Inertial Labs
Attitude is Everything

OEM Version of the Professional GPS-Aided Inertial Navigation System
"INS-P-OEM"

- **Tactical Grade IMU**
- **Competitively priced**
- **Small Size, light weight**
- **NovAtel/uBlox GNSS Receiver**
- **0.5 cm Position accuracy (PPK)**
- **0.03 deg Heading accuracy (PPK)**
- **0.006 deg Pitch & Roll accuracy (PPK)**
- **Ideal solution for accurate point clouds**
- **Compatible with LIDAR, Optical camera**
- **Applications: flight control, remote sensing**
- **Embedded gyro compensated Fluxgate compass**
- **Real time (RTK) & Post Processing (PPK) Kinematics**

The **Professional Inertial Labs GPS-Aided Inertial Navigation System (INS-P-OEM)** is the OEM version of Inertial Labs' new generation, fully-integrated, combined GPS, GLONASS, GALILEO, QZSS, NAVIC and BEIDOU GNSS 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 a high level of accuracy for both motionless and dynamic applications.

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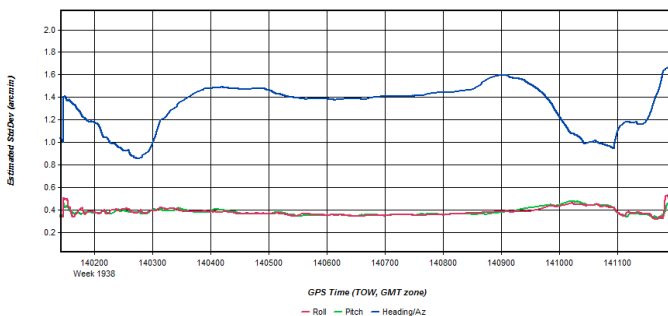
KEY FEATURES, BENEFITS & FUNCTIONALITY

- Commercially exportable GPS-Aided Inertial Navigation System
- Small size & light weight: 85,5 x 47,7 x 46,9 mm size and 174-gram weight
- High precision IMU (1 deg/hr gyroscopes and 5 micro g accelerometers Bias in-run stability)
- GPS, GLONASS, GALILEO, BEIDOU, QZSS, NAVIC, SBAS, DGPS, RTK supported signals
- Compatibility with LiDARs (Velodyne, RIEGL, FARO)
- Trigger for optical camera
- Up to 2000 Hz IMU; 200 Hz INS and 100 Hz GNSS data rate
- GNSS measurements and IMU raw data for post processing
- 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, Tunnel Guide, and GNSS tracking angle features
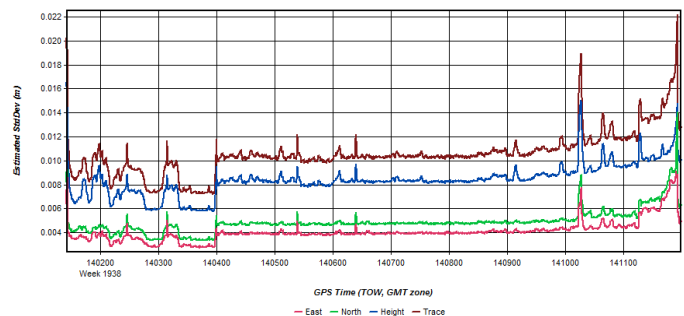- Full temperature calibration of all sensing elements

INS-P-OEM performance

Outage duration	Positioning mode	Position accuracy (meters, RMS)		Velocity accuracy (meters/sec, RMS)		Attitude accuracy (degree, RMS)	
		Horizontal	Vertical	Horizontal	Vertical	Pitch, Roll	Heading
0 sec	RTK	0.01 + 1ppm	0.02 + 1ppm	0.02	0.01	0.015	0.08
	SP	1.2	1.0	0.03	0.02	0.08	0.1
	PP	0.005	0.01	0.02	0.01	0.006	0.03
60 sec	RTK	7	2	0.3	0.1	0.05	0.15
	SP	8	3	0.3	0.1	0.1	0.5
	PP	0.3	0.2	0.03	0.05	0.01	0.1

Inertial Labs Address: 39959 Catoctin Ridge Street, Paeonian Springs, VA 20129 U.S.A.
Tel: +1 (703) 880-4222, Website: www.inertiallabs.com

2

INS-P-OEM Specifications

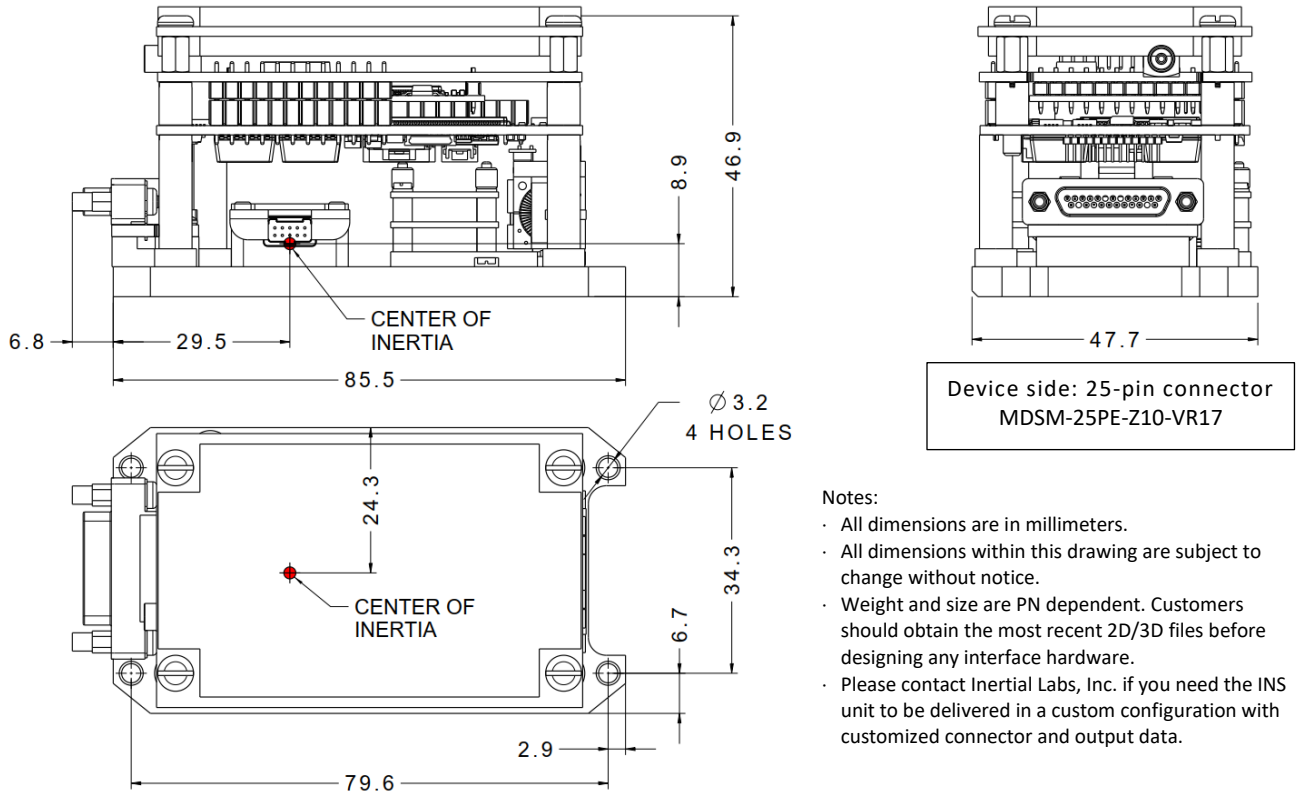|	Parameter	Units	INS-P-OEM
Inputs & Outputs	Input signals		• Marine application: DVL (Doppler Velocity Log) • Land application: Odometer, Wheel sensor, Encoder, DMI • Aerial application: Wind sensor, Air Speed Sensor, Doppler shift from locator (for long-term GPS denied)
	Output signals		• Positions, Heading, Pitch & Roll, Velocity, Accelerations, Angular rates, Barometric data, 1PPS • Direct AT_ITINS message with Position, Heading, Pitch & Roll to COBHAM AVIATOR UAV 200 • Direct Navigation Support for Pixhawk Flight Controllers as NMEA messages
	Main feature		Ideal solution for flight control and remote sensing (mapping, survey and inspection with LiDAR, Optical Camera)
	Update rate (INS data)	Hz	1 … 200 (user settable)
	Update rate (IMU data)	Hz	1 … 2000 (user settable)
	Start-up time	sec	<1
Navigation	**Positions, Velocity and Timestamps**	**Units**	**INS-P-OEM**
	Horizontal position accuracy (GPS L1), RMS	meters	1.5
	Horizontal position accuracy (GPS L1/L2), RMS	meters	1.2
	Horizontal position accuracy (SBAS), RMS [1]	meters	0.6
	Horizontal position accuracy (DGPS), RMS	meters	0.4
	Horizontal position accuracy (post processing) [2]	meters	<0.005
	Horizontal position accuracy (RTK), RMS	meters	0.01 + 1 ppm
	Vertical position accuracy, RMS	meters	<1
	Velocity accuracy, RMS	meters/sec	0.03
	Position accuracy (free inertial, land vehicles)	%, DT	0.2 (w/o odometer input), 0.05 (w/ odometer input)
	PPS timestamps accuracy	nano sec	20
Orientation	**Heading**	**Units**	**INS-P-OEM**
	Range	deg	0 to 360
	Static Accuracy [3]	deg	1
	Gyromagnetic accuracy	deg	0.4
	Dynamic accuracy (GNSS) [6]	deg RMS	0.1
	Post processing accuracy [2]	deg RMS	0.03
	Pitch and Roll	**Units**	**INS-P-OEM**
	Range: Pitch, Roll	deg	±90, ±180
	Angular Resolution	deg	0.01
	Static Accuracy in whole Temperature Range	deg	0.05
	Dynamic Accuracy [6]	deg RMS	0.03
	Post processing accuracy [2]	deg RMS	0.006
IMU	**Gyroscopes**	**Units**	**INS-P-OEM**		
	Measurement range	deg/sec	±450, ±950, ±2000		
	Bias in-run stability (RMS, Allan Variance)	deg/hr	1		
	Bias error over temperature range (RMS)	deg/hr	<30		
	Angular Random Walk (ARW)	deg/√hr	<0.2		
	Accelerometers	**Units**	**INS-P-OEM**		
	Measurement range	g	±8	±15	±40
	Bias in-run stability (RMS, Allan Variance)	mg	0.005	0.02	0.03
	Bias error over temperature range (RMS)	mg	0.5	0.7	1.2
	Bias one-year repeatability	mg	1.0	1.3	1.5
	Velocity Random Walk (VRW)	m/sec/√hr	0.015	0.035	0.045
	Magnetometers	**Units**	**INS-P-OEM**		
	Measurement range	Gauss	±1.6		
	Bias in-run stability, RMS	nT	0.2		
	Noise density, PSD	nT√Hz	0.3		
General	**Environment**	**Units**	**INS-P-OEM**
	Operating temperature	deg C	-40 to +70
	Storage temperature	deg C	-50 to +85
	Vibration & Shock		MIL-STD-810G
	MTBF	hours	100,000
	Electrical	**Units**	**INS-P-OEM**
	Supply voltage	V DC	9 - 36
	Power consumption	Watts	2.5 (3.5 with data logger)
	Output Interface (options)	-	RS-232, RS-422, Ethernet, CAN
	Output data format	-	Binary, NMEA 0183 ASCII characters
	Physical	**Units**	**INS-P-OEM**
	Size	mm	85,5 x 47,7 x 46,9
	Weight	gram	174

[1] GPS only; [2] RMS, incremental error growth from steady state accuracy. Post-processing results using third party software; [3] calibrated in whole operational temperature range, in homogeneous magnetic environment, for latitude up to ±65 deg; [4] tracks up to 60 L1/L2 satellites; [5] 50 Hz while tracking up to 20 satellites. 20 Hz position update rate for Basic model of INS ; [6] dynamic accuracy may depend on type of motion ; [7] time accuracy does not include biases due to RF or antenna delay

	Receiver Options Available	Units	NovAtel OEM719	uBlox ZED-F9P
GNSS Specifications	Number of GNSS Antennas	-	Single	Single
	GNSS Constellations	-	GPS L1 C/A, L1C, L2C, L2P, L5; GLONASS L1 C/A, L2 C/A, L2P, L3, L5; BeiDou B1I, B1C, B2I, B2a, B3I; Galileo E1, E5 AltBOC, E5a, E5b, E6; NavIC (IRNSS) L5; QZSS L1 C/A, L1C, L2C, L5, L6; L-Band	GPS L1C/A L2C, GLONASS L1OF L2OF, Galileo E1B/C E5b, BeiDou B1I B2I, QZSS L1C/A L2C
	GNSS Corrections	-	WAAS; EGNOS; MSAS; GAGAN; SBAS L1, L5; DGPS; RTK; PPP Terrastar	WAAS; EGNOS; MSAS; GAGAN; SBAS L1C/A; DGPS; RTK
	Channel Configuration [1]	-	555	184
	GNSS Data Rate [1]	Hz	5 / 20 / 100	10, 20 [2]
	RTK Corrections	-	RTCM 2, RTCM 3	RTCM 3
	Velocity Accuracy	m/s	0.03	0.05
	Initialization Time	s	<39 (cold start), <20 (hot start)	<30 (cold start), <10 (hot start)
	Time Accuracy (clock drift) [3]	Nano sec	20	30

[1] tracks up to 60 L1/L2 satellites; [2] If tracking GPS only; [3] time accuracy does not include biases due to RF or antenna delay

Inertial Labs Address: 39959 Catoctin Ridge Street, Paeonian Springs, VA 20129 U.S.A.
Tel: +1 (703) 880-4222, Website: www.inertiallabs.com

3

INS-P-OEM mechanical interface drawing (standard configuration)

CENTER OF INERTIA

6.8 — 29.5 — 85.5 — 8.9 — 46.9

⌀ 3.2
4 HOLES

24.3 — CENTER OF INERTIA — 34.3 — 6.7

2.9 — 79.6

47.7

Device side: 25-pin connector
MDSM-25PE-Z10-VR17

Notes:
· All dimensions are in millimeters.
· All dimensions within this drawing are subject to change without notice.
· Weight and size are PN dependent. Customers should obtain the most recent 2D/3D files before designing any interface hardware.
· Please contact Inertial Labs, Inc. if you need the INS unit to be delivered in a custom configuration with customized connector and output data.

INS-P-OEM part numbers structure

Model	Gyroscope	Accel	Calibration	Connector	Encoder support	Data Logger	GNSS receiver	Version	Interface
INS-P-OEM	G450	A8	TMGA	C8	E (option)	S64 (option)	O719	V0	1
	G950	A15					ZF9P	V1	2
	G2000	A40						V2	4
								V3	5
								V4	11
								VR43	22
								VR5	145
								V9	245
									1245

Example: INS-P-OEM-G450-A15-TMGA-C8-O719-V0.1
Part number details:

- INS-P-OEM: OEM Version of Professional Model of GPS-Aided Inertial Navigation System
- G450: Gyroscopes measurement range = ±450 deg/sec
- G950: Gyroscopes measurement range = ±950 deg/sec
- G2000: Gyroscopes measurement range = ±2000 deg/sec
- A8: Accelerometers measurement range = ±8 g –> recommended for applications with low level of operational vibrations
- A15: Accelerometers measurement range ±15 g –> recommended for applications with medium level of operational vibrations
- A40: Accelerometers measurement range ±40 g –> recommended for high dynamic applications or/and with high level of operational vibration
- TMGA: Magnetometers, Gyroscopes and Accelerometers
- C8: Aluminum base plate with 25-pin micro D-SUB connector with screw lock (MDSM-25PE-Z10-VR17 by ITT Cannon) (with available interfaces of: RS-232, RS-422, Ethernet and CAN)
- E: encoder support
- S64: 64GB embedded Data Logger (optional)
- O719: Novatel OEM719 single antenna GNSS receiver
- ZF9P: Single uBlox ZED-F9P GNSS Receiver
- V0: GPS L1, SBAS, DGPS, 20 Hz positions (NovAtel Single Antenna GNSS Receiver only)
- V1: GPS L1, SBAS, DGPS, 50 Hz positions (NovAtel Single Antenna GNSS Receiver only)
- V2: GPS L1, GLONASS, SBAS, DGPS, 20 Hz positions (NovAtel Single Antenna GNSS Receiver only)
- V3: GPS L1/L2, SBAS, DGPS, 20 Hz positions (NovAtel Single Antenna GNSS Receiver only)
- V4: GPS L1/L2, GLONASS L1/L2, SBAS, DGPS, 20 Hz positions (NovAtel Single Antenna GNSS Receiver only)
- VR43: GPS L1/L2, GLONASS L1/L2, SBAS, DGPS, 20 Hz positions, 20 Hz measurements (NovAtel Single Antenna GNSS Receiver only)
- VR5: GPS L1/L2, GLONASS L1/L2, SBAS, DGPS, RTK, 20 Hz positions, 20 Hz measurements (NovAtel Single Antenna GNSS Receiver only)
- V9: GPS L1/L2, GLONASS L1/L2, BEIDOU B1/B2, GALILEO E1/E5, QZSS L1/L5, DGPS, RTK, 20 Hz measurements, 20 Hz positions (Single Antenna GNSS Receiver only)
- VX.1: RS-232 interface
- VX.2: RS-422 interface
- 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 interface (with optional Encoder support)
- VX.245: RS-422, CAN and Ethernet interface (without Encoder support)
- VX.1245: RS-232, RS-422, CAN and Ethernet interface

Inertial Labs Address: 39959 Catoctin Ridge Street, Paeonian Springs, VA 20129 U.S.A.
Tel: +1 (703) 880-4222, Website: www.inertiallabs.com

4