0.06
Pitch & Roll (dynamic, GNSS denied), RMS	deg	0.08	0.08	0.08

** According Inertial labs ICD (Interface Control Document)*

IMU-P mechanical interface description



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

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 part number description

IMU-P	-	G450	-	A8	-	TGA	-	C1	-	B	-	V1A._	_.1
		G950		A15						G		V1S._	_.2
		G2000		A40						D		V2._	_.3
				A8A90								V3._	_.12
				A15A90									_.13
				A40A90									

Model	IMU-P	Inertial Measurement Unit, Professional version
Gyroscopes dynamic range	G450	±450 deg/sec measurement range (Tactical "A" and Tactical "S")
	G950	±950 deg/sec measurement range (Tactical "A" only)
	G2000	±2000 deg/sec measurement range (Tactical "A" only)
Accelerometers dynamic range	A8	±8 g measurement range
	A15	±15 g measurement range
	A40	±40 g measurement range
	A8A90	±8 g and ±90 g measurement range (all models except Tactical, model S)
	A15A90	±15 g and ±90 g measurement range (all models except Tactical, model S)
	A40A90	±40 g and ±90 g measurement range (all models except Tactical, model S)
Temperature calibration	TGA	Gyroscopes & Accelerometers are calibrated
Enclosure	C1	Aluminum Enclosure
Color of enclosure	B	Black (default)
	G	Green
	D	Desert tan
Grade	V1A._	Tactical grade. Model A: guidance & navigation
	V1S._	Tactical grade. Model S: stabilization & pointing
	V2._	Industrial grade
	V3._	KERNEL
Interface	_.1	RS-232
	_.2	RS-422
	_.3	RS-485
	_.12	RS-232 and RS-422
	_.13	RS-232 and RS-485

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